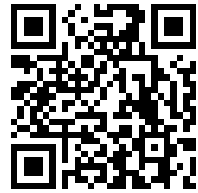

HISTORY OF THE SECOND WORLD WAR

UNITED KINGDOM MEDICAL SERIES

Editor-in-Chief

SIR ARTHUR S. MACNALTY, K.C.B., M.A., M.D., F.R.C.P., F.R.C.S.

THE ROYAL NAVAL MEDICAL SERVICE

BY
Surgeon Commander J. L. S. COULTER, D.S.C., R.N.
Barrister-at-Law

VOLUME I

Administration

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PREFATORY NOTE

by the Editor-in-Chief

THE ROYAL NAVAL MEDICAL SERVICE

THE medical care of British sailors has probably been a matter of State concern since the days of the Tudors and the Stuarts. In 1692 after the glorious victory in the five days' battle of La Hogue, fifty surgeons, plentifully supplied with instruments, bandages and drugs, were sent down in all haste from London to Portsmouth. Queen Mary II gave orders that in the two ancient hospitals of Saint Bartholomew and Saint Thomas, arrangements should be made at the public charge for the reception of wounded patients from the Fleet (Narcissus Luttrell's Diary). She also declared that the building at Greenwich, begun by Charles II, should be completed and should be a naval hospital and retreat for seamen disabled in the service of their country.

We learn something about the rough and ready surgery of the eighteenth century from Tobias Smollett, surgeon's mate, in the 'expedition against Carthagena', 1741, and from John Hunter, who in 1761 to 1762 saw both naval and military warfare and studied gunshot wounds. The beginnings of naval hygiene and the prevention of scurvy come into this century.

The nineteenth century saw the Royal Naval Medical Service grow in strength and reputation, and in the First World War (1914–18) its medical and nursing staff were greatly enlarged and their devoted and skilled work saved lives and alleviated suffering. The Royal Navy, however, is proverbially a 'silent service' and much advance and progress went unrecorded. In the Second World War the Service added fresh laurels to its crown of triumphs in medicine and surgery throughout the seven seas, and it is fitting that these should be recorded in the Official Medical History of the War.

I must express my gratitude to the following Medical Directors General of the Navy: Surgeon Vice Admiral Sir Sheldon Dudley, the late Surgeon Vice Admiral Sir Basil Hall, Surgeon Vice Admiral Sir Henry Colson and Surgeon Vice Admiral Sir Edward Greeson who have co-operated so fully in the preparation of the History and have helped my staff and me in many ways. The same tribute is due to the previous naval editors, Surgeon Commander John Keevil, D.S.O., R.N., Surgeon Lieutenant L. D. de Launay, R.N.V.R., the late Surgeon Lieutenant Commander N. M. McArthur, R.N., and Surgeon Commander A. D. Sinclair, R.N. Finally, I would thank Surgeon Commander J. L. S. Coulter, D.S.C., R.N., Barrister-at-Law, under whose editorship the first volume of the Royal Naval Medical Service, which

is devoted to Administration, now appears. A second volume, dealing with Operations, is in preparation. The aims and purposes of the Naval History, as a whole, are set forth in Surgeon Vice Admiral Sir Edward Greeson's foreword.

This volume has been prepared under the direction of an Editorial Board appointed by H.M. Government, but the Editor alone is responsible for the presentation of the facts and the opinions expressed.

October, 1951 ARTHUR S. MACNALTY

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FOREWORD

BY SURGEON VICE ADMIRAL SIR EDWARD GREESON
K.B.E., C.B., M.D., Ch.B.
Late Medical Director-General of the Navy

IT is with pleasure, and also with some surprise, that I take up my pen to write a foreword to the Official Naval Medical History of the War, for I must confess that I did not anticipate that such an honour would come my way during my time as Medical Director-General of the Navy.

'The History', as we have come to call it, has, rather like 'The Poor', become more or less permanently appurtenant to my Department of the Admiralty. It originally became the care of my illustrious predecessor but one, Surgeon Vice Admiral Sir Sheldon Dudley. From him it descended, by right of succession, through Surgeon Vice Admiral Sir Henry Colson, to myself. Its preparation has thus lasted, so far, through the reigns of three Medical Directors-General of the Navy, and has covered a period of almost ten years. It has employed a number of medical officers and civilian staff who have laboured away quietly at a task, which I am afraid, must have seemed to be rather a thankless one with the passage of time.

There have been moments when 'The History' has appeared as a burdensome accompaniment of my office; moments when I must admit to having had to resist the temptation to divert into routine duties those persons employed upon it, thereby solving some of my administrative problems.

There have been moments too, when I have been impatient that the task should have taken so long. Yet, having reflected, and having observed its slow but steady progress, I am now surprised that so much of it should already have been completed so quickly, and I am glad that I and my predecessors should have been ready always to protect against intruders our attempt to set on record for posterity the outstanding events of naval medicine and surgery during the war years.

My investigations have revealed that although it may appear a simple proposition that history should be more easily written in sequence, as events actually occur, such a procedure is rarely possible in practice, and will undoubtedly result in inaccuracies of fact in the absence of that true perspective which can only be gained by viewing past events in retrospect. Records must be available free from the war-time veil of security. Isolated events, though important in themselves, must be relegated to form a mere part of the greater comprehensive picture of the whole.

I have read that many authors of fiction claim that once they have been created, their characters work out their own destiny as the story

develops. This may well be so in the case of fiction. But the writer of history must record a story which is factual, and, therefore, the beginning cannot be written accurately until the true ending is known. Even then the picture of events is unlikely to satisfy every reader, and there is certain to be a number of persons who will be only too ready to say, '*That* never happened', or '*This* is the true version of what appears on page so-and-so'. In fact, as I have studied the pages which follow, I myself have inclined towards this doubting and critical attitude of mind on more than one occasion.

Then one day, in a reference library, I happened to notice the vast number of 'Histories of England' upon the shelves and how great a number of different authors had each written his version of a particular period, and how wide were the factual variations in some cases. Brief research then suggested to me that nobody has ever yet written *The* History of anything, while many have written *A* History of most things.

Thus, I would point out to the adverse critic in advance that, though the Official Naval Medical History of the War is the best we have been able to compile, yet we do not claim for it a status greater than '*A* History' as opposed to '*The* History'. Should there happen to arise in future years, an author who feels impelled to write '*The* History,' I should be the first to offer him my congratulations—and my sympathy! But until then, this present History must suffice.

I have not had the opportunity of studying the Medical Histories of the Army and the Royal Air Force, but I understand that, compared with them, the Naval History is different in style, smaller and less elaborate. This is probably true, for the Medical Organisation of the Navy was itself different in style, smaller, and less elaborate than that of the other Fighting Services during the course of the war. Though naval commitments were varied and wide, and included such innovations as the Air Arm and Combined Operations, yet it could never be pretended that naval medical problems approached in magnitude those which the Army faced and so nobly surmounted time and time again.

Our History was originally planned by Surgeon Commander John Keevil, D.S.O., R.N.(ret.), and where possible, the framework which he constructed has been adhered to. Unfortunately, retirements and routine Service exigencies made it necessary for the Editor to be changed from time to time. Surgeon Lieutenant L. D. de Launay, R.N.V.R., continued the work of Surgeon Commander Keevil, but on returning to civil life, he was relieved by the late Surgeon Lieutenant Commander N. M. McArthur, R.N., whose sudden death after some months of good progress meant such a sad loss. The next Editor was Surgeon Commander A. D. Sinclair, R.N., who represented the Navy at the first meeting of the United Kingdom and Dominions Official Medical Histories Liaison Committee at Ottawa, in 1947. Soon afterwards it became necessary for him to fill an appointment elsewhere.

These necessary changes inevitably hampered progress, and the fifth Editor, Surgeon Commander J. L. S. Coulter, D.S.C., R.N., Barrister-at-Law, was appointed in December 1947, at a time when the Naval Medical History was still largely in a preparatory stage and showed signs of lagging behind the Histories of the other Services to an extent sufficient to cause some anxiety in the Editor-in-Chief's Department. Fortunately, Sir Arthur MacNalty, and his helpful staff, did everything possible to encourage us at this stage. Also, the appointment of Sir Zachary Cope to the staff of the Editor-in-Chief did much to stimulate some of our clinical contributors whose promised material was still undelivered.

The task of the fifth Editor was to bring to a close the phase of preliminary research and preparation, and to translate the products of that phase into a comprehensive historical narrative as soon as possible.

To achieve this object, it was necessary to discard permanently the promised contributions of many medical officers who had left the Service, and whose recorded experiences would have been of great value. But what they had promised was by now so overdue as to have become extinguished by long delay.

To weave into a continuous narrative the information which has been extracted from a mass of records, including some 26,000 Medical Officers' Journals, has been a most difficult task. Our History is 'thin' in places, while here and there are obvious gaps which we have found impossible to fill.

These deficiencies have been due to a variety of causes beyond the control of my Department. I have already mentioned the defaulting contributor. In one case the records held by a contributor were destroyed by fire. We have always realised that the chapter on the 'Health of the W.R.N.S.', which was prepared from the records of the late Dr. Genevieve Rewcastle, might have been elaborated further. Unfortunately, it was impossible for us to seek further assistance from her.

Of necessity, certain chapters have had to be curtailed for reasons of security, and, in this respect, we are greatly indebted to the Chief of Naval Information, whose staff has shown infinite patience and co-operation in guiding us towards the production of a narrative the publication of which aims to help everybody and to harm nobody—by no means an easy feat.

As regards some important events, we have had a superabundance of material from which to draw, while as regards others, the records have been scanty or non-existent. The latter circumstance has frequently been evidential of a total loss of ship and lives.

Already our History has served a useful purpose as an inter-departmental administrative work of reference inside the Admiralty itself. It has also drawn attention to certain deficiencies which existed in the past.

I have no wish to embark upon a 'History' of our History, so I trust that these remarks of mine may suffice to reveal to our readers some of the difficulties which have existed, and that they in turn will be generous, or at least not too unkind in their judgment.

In conclusion, it would be impossible for me to nominate individually all those persons who have assisted in the task, for the list would be very long indeed, and would extend from our loyal and generous civil consultants to the less exalted clerical staff who have done so much work behind the scenes. But it would be wrong for me to fail to set on record an appreciation of the valuable work of Miss Joan Roffey of the Admiralty Civil Staff, who has watched our History grow from the first seed which was planted. To her is due a great measure of the credit for such success as this work may achieve. Finally, for the energetic policy pursued by the present Editor, Surgeon Commander Coulter, I have nothing but praise.

C. E. GREESON

Department of the Medical Director-General,
Admiralty.
September 1951.

CHAPTER 1

BETWEEN THE WARS, 1918-1939

THE NAVAL MEDICAL MACHINE

In any history designed for both the professed expert and the average intelligent reader, it is desirable to provide some kind of explanatory introduction if the whole is to be absorbed. In a history devoted to the Medical Branch of a Fighting Service this is essential, for the reader must gain some early idea of the basic principles of relationship involved, and must keep these in mind in his subsequent reading.

The Naval Medical Machine is in no way complex. It exists because of, rather than in spite of, the lack of any written comprehensive code of the individual rights or duties of its members. Its working has long been the despair of medical historians, yet the astute observer cannot fail to realise that in its simplicity is found the reason for its success.

On the one side is the Royal Navy, with its customs and usages. It is important to remember that the Navy itself differs from the other Defence Services by virtue of its exclusion from the Bill of Rights in 1689. It does not owe its survival to an annual Act of Parliament, but has always remained a prerogative force. On the other side is the Profession of Medicine with its own rigid discipline, ethics and recognised principles of procedure.

In a manner difficult of perception, except after years of personal experience, it has been possible for these two great bodies to combine to the advantage of each. The requirements of the one have been met, and the privileges of the other have been tacitly accepted. But instead of resorting to the confusion of a general declaration in writing of the rights of its doctors, the parent body has unconsciously applied in silence the better doctrine of '*ubi jus ibi remedium*', resulting in a medical service, which, moulded harmoniously into a background of naval tradition, has itself become unique.

By observing these principles the Medical Branch of the Navy emerged from the First World War with its good reputation established. It is therefore surprising that in the years that followed, this reputation should have suffered and more so, that fundamental principles should have been questioned and even condemned, resulting in a long period of difficulty which had barely been survived at the time of the outbreak of the Second World War.

THE FISHER COMMITTEE

An insidious decrease in the recruiting of medical officers, which affected all the Fighting Services in the years immediately following

1918, had by 1923 become a matter of grave concern. The Royal Navy found that, whereas in former years medical officers had been entered by competitive examination, it was now faced with a shortage of applicants which showed signs of jeopardising even the small peace-time medical commitments of the years ahead. The shortage continued, and a Cabinet Committee investigated the facts in 1925 and 1926 and was succeeded by a committee under the chairmanship of Sir Warren Fisher in May 1931.

The committee reported in 1933 and recommended the following changes in the Terms of Service of Naval Medical Officers:

Professional Improvements.—To be effected by an increase in specialist posts, increased periods of professional as opposed to administrative work, and increased periods of employment for recognised specialists. To achieve this a reduction in total establishment was urged in order to offer a professionally satisfactory career to all, the distribution of medical officers to be aimed at giving the newly entered medical officer the experience required to improve his professional skill.

Economic Improvements.—To be effected by a reduction in the number established from 400 to 355 medical officers, with an upgrading of higher ranks from 27 to 40, the length of career to be extended by increasing the retiring age of senior medical officers, and in addition to specialist pay for the increased specialist appointments, a short service scheme of entry with an attractive gratuity was recommended.

Opinions may differ as to the wisdom of these recommendations and as to the value of the evidence on which they were based—a large part of it from students of four selected medical schools. But it must in fairness be reported that when they were implemented, some increase in recruiting followed in the ensuing years, as is seen from the figures below:

Surgeon Lieutenants R.N. entered in:

1929	19
1930	11
1931	18
1932	16
1933	26
1934	24
1935	21
1936	24
1937	32
1938	36

Every effort was made by the Naval Medical Authorities to abide by the new principles laid down. Newly entered medical officers were carefully nursed as regards professional opportunity, while basic Service knowledge was acquired in a manner perhaps more academic than the practical sea-going methods of former times. But experience showed

that it was the character of the new officer himself which really counted, and that most recruits were still possessed of an inherent attraction towards the Royal Navy above all else. The right type of officer was still being obtained, though numbers were not yet sufficient for future commitments. But on the whole, the effects of the recommendations were good as regards the Navy, despite the obvious pressure of unforeseen circumstances in later years. But the general tone of young medical officers remained high, and uninfluenced by the ingenuity of the occasional malcontent who produced problems through which his embarrassed and overworked seniors were forced to pick their way, always with apprehension and sometimes with disgust.

The provision made was naturally on a peace-time footing, and had been prepared always against a background of national retrenchment. It is doubtful whether war expansion had yet been visualised. As will be seen later in this history the question of female and male nursing establishments presented a similar recruiting problem.

The emergencies brought about by the Italo-Abyssinian War in 1935 and the Munich crisis of 1938 revealed all too well the personnel difficulties which would have to be faced in the event of hostilities. In spite of careful planning, which will be described, the Medical Branch of the Royal Navy entered the War of 1939–45 handicapped from the beginning by a numerical nightmare from which it never fully recovered. From less than 400 permanent Royal Naval medical officers at the outbreak of the war, the numbers increased to a peak of 2,610 doctors at the end of the war, of which 85 per cent. were Royal Naval Volunteer Reserves. But although the number of medical officers increased about seven-fold, yet the proportion of doctors in the total naval force declined. This was because the expansion of the Medical Service did not keep pace with that of the total force. The peace-time establishment of medical officers was about four per thousand total force. This is a reasonable figure on which to run a naval medical service, though less than considered necessary by the United States and the German Navies. But by 1942, this ratio had fallen to 3·6 per thousand, and to 3·0 per thousand early in 1945. These figures are an answer in themselves to much of the unfair and prejudiced criticism, generally of a purely destructive nature, to which the Medical Services were frequently subjected during the war years.

PREPARATIONS FOR WAR

The international unrest of the middle 1930s, as is well known, called for preliminary preparations to be made throughout the nation for possible war with a major European enemy.

The preliminary preparations made by the Medical Department of the Navy were naturally based on the distribution of the Fleet itself and the existing shore establishments, to be added to according to

plan. Broadly speaking, naval medical preparation was based on the provision of personnel, hospital accommodation, and medical stores and equipment.

Medical Personnel. It was estimated that a total of 800 medical officers would be the initial number necessary to meet new commitments on the outbreak of war. At the time of preparation, 370 medical officers were already on the Active List, to which could be added 115 officers on the Retired and Emergency Lists, as well as a nucleus of 190 permanent R.N.V.R. officers. This total of 675 left a possible deficit of 125, but this was discounted by virtue of the undertaking of the British Medical Association to provide through its organisation a number of medical men throughout the country who would offer their services to the Royal Navy in the event of a national emergency. As will be seen, this proved to be the case.

It was estimated that approximately 180 nursing sisters would be required, of which 84 would be available on declaration of war, and 168 in reserve as required. This total of 252 gave a surplus of 72 over estimated requirements.

An increase of 2,230 was estimated in the sick berth branch, of which the majority were available from reserve sources, the figure including a number of V.A.D. nursing members. A total of 400 mobile nursing members and 100 cooks and clerks were guaranteed by the V.A.D. Council.

As regards civil consultants and specialists, it was arranged that the peace-time list of permanent civil consultants should be augmented as considered desirable, and temporary naval rank given in accordance with the standing of the consultant in the profession. Experience in the War of 1914–18 however, had suggested that, as regards specialists in a future war, it might be well to adopt a more conservative policy. In the former war active service medical officers had been immediately replaced by civil specialists, and the lack of clinical opportunity suffered by the former during the war years had undoubtedly left the individual with a sense of professional inferiority in the years that followed. It was therefore decided that in a future war, it would be preferable to retain in their appointments those active service officers already serving in the hospitals, and not to enter civilian specialists to replace them, at all events, immediately.

Hospitals. Accommodation likely to be necessary for sick and wounded naval personnel in a European war was studied in relation to the probable distribution of the Fleet, the vulnerability of existing naval hospitals, and the number of main naval bases to be anticipated.

It was reasonable to expect the distribution of the Fleet to be similar to that of the War of 1914–18 at the beginning. It was assumed that the Royal Naval Medical Establishments at Chatham, Deal, Shotley and Haslar would probably be untenable, and available only as casualty,

first-aid and clearing stations. It was thought possible that Portland and Plymouth might have to be brought into this category at a later date.

The scheme was therefore prepared to provide main naval base hospitals elsewhere in the country. It was considered that the site of these hospitals must be west of a line drawn from Berwick through Nottingham and Reading to Weymouth. The governing factors in selection were to be accessibility by rail, remoteness from legitimate targets, and remoteness from densely populated areas. Selection was therefore limited to the areas around Newbury, Gloucester, Bath, Hereford, Shrewsbury and Lancaster, and the Carlisle district, with a site in Devon if Plymouth could not be maintained. It was also considered essential to provide a base hospital in Scotland in addition to the establishment already existing at Port Edgar. In this case reasonable accessibility by rail from the Firth of Forth and the Firth of Clyde had to be taken into account.

Hospital ships were naturally included in the preparations and in this connexion the question of selecting convenient ports of disembarkation had to be considered. Here, the governing factors were shortness of sea passage, avoidance of exposure to enemy interference on passage, ease of access from the port to the naval base hospital, rail facilities, wharf accommodation, the draught of ship and navigational hazards. Owing to lack of immediate shore accommodation, it was considered that, in some ports hospital facilities would have to be provided to some extent by hospital ship alone. This proved to be the case, for example, at Scapa Flow throughout the whole war period. An idea of the first scheme on these lines is given in the following proposals:

Reception and Disposal of Sick and Wounded

Base	*Reception*	*Disposal*
North of Scotland and Ireland	Hospital ships. (Hospital carriers until hospital ships ready.)	By hospital ships to ports on West Coast, e.g. Clyde, Stranraer, Mersey, Fishguard, Bristol Channel. Thence by hospital train to a main Naval Base Hospital.
Firth of Forth	Hospital ships	Hospital ships to evacuate locally if possible, e.g. Leith, Rosyth and Queensferry. Thence by hospital train to main naval base hospital. If local evacuation is not possible, hospital ship must proceed to a port, preferably one on the West Coast.
Aberdeen and Dundee	Local Army or civil hospitals. Transport by road ambulance.	By ambulance train as necessary to base hospital.
Tyne	If used extensively, a small hospital ship to be provided.	To local Army hospital, hospital train to base hospital.

Base	*Reception*	*Disposal*
Humber	As for Tyne.	By hospital train to base hospital. Hospital ship to evacuate at Immingham.
Harwich	Hospital ship or local sick quarters or civil hospital.	By hospital train to base hospital or by hospital ship to selected port.
Chatham, Sheerness and Deal	Local naval hospital, sick quarters and infirmary temporarily, to be moved elsewhere as soon as practicable.	By hospital train to main naval base hospital.
Dover	Hospital ship or sick quarters on shore.	By hospital train to main naval base hospital.
Portsmouth	Local naval hospital.	By hospital train to base hospital.
Southampton	If extensively used, then hospital ship, otherwise local hospital.	By hospital train to Army hospital at Bournemouth or Bath or to main naval base hospital.
Portland	Local naval hospital.	By hospital train to base hospital or Army hospital at Bath.
Plymouth	Local naval hospital expanded as necessary.	To a hospital in a selected site in Devon or Cornwall.

In essence, the planning was based on the assumption that one of the three main naval hospitals would be available for the reception of sick and wounded from the Fleet and the retention of cases requiring prolonged treatment. This entailed a loss of effective hospital accommodation to the extent of 2,400 beds. It was remembered that in 1918, the Navy had in Great Britain a total of approximately 5,000 beds available, and this number was assumed to be the minimum likely to be required in any future European war. Also, it was realised that the total requirement must be expected to rise at a very early stage of hostilities. It was further considered necessary to provide a minimum total of 3,800 beds outside the main hospitals, of which 2,400 beds would be required at the outbreak of war.

It should be noted that these arrangements followed the opinions of the various committees which had investigated similar hospital provision for the civil population during hostilities, and held that the Navy and Army should make their own arrangements. This decree was based on the forecast that the total number of civilian casualties in the first few weeks of the war would far exceed the number of beds available in civil hospitals. To implement the hospital scheme various suggestions were put forward:

It was suggested that in England, the immediate requirements should be met by the selection of suitable buildings and institutions which

would be readily convertible into hospitals, and that these should be marked down as 'shadow hospitals' at once. It was thought that deficiencies might be met by augmenting the shadow hospital by marquee hospitals capable of erection at short notice on selected sites. This obviously was a fine-weather project if intended seriously. In Scotland, arrangements were made with the authorities of certain institutions marked down as shadow hospitals.

As a long-term project the provision of hutted hospitals was suggested in certain areas, but here it was realised that a fair length of time must be allowed for preparing the sites to be occupied by such erections, particularly as regards water supplies, lighting, drainage, as well as the large supply of labour which would have to be employed. On the above lines several large institutions and buildings throughout the country were scrutinised, especially some of the larger boarding schools which, having extensive dormitory accommodation, were considered eminently suitable and readily convertible. Also they provided prepared sanitary surroundings capable of extension by hutments.

Stores and Equipment. A more detailed narrative under this section will be given later in this history. During the preliminary phase of preparation efforts were concentrated on replenishing the existing deficiency of stores in accordance with the Naval Deficiency Programme of 1935. The chief items concerned were the provision of technical stores for eight hospital ships, supplies to satisfy demands from Malta and Hong Kong, to increase the reserves of packed chests and to provide service-afloat X-ray machines, the date of completion to be the end of 1938. Attention was also given to the provision of safe storage space at home and oversea, and in light of subsequent events, it is of some interest to note that it was proposed to dismantle the medical store at Colombo as being unsatisfactory and expensive.

Emergency contracts with continuity of supply were placed for all types of medical stores and equipment, contracts being based on an immediate supply of six months' war-time requirements, and thereafter on a quarterly supply.

Concurrently, an up-to-date system of medical store accounting was introduced throughout the medical establishments.

This brief outline of naval medical preparations for war will be amplified in some detail under later sections of this history. It may, however, be noted at this point, that subsequent events proved the preliminary preparations to be less elementary than they might appear to have been at first sight. Many of the original ideas were put into effect on the outbreak of war and worked efficiently for the next six years. But the reader cannot fail to note the omission of certain features which played such an important part in later years. For instance, there is little mention of inter-service co-operation, and the possibility of war with an enemy in the Far East is overlooked.

CHAPTER 2

THE WAR YEARS

PRELIMINARY SURVEY

A PRELIMINARY survey of the war years in relation to the preparations for war may be covered briefly.

1939

By the end of 1939, instead of the estimated number of 800 medical officers, 1,062 had been employed. These were made up of 408 R.N. active service, 88 R.N. retired and emergency, 288 permanent R.N.V.R. and 278 temporary R.N.V.R. Four months' experience of war suggested that an increase of 1,300 medical officers would be necessary by early 1941. Among unforeseen commitments were the employment of medical officers on whole-time passive defence duties in the base hospitals and dockyards, and the provision of a separate medical officer for each destroyer afloat. This function had been carried out in peace-time by a single medical officer carried in the flotilla leader. In the War of 1914–18 senior medical students had been employed as surgeon probationers for service in destroyers. The policy of employing a separate qualified medical officer for each destroyer was proved to be justified in the early months of the war following the menace of the magnetic mine.

Consultants were employed on the outbreak of war in accordance with previous arrangements.

At this time the Central Medical War Committee had no difficulty in supplying the necessary numbers, but it was realised that some difficulty must be anticipated in the near future in meeting the combined requirements of the three fighting services and the civilian services.

Before August 1939 there was a gradual improvement in recruitment of sick berth staff. On mobilisation the staff was augmented by recalled pensioners and R.N. auxiliary reserves, in addition to which recruitment of staff for both continuous service and 'hostilities only' progressed very satisfactorily. A beginning was made in the training of special reserve ratings entered under the Emergency Acts. By the end of December 1939, 3,640 sick berth ratings were employed as opposed to 2,230 originally estimated. Concurrently, increases were made in the complement of wardmaster officers from the sick berth branch to the extent of one additional commissioned wardmaster and three additional warrant wardmasters. At this time, therefore, the total number of wardmaster officers employed was 43.

The volume of female nursing staff was at this time very satisfactory. During the whole of 1939 there was no dearth of suitable candidates for

the Regular Naval Nursing Service, and enrolment in the Naval Nursing Service Reserve had improved considerably. In the first few weeks of war 91 regular and 231 reserve nursing sisters were employed, making a total of 322. At the same time, 265 V.A.D. nursing members had been entered, but had as yet not been employed abroad or afloat.

By arrangement with the Ministry of Health and the Department of Health for Scotland, R.N. Auxiliary Hospitals were established at Barrow Gurney, near Bristol, at Newton Abbot, Devon, and in Scotland at Kingseat, a former mental hospital in Aberdeenshire. A smaller hospital was established at Invergordon. Five convalescent establishments were also offered and accepted in various parts of the British Isles.

To augment the obsolete *Maine*, the only naval hospital ship afloat, two hospital carriers, the *Isle of Jersey* and the *Aba* were taken over, while the *Oxfordshire*, *Vasna* and *Amarapoora* were commissioned as major hospital ships.

In contrast to the original preparatory programme for war-time medical stores and equipment, major increases were added in the few months before the war. The arrangements made proved more than satisfactory and within the first three months of war the commitments met included the equipping of 19 minor establishments ashore, three hospital ships and three hospital carriers, the storing of all vessels brought forward from reserve as well as newly constructed ships on commissioning. In addition stores were provided for several armed merchant cruisers, and many hundreds of small craft. It is worthy of note that the emergency contracts for the supply of essential medical materials at stated periods were successfully operating on the outbreak of war, and ensured a continuous delivery of stores to meet naval requirements.

1940.

During this year the total number of medical officers employed reached 1,457. It was estimated by the end of the year, that a further 360 would be needed to meet future commitments and loss by waste. During 1939 and 1940 6 R.N. and 24 R.N.V.R. medical officers lost their lives. A feature of this year was the arrangement made to receive batches of medical officers entering from the Dominions.

Four additional civil consultants were employed in orthopaedic surgery, plastic surgery, anaesthetics and neurology.

With the growth of the total Royal Naval and Royal Marine personnel an increase inevitably occurred in the sick berth branch, and the total now reached 4,300. The number of naval nursing sisters increased to 387, and V.A.D. nursing members to 500. A feature of 1940 was the Medical Organisation to cover the Women's Royal Naval Service. A most important landmark in Naval Medical History, was the appointment of the Royal Navy's first woman medical officer, with the relative rank of surgeon lieutenant, R.N.V.R.

During 1940 the strain of war also revealed the need to develop an advanced organisation to cover the requirements of neuro-psychiatry.

The increase in augmenting hospital accommodation continued and included plans to erect an establishment at Sherborne under the Emergency Medical Services, which was to be allocated to the Royal Navy on completion.

A progressive increase in the demands for medical stores and equipment was met throughout the year. The demands from medical establishments now numbered 5,800 per annum as compared with about 1,500 in peace-time, and the service afloat commitments increased in a similar proportion. The fact that this increase was satisfied in spite of the difficulties created by air activity, which seriously affected communications, contractors' deliveries and transport generally, reflected great credit on the department concerned.

1941.

During the year the shortage of medical man-power became severe. The number of medical officers employed in destroyers continued to constitute a heavy strain on medical officer personnel, but in view of its proved practical value it was considered that the commitment must be maintained. In addition extra medical officers were required for the manning of newly constructed shore establishments, ships afloat, and a multiplicity of special units which later came under the heading of Combined Operations. With an increasing appreciation of the danger of war in the Far East, 25 additional medical officers were needed for the Ceylon area. Substitutes were necessary to replace 57 invalided and 49 released medical officers. At this time the casualty rate among medical officers had mounted to 84, 56 being killed in action, 11 missing, 10 died on active service and 7 prisoners-of-war.

In spite of wastage, great difficulty was experienced during the whole of 1941, in convincing the Medical Personnel (Priority) Committee of the needs of the Fleet, and the necessity for a constant pool of medical officers on shore ready for sea service when required. In fact, towards the end of the year the supply of medical officers ceased altogether. The Dominions had assisted to the extent of 62 medical officers, but with the expectation of Far East developments it became obvious that this source could no longer be available. By the end of 1941 the number of medical officers had risen to 1,705.

The number of nursing sisters employed during the year was 450. V.A.D. nursing members totalled 780, while sick berth staff reached the figure of 6,060.

Additional civil consultants were appointed in dermatology, radiotherapy, and physiotherapy.

It was surprising, though gratifying, that, at this stage in the war, all the naval hospitals, both permanent and auxiliary, had continued to

function in spite of severe enemy action. The new hospital at Sherborne was completed during the year, in addition to which two establishments for the reception of neuro-psychiatric cases were opened at Cholmondeley Castle, Cheshire, and Knowle, Hants. The large increase in naval personnel in the Mersey and Clyde areas necessitated increased hospital accommodation in these districts.

There was no change in the hospital ship situation during the year.

Great losses of medical stores and equipment were suffered by enemy action at Deptford, Haslar, Coventry and Plymouth. These necessitated a complete reorganisation and the institution of depots at Huthwaite, Leicester and Wellingborough. Oversea, a new depot was established at Freetown, and it is of interest to note that during the year complete replenishments for Fleet requirements in medical stores in Alexandria were destroyed on three separate occasions.

1942

It is obvious that the outbreak of war with Japan did nothing to ease the burdens of an already embarrassed Medical Department of the Royal Navy. Further wastage of medical man-power, accommodation and stores and equipment was occasioned by the loss of the R.N. Hospital, Hong Kong, Singapore Naval Base, as well as by the sinking of H.M. Ships *Prince of Wales*, *Repulse*, *Hermes*, *Dorsetshire*, *Cornwall*, *Exeter* and smaller units of the Fleet. It is to the credit of naval medical planning that the losses of staff, equipment and accommodation were not more severe, as they might well have been but for the fact that it had always been arranged that in the event of war in the Far East, the main centre for naval hospitals should be Ceylon. This foresight was amply justified by subsequent events.

In January 1942 the supply of medical officers recommenced, and during the year, the number employed rose to 2,026. Corresponding increases were effected in the nursing staffs. The number of wardmaster officers increased to 80, nursing sisters to 658, sick berth staff to 8,000, and V.A.D. officers and members to 1,587.

The work of the Medical Personnel (Priority) Committee (and also, to a diminishing extent, of the Regional Committees established on the recommendation of that committee to secure local co-operation to meet civil and Service needs), proceeded under very much the same conditions as during the previous twelve months. The preparations for the invasion of North Africa late in the year abundantly demonstrated the imperative need for a pool of medical officers being available for sea and special service when required.

The number of Dominion and Colonial medical officers serving during the year was 61 and the number of women doctors was increased from one to two.

During the year there was a wastage of 99 medical officers made up of 30 killed in action, 2 died on active service, 8 missing, 11 prisoners-of-war, 24 invalided and 24 released for compassionate and other reasons.

A feature of the year was the appointment of two naval medical officers to the flight surgeons' course at Pensacola, U.S.A.

The number of consultants employed was increased by seven, made up of orthopaedic surgery, genito-urinary diseases, rehabilitation, radiology, surgery for the North of England, gynaecology for the North of Scotland and gynaecology for Northern Ireland.

All naval hospitals continued to function during the year. The Royal Naval Auxiliary Hospital, Kilmacolm, near Glasgow, was opened, and its extra accommodation for venereal cases and sick W.R.N.S. greatly eased the accommodation question in the Clyde area.

The Woolton convalescent home was taken over and provided 200 beds for general cases which was of great assistance in the Liverpool area. An extension to the Seaforth Hospital, Liverpool, was also made.

The difficulties in accommodating tuberculosis cases in England and Wales were met by requisitioning the Victoria Hotel, Southport.

A hospital was opened at Durdham Down, Clifton, for the accommodation of officer patients in the Bristol area.

The hospital ship fleet was augmented by the S.S. *Ophir* and the S.S. *Tjitjalengka*. The disposition of hospital ships at the end of 1942 was

Home Waters	— *Isle of Jersey*
Eastern Mediterranean	— *Maine*
Western Mediterranean	— *Amarapoora* and *Oxfordshire*
Far East	— *Vita*, *Vasna* and *Tjitjalengka*

The progressive increase in the number of demands for medical stores continued. New depots were opened at Liverpool, Londonderry, Bournemouth, Durban and Mombasa. Stores were despatched to equip such a depot at Haifa should the need arise.

1943

During the year the number of medical officers employed rose to 2,393, wardmaster officers to 115, nursing sisters to 892, sick berth staff to 11,000, and V.A.D. officers and members to 2,800. The wastage of medical officers amounted to 63, made up of 15 killed in action, two died on active service, four missing, one prisoner-of-war, 18 invalided and 23 released for various reasons.

The number of women doctors increased to 8.

The number of Dominion and Colonial officers employed was 49. The list of consultants was increased by 4, to cover venereal diseases, medical statistics, anaesthetics, and ophthalmology in Scotland.

During the year the proceedings of the Medical Personnel (Priority) Committee were almost entirely over-shadowed by the inquiries carried

out by the Lord Privy Seal into the supply of doctors for the Services and the civil population, and the consideration given in the Admiralty to the naval medical requirements of Far Eastern operations. It was found that the intake of doctors into the Services was in fact severely restricted owing to the needs of the civil population.

A feature of the year was the proposal placed before the Treasury to bring the pay and grading of naval nursing sisters into line with the recommendations of the Rushcliffe Committee. The recommendations of the Committee on V.A.Ds. set up by the War Office, however, were not applied to the naval V.A.D. scheme. This was because it was considered that changes would not be achieved without undue disturbance of arrangements which were already proved to be satisfactory.

All naval hospitals continued to function throughout the year.

A Royal Naval Auxiliary Hospital was opened at Rainhill, and the Victoria Hotel, Southport, functioned successfully as a Royal Naval Auxiliary Hospital for diseases of the chest.

There was no change in the number and disposition of hospital ships during the year, but the question of hospital ships for future Far East requirements was causing considerable concern.

The number of demands for medical supplies during 1943 showed a 10 per cent. increase over those for 1942. New depots were opened at Algiers, Bombay, Taranto, North Shields and Rinigill, Orkneys. Equipment was also assembled and shipped for the proposed new auxiliary hospitals at Bombay and Nilavoli. As a result of negotiations between the Admiralty and the Ministry of Supply, considerably greater use was made of the Ministry's facilities for procuring medical stores, and a greater degree of liaison was established between the departments for the facilitation of production.

1944

During the year the number of medical officers employed was 2,393, which included 18 women doctors and 72 from the Dominions and Colonies.

Casualties and wastage during the year accounted for 84, made up of 12 killed in action, 2 died on active service, 2 missing, 1 prisoner-of-war, 48 invalided, and the remainder released for various reasons.

Wardmaster officers employed during the year totalled 115.

The numbers employed in the Royal Naval Nursing Service were 892.

Sick berth staff totalled 11,000, and V.A.D. members 2,800.

It was found that the intake of medical officers was insufficient to meet all commitments, many of which were quite unforeseen. Forty medical officers were trained and employed on duties afloat as part of the Normandy landing operations. Planning for operations in the south-west Pacific required medical staffs for new hospitals in the Far East. Research developments in connexion with the Far East absorbed a further

number of medical officers. But perhaps the greatest difficulty was created by the Central Medical War Committee's demand for releases of numerous medical officers from the Royal Navy in order to meet shortages in civil life. This demand had been quite unforeseen and was most embarrassing.

A feature of the year was the introduction of a new pay code for naval nursing sisters, and an innovation was the introduction of specialist allowances for nurses and sisters employed in operating theatres.

New hospital development was concerned mainly in augmenting existing facilities in the Far East. Auxiliary hospitals were equipped and staffed at Sydney and Brisbane. Nearer home a second auxiliary hospital was opened in Colombo. In India an auxiliary hospital was commissioned in Bombay, a second was planned for Mandapam, while naval sections of new or existing military hospitals were commenced at various places throughout the country, notably at Cochin and Vizagapatam. These hospital preparations in India and Ceylon were in addition to the requirements of sick quarters attached to numerous naval air stations. The latter were at times far removed from hospital facilities, and the sick quarters therefore undertook the work of small general hospitals.

As part of the Far East planning, the shortage of hospital ships caused considerable concern in the second half of the year. The minimum of five extra estimated to be required appeared to be beyond the powers of the Ministry of War Transport.

New medical supply depots were opened at Bishopston, Belfast and Naples. But the greatest commitment of the busy Medical Supply Branch was the devising of new units to meet special circumstances. The major task in this connexion was the supply of complete minor hospital units to the 70 landing craft utilised to evacuate casualties from Normandy. Further commitments were the provision of hospital equipment for the mobile landing craft defence bases, and mobile naval air bases. During the year an organisation was developed for supplying penicillin to all ships afloat carrying a medical officer.

This outline of the year 1944 is deliberately brief, but it was in fact the busiest year of the naval medical administration, as will be seen in the more detailed account given later in this history.

1945

The year 1945 was perhaps the most difficult of the war years as regards naval medical personnel. Up to the end of hostilities with Japan the commitments were largely anticipated, but the sudden cessation of hostilities in September 1945 produced problems of reconstruction and rehabilitation in the Far East, many of which were medical in nature and had to be undertaken by naval medical officers. In many places occupied by the Japanese, the local Asiatic population had been completely

neglected medically, and disease of all descriptions was widespread. Care of such civil populations was undertaken largely by the Navy, as well as the reconstruction of the public health and sanitary organisations in some areas which had fallen into abeyance under the enemy.

All this meant that on the whole the medical commitments of the Royal Navy were, if anything, increased when the war ended, and in the transition period from war to peace, the numerical shortage of medical personnel became more acute than ever before.

In May 1945 the number of medical officers employed was 2,535, wardmaster officers totalled 138, nursing sisters 1,095, sick berth staff 12,000, and V.A.D. members 3,893.

In August 1945 it was decided that the number of doctors released from the Navy should be increased, and it was inevitable that the existing scale of medical provision in the Navy would have to be reduced. Notice to this effect was published throughout the Service, particularly for the benefit of commanding officers. The essence of this order was, that in order to reduce the number of medical officers employed, the qualified medical assistance available in the Navy must approach the standard pertaining to civil life. In order to do this, any suggestion of over-insurance had to be eliminated, the duties of medical officers ashore were enlarged to embrace greater areas, transport was provided, and the doctrine of the Service that a sick man must be seen by a doctor 'at once', was replaced by a more up-to-date doctrine that he should be seen by a doctor 'within a reasonable time'.

At this time it was found possible to reduce the complement of the Fleet to peace-time standards, except in the Pacific area. But in addition to this reduction Cabinet demands called for the release of 1,265 medical officers in November 1945. The actual number released was about 850, but even so, this meant a ratio of two medical officers per thousand naval personnel.

At the same time some thought had to be given once more to building a permanent Naval Medical Service, for at this time the number of permanent R.N. medical officers was only just over half that of the pre-war service.

The release of nursing sisters and naval V.A.Ds. was governed by the normal rules of the Release Scheme, and proceeded smoothly.

The naval hospital ship situation during the early months of 1945 was in a very serious state, causing grave apprehension and anxiety to the naval medical administration. In fact, a possible calamity was probably only avoided by the collapse of Japan earlier than had been suspected. The joint Administrative Planning Staff during 1944 had planned that five additional naval hospital ships would be required for service in the Indian and Pacific Oceans early in 1945, for naval operations against the Japanese. The Ministry of War Transport, however, was unable to supply the vessels as planned for Far Eastern commitments, and the

whole situation had to be reviewed urgently during December 1944. A compromise had to be arrived at, taking into account the fulfilling of naval and military requirements, in view of the world-wide shortage of shipping generally. The Navy had to accept most reluctantly a reduction by two of the five additional hospital ships for 1945. The three ships supplied were the *Gerusalemme*, *Cap St. Jacques* and the *Empire Clyde*. Each of the vessels was over 20 years old, and delays caused by conversion, repairs, and a fire in one case, meant that none was really functioning satisfactorily before the end of the war.

The work of the naval medical supply branch during 1945 was increased rather than decreased, despite the closing of several depots and sub-depots in Home Waters and the Mediterranean. Far Eastern commitments held first priority, and were increased by the post-war reconstruction plans in Singapore and Hong Kong. A more detailed account will be given under the appropriate section of this History.

THE PERSONNEL PROBLEM

It will be better to record now, rather than later in this history, an account of the effects of the medical personnel problems so far described.

As is known there was a general shortage of medical men and women during the war. In 1941 the Cabinet appointed a Medical Personnel (Priority) Committee to investigate the distribution of doctors between the defence services and the civilian population. The Medical Director-General of the Navy made many appeals to this committee to increase the quota of doctors allocated to the Senior Service. The Medical Personnel (Priority) Committee and the executive body, the Central Medical War Committee, could not always meet these demands consistently with due regard to the needs of the other Services and the civilian population. Notwithstanding constant appeals, protests, and well considered reports of the Naval Medical Department, the quota of doctors continued to drop, until in 1945 the number of medical officers in the Navy reached the perilously low ratio of three per thousand total force. The experience gained from working to this ratio demonstrated that three doctors per thousand naval strength is not enough to maintain a fully efficient medical service for any length of time.

The first effect which was apparent was in the training of naval medical officers. In a defence service, provision must be made to train doctors newly joined from civil life. There is no doubt that subjects which are of paramount importance to the Services in time of war are badly, if ever, taught at all in the civil medical schools. Preventive medicine, hygiene, tropical diseases, administration and psychological medicine do not form a major part of the normal curriculum. Early in the war, representations were made to the medical schools by the Medical

Directors-General of all three Services, requesting that preliminary training in these subjects should be given to senior medical students before entering the Services. Experience in the Navy suggested that these appeals had little effect, possibly because there were not enough teachers in the schools with the necessary knowledge or experience to carry out such instruction.

The first task, therefore, was to train newly joined doctors in special subjects after joining the Navy rather than before, and this meant loss of time. Efficient training could not be carried out without an adequate margin of medical officers to attend courses. Unfortunately the most valuable instructors among permanent Royal Naval medical officers were themselves required for active service. The result was that much of the attempted preliminary training of newly joined medical officers was left in the hands of older retired medical officers. In some respects this inability to give the newly joined medical officer a preliminary course of instruction of reasonable duration and good quality was the most damaging effect of an inadequate margin of medical officers. Early in the war in addition to preliminary training on entry, special courses were initiated and schools established in which to instruct as many officers as could be made available. Some of these schools produced work of the highest quality, but of necessity the courses were all too short, and many medical officers could never be spared to attend them owing to the exigencies of the Service.

Those medical officers who would normally have started their naval career with a six months' course in naval hygiene, were given instead a course lasting only a week or two. It says much for the zeal and adaptability of young medical officers from civil life, that so many of them eventually became able practitioners of marine medicine, chiefly by their own efforts and self-education. The Navy was in fact, forced to apply the system of apprenticeship to its new doctors. The fact that these practically untrained people made good was most heartening. Throughout the whole war the morale of naval medical officers was maintained at a high standard and the lack of special training in naval medical matters was largely compensated by the personal initiative, courage in action and constant devotion to duty which was displayed.

As a matter of historical interest it is worth recording that a comparison of the two world wars revealed certain matters of status which concerned the permanent Royal Naval medical officer, and his R.N.V.R. contemporary to whom so much was owed.

As always when men perform the same duties, but work under different conditions of service, particularly as regards pay and emoluments, some degree of friction between groups must be expected. In a war which lasts for some years, the first flush of enthusiasm is bound to be replaced eventually, when the novelty wears off, by more practical and material considerations, largely economic.

Permanent R.N. doctors, being only human, could not fail to be envious of the large number of acting ranks which extra seniority gave to certain selected experienced specialist R.N.V.R. medical officers. The R.N. doctor forgot that he himself must weigh his permanent career and pension against the seniority of the R.N.V.R. man.

The peace-time R.N.V.R. doctor, called up on the outbreak of war, was apt to resent the fact that the R.N.V.R. uniform of which he was so proud was also worn by the conscripted doctor from civil life, and who thus masqueraded as a volunteer. In the First World War, the conscripted doctor wore the same uniform as the permanent R.N. medical officer, and was therefore distinct from the permanent R.N.V.R. officer with his own separate contract of service. As a result, in the First World War, there was less clamour for extra pay and promotion than there was in the Second World War. Successive Medical Directors-General were continually embarrassed by complaints of unfairness and favouritism from officers who considered, sometimes with justification, that they were more entitled to higher rank or emoluments than those medical officers to whom such privileges had been extended. There is no doubt that, from the psychological point of view, it would have been better in the Second World War to have entered conscripted doctors in some other Reserve, leaving the permanent pre-war R.N.V.R. doctors as a *corps d'élite* of real volunteers recognised to have been enthusiastic enough to give up their leisure in peace-time in order to gain naval experience.

The operational effects of personnel shortages were at times severe. For example, the Normandy operation demanded that certain naval hospitals and sick quarters should have an augmented staff in order to meet an expected rush of casualties. But in practice the reverse happened, and these establishments had to be depleted of staff in order to man the landing craft and medical stations required in the plans for the evacuation of wounded during the actual start of the invasion. Fortunately, the General Staff estimate of the number of casualties was three times the number which actually occurred, and the Royal Naval medical establishments concerned acquired much merit in the eyes of the British and United States Authorities for the successful evacuation and treatment of some thousands of army casualties. But this was by luck, rather than good judgment, and the story would have been very different had the casualty rate been higher.

Again, before the end of the war in the Far East, it was found most difficult to man hospitals and hospital ships, although the number of beds demanded by the Navy was much lower than considered necessary by the other Fighting Services. The impossibility of fulfilling all commitments was a grave responsibility for the Naval Medical Administrative Authorities who had, in fact, to juggle at times with medical officers and nursing staffs, reinforcing establishments and ships in one place, and

depleting in others according to the ebb and flow of naval operations over a vast area. There were times when the Medical Department was forced to use its own judgment, and turn a deaf ear to the protests and recriminations of Executive Authorities who demanded special consideration for their own alleged medical requirements at the expense of the rest of the Navy.

These remarks on personnel shortages apply chiefly to medical officers, but they also apply to a slightly less extent to male and female nursing staffs. Difficulties created by the latter were largely solved by a much larger dilution of trained with partially trained nurses than had been considered practicable by most nursing authorities before the outbreak of war. As with the medical officers, the normal preliminary training of nursing sisters, V.A.Ds. and sick berth staff was replaced by the policy of apprenticeship in the wards, which produced perhaps far better nurses than any scheme of set lectures and demonstrations. Reserve nursing sisters, sick berth staff and V.A.Ds. did wonderful work when the time of testing came, and many became first-class nurses and practical technicians in the special departments before the end of the war.

As regards the personnel shortage, the chief mitigating factors were improved hygiene discipline throughout the whole Navy, the introduction of penicillin, the development of the air evacuation of casualties, and the skilful exploitation of D.D.T. as an insecticide and antimalarial agent.

Added to these were other various measures, some of which were drastic to an extreme. A large amount of clinical and technical work which was customarily done by medical officers was successfully carried out by nurses, W.R.N.S. and V.A.Ds. Injections, minor surgical procedures, blood transfusions, and certain routine inspections were entrusted to specially trained sisters and sick berth ratings.

Economy in the use of doctors was also effected by the more generous provision and less restricted use of motor transport. In fact the war revealed, that as regards naval shore establishments, great saving could be effected in time, medical staff and equipment by the free use of motor transport. It was found to be more economical in every way, and better for patients, to make medical officers dynamic instead of static. It proved a sound policy to keep one doctor always fully employed looking after two or more places, rather than employing a single doctor in a single establishment with little to do. It may be difficult for the reader to appreciate how great a departure this was from the traditional medical organisation of the Royal Navy. In the past, each Commanding Officer liked to feel that he had his own medical officer at the disposal of his ship's company, and he came to regard this as his right. Such a system of over-insurance was bound to result in wastage of medical personnel, and monotony for the individual medical officer. The new policy meant

that a medical officer must be shared by two or more establishments in a given area, and must be provided with a car wholly for his own use.

It was found that certain hygiene duties normally undertaken by medical officers, could be done as well, or even better, by pure biologists and scientists working under, or in close co-operation with, the medical authorities. It was considered that the bio-chemists, physiologists, psychologists, physicists, engineers, naval constructors and many others who play a part in preserving the health of the Navy, need not of necessity have medical qualifications. In the Far Eastern war this was exceptionally well demonstrated by the use of twelve entomologists who were employed on anti-malarial duties. This was a most successful innovation because, not only did these scientists release doctors for purely medical duties, but they carried out anti-malarial work much better than the untrained medical officer, and were capable of instructing all ranks in the best ways of coping with disease vectors in the tropics.

The acute shortage of male and female nurses was met by drastic reductions up to 25 per cent. in the nursing staffs of medical establishments throughout the Navy. An attempt was made to compensate for the deficit by employing certain seamen and other ratings to undertake cleaning and unskilled nursing duties. In the Far East a number of Royal Marines were given courses in nursing duties. But on the whole this policy was not successful, and was abandoned wherever circumstances permitted. It was found that to employ miscellaneous naval ratings on the duties of scrubbing hospital decks, carrying round meals and cleaning bed-pans was not in the best interests of discipline, efficiency and general administration.

In addition to the above endeavours to economise in medical manpower within the Navy itself, every effort was made to pool or integrate the doctors and medical resources of the three Fighting Services and of the civilian Emergency Medical Services. This inter-Service liaison and pooling of medical resources had a far-reaching effect in the Eastern Mediterranean theatre, and in planning the war in the Far East, as will be seen later in this history.

CENTRAL ADMINISTRATION

Before concluding this part of the Administrative Section of this history it is necessary to give a short description of the Central Medical Administration of the Royal Navy.

The Medical Department of the Royal Navy is responsible for the administration of the Naval Medical Services, in which are included all ancillary services such as the Royal Naval Dental Service, Queen Alexandra's Royal Naval Nursing Service, the Sick Berth Branch of the Navy, and the Voluntary Aid Detachment allotted to the Navy.

The Medical Department itself is divided into four main sections, personnel, material and finance, sickness and surveys, and statistical.

The pre-war naval staff consisted of:

1 Surgeon Vice Admiral—Medical Director-General of the Navy.
1 Surgeon Rear Admiral—Deputy Medical Director-General of the Navy.
1 Surgeon Captain R.N. as Assistant for Medical Personnel.
1 Surgeon Captain (D) R.N. for the administration of the Dental Service.
3 Surgeon Commanders R.N. for Material, Hygiene, Statistics, etc.

The civilian staff consisted of:

1 Civil Assistant to the Medical Director-General.
1 Staff Officer.
4 Higher Clerical Officers.
19 Clerical Officers and Assistants.

With the inception of the Naval Air Arm just before the war, arrangements were made for medical examinations and catagorisations to be performed in the Medical Department, which meant an increase in the staff.

Naturally further increases became necessary during the war years, and the administrative staff, both naval and civil, had to be augmented, but at no time could the Medical Department of the Royal Navy be regarded as over-staffed in relation to its heavy commitments. The reverse was probably the case.

RESEARCH

A more detailed account of research in marine medical matters is given in the section devoted to that subject later in this history. In the present chapter it is intended only to give a brief account of the preliminary stages which were passed through in building up the major research organisation.

As the war progressed, many problems naturally arose which it became essential to keep constantly under review and for which solutions had to be sought. As a result of early U-boat activities, the necessity of some authoritative rulings on the best methods of preserving the lives of shipwrecked seamen made itself felt. The Medical Research Council therefore formed a committee under the chairmanship of the Medical Director-General of the Navy to examine the problems of survival in open boats, rafts, etc. As many of the problems were concerned with seamanship and navigation as much as with medicine and physiology, it was arranged that the committee should be composed of a mixture of Royal and Merchant Navy professional seamen, as well as doctors and scientists capable of supplying expert knowledge of the problems to be considered. The first matters studied were the effects of exposure, thirst, fatigue, psychological factors affecting navigation and seamanship, and the life-saving equipment in ships and boats.

This first venture of the committee was most enlightening because it revealed not only what valuable results could be achieved by the co-operation of a variety of experts, but also that a large amount of scientific work had been done already in such problems, but had never been utilised by those persons afloat to whom it would have been of practical value. In addition, the work of the committee showed how desirable it was to eliminate the many false superstitions and harmful traditions which were current on the subject of survival at sea.

Following these early investigations, it became obvious that the work of such a committee could be extended to include problems affecting all branches of naval hygiene, both ashore and afloat, and it was suggested that a Royal Naval Personnel Research Committee should be constituted as a section of the Medical Research Council. By this means the Royal Navy was able to obtain the advice and assistance of the best medical and physiological experts in the country, and was also able to share that high prestige in which the Medical Research Council is held in the medico-scientific world. As part of the preliminary policy, it was considered essential that executive non-medical officers should serve on it in equal force with medical officers, civilian experts, and representatives of other interested Admiralty Departments.

The committee was presided over by Sir Edward Mellanby, F.R.S., and became the main co-ordinating committee of various sub-committees which did the actual research. These sub-committees covered such matters as clothing, habitability, vision, diving and all matters affecting the comfort and efficiency of the sailor in all sorts of environments and extremes of climate. In addition, a Statistical Committee was formed to examine how far naval vital statistics and records could be improved, simplified and integrated with those of other Admiralty Departments. (*See* Medical Research Volume, Chapter 2.)

CHAPTER 3

MEDICAL ASPECTS OF RECRUITING

RATINGS

IT is not proposed in this history to give more than the salient features of the medical factors involved in naval recruiting during the Second World War.

Before the introduction of the Military Training Act of 1939, recruiting into the lower deck of the Royal Navy was on a purely voluntary basis. There were three forms of engagement for which men were recruited:

1. Continuous Service, in which a man served for 12 years, after which he became eligible to re-engage for a further ten years, to complete twenty-two years of pensionable service in all.
2. Special Service for seven years on the Active List, followed by five years subject to emergency recall in the Royal Fleet Reserve.
3. Non-continuous Service engagement of five years, which was open only in the case of a few branches of the Navy.

Depending on which branch of the Navy was selected, the mode of entry varied with educational requirements, in some cases entry being by competitive examination where the selection was confined to candidates for training as skilled artisans. In all branches a high physical standard was required, especially for men and boys for continuous service who would be required to serve for twenty-two years under Service conditions, ashore and afloat, in all parts of the world, and subjected to varying climatic conditions. The raising of men and boys suitable in all respects was, in general, effected in the following way:

Officers not above the rank of commander R.N. or lieut. colonel R.M. were appointed by the Admiralty as recruiting staff officers under the Director of Naval Recruiting. These officers were located at nine headquarter recruiting stations in London, Birmingham, Bristol, Derby, Glasgow, Liverpool, Manchester, Newcastle and Southampton, and each was responsible for a certain area of country. Candidates for the Royal Marines could also apply at the Royal Marine Barracks.

The recruiting staff officers at these headquarter recruiting stations were assisted by a staff of 'recruiters' (pensioned N.C.Os., Royal Marines, chief petty officers and petty officers, Royal Navy), who were selected for this duty and appointed by Admiralty Order. These 'recruiters' were distributed throughout each area between the headquarter stations in a number (37) of 'out-stations' or sub-offices situated in places away from the headquarter station. In this way, the entire country was covered and the numbers required for the Royal Navy

were obtained through this organisation. The raising of suitable applicants was encouraged by advertisements, announcements by the B.B.C., posters and hand-bills, travelling cinema, visits by the 'recruiter' to the outlying villages, etc.

The routine followed by a candidate presenting himself at a recruiting out-station was roughly as follows:

His eligibility with regard to age, education, ability, character and general suitability was investigated by the naval recruiter, who tested the candidate roughly for visual acuity, hearing, condition of teeth, colour vision, height and chest measurement, in addition to his medical history of injuries and other diseases. This preliminary examination ensured the rejection of those suffering from obvious defects, with subsequent saving of time and expense in forwarding unfit candidates to headquarters stations for medical examination.

The candidate who passed this preliminary examination was then forwarded, with the necessary papers, to the nearest headquarter recruiting station for final medical examination, and further investigation as regards character, etc. If by reason of the remoteness of the out-station from headquarters, or for reasons of his employment he was unable to make the journey to the headquarter station, the candidate was first sent by the 'recruiter' to an Admiralty surgeon and agent for examination, but in any case the final examination was carried out by a final examining medical officer.

The final examining medical officer was a naval medical officer on the active or retired list, one being appointed for duty at each of the above-named headquarter stations, and the examination of recruits by these officers was final in all respects. The medical officers of R.N. Barracks at Portsmouth, Chatham and Devonport, and of Boys' Training Establishments, were also responsible for the examination of their local recruits, and the Senior Medical Officers of Royal Marine Divisions examined candidates for Royal Marines who presented themselves at R.M. Divisions.

The successful candidate then returned to his home until such time as he should receive a calling-up notice. If a period of more than fourteen days elapsed after a final medical examination before he was called up, he was subject to another examination to ensure that his medical condition had not deteriorated.

General Standards. The requirements of the high standard laid down before the war were maintained during the war for all entries for continuous and special service, and were considerably higher than the standards allowed for 'hostilities only' candidates.

The procedure for the medical and dental examination to be carried out by the final examining medical officers was laid down in Admiralty Publication B.R.689 (Instructions for Recruiting for Royal Navy and Royal Marines), and the examination was designed so as to test as far

as possible, the likelihood of the candidate continuing efficient and serviceable in any climate and under all conditions of service for a period of not less than 12 years, and to eliminate the possibility of invaliding before the expiration of his engagement with consequent expense to the Crown.

Persons of whatever class or age who were found to have certain specified physical defects or infirmities were considered unfit, *prima facie*, for entry into the Royal Navy. In general, the following obvious disabilities were an absolute bar to entry:

1. A weak constitution, imperfect development, or important malformation; physical weakness, either hereditary or acquired.
2. Skin disease, unless temporary or trivial. Scars which by their extent or position caused, or were likely to cause, disability or marked disfigurement.
3. Malformation of the head, deformity from fracture or depression of the bones of the skull, impaired intellect, epilepsy, paralysis, or impediment of speech.
4. Eyesight and colour vision below the standards required, fistula lachrymalis, or any chronic disease of the eyes or eyelids.
5. Impaired hearing, discharge from, or disease of, one or both ears.
6. Disease of the bones or cartilages of the nose, and nasal polypus.
7. Disease of the throat, palate or tonsils; diseased gums; tuberculous glands of the throat or neck; enlargement of the thyroid gland; scars indicative of the removal of tuberculous glands or of tuberculous disease; scars of suicidal wounds.
8. Functional or organic disease of the heart or blood vessels, deformity or contraction of the chest, phthisis, haemoptysis, bronchitis, asthma, dyspnoea, aphonia, chronic cough or any symptom of lung disease or tendency thereto.
9. Undue swelling or distention of the abdomen, disease of the liver, spleen or kidneys, hernia, or tendency thereto, from weakness of the abdominal rings; stricture of the urethra, incontinence of urine, syphilis or gonorrhoea. Otherwise desirable candidates below twenty-five years of age were not rejected for albuminuria, unless there was other reason to believe that there was disease of the kidneys.
10. The absence of one testicle should not cause rejection unless (1) the testicle had been removed on account of disease. (2) its absence had affected the bodily or mental health of the candidate. If one testicle were situated in the inguinal canal, it had either to be (*a*) removed; (*b*) brought down into the scrotum; or (*c*) returned into the abdomen prior to entry, provided the other testicle was in the scrotum and was normal in character. Hydrocele, or other serious defect or malformation of the genital organs. Varicocele was not to be considered a cause of rejection unless in exceptional cases in which it clearly formed, or was likely to form, a serious impediment to the efficient performance of duty, e.g. when it was associated with varicose veins or piles.

11. Fistula, or fissure of anus, haemorrhoids, or any disease of the stomach or bowels.
12. Paralysis, weakness, impaired motion, or deformity of the upper or lower extremities from whatever cause—a varicose state of the veins, especially of the leg—distortion or malformation of the hands or feet, fingers or toes. Loss of a finger (except the index or thumb) or a toe (except the great toe) was, however, not to be a cause of rejection where candidates were otherwise specially desirable, provided that the loss caused no disability. Flat foot was not to disqualify, unless it existed in an extreme degree so as to interfere with marching. Slight degrees of knock-knee or other similar deformities were not to disqualify otherwise desirable candidates for entry as sick berth attendants, writers, supply assistants, assistant cooks or officers' stewards or cooks.
13. Distortion of the spine, of the bones of the chest or pelvis, from injury or constitutional defect.

As it was clearly possible that some of the preceding defects or disabilities might exist in a minor degree, the examining officers in such cases had necessarily to be guided by their own judgment as to whether they were of such importance as to disqualify a man or boy for the Service entirely.

The real test of fitness was the candidate's likelihood to continue efficient and serviceable in any climate, and under all conditions of service, for a period of not less than 12 years.

Specially desirable men and boys, although slightly under the physical standard, or suffering from some minor disability, could be entered if the deficiency in height or chest measurement was more than counterbalanced by special fitness otherwise, and if they were robust, intelligent, and of perfectly sound and healthy constitutions.

Desirable candidates for entry in men ratings, who might be unable to pass the prescribed educational examinations, could be entered if their good physique and general fitness for the Service more than counterbalanced their mental disability. This rule did not apply to boys.

Naval medical officers could not recommend for special entry candidates whom they did not feel justified in accepting on their own responsibility. These officers, being final examiners, were expected to exercise their discretion in dealing with all candidates forwarded to them for examination, without reference to superior authority.

From time to time when increased numbers of certain ratings were required, the standards for height and chest measurement were relaxed, while a man, notwithstanding some minor disability, or being slightly below the physical standard, could be recommended to the Director of Naval Recruiting for acceptance, providing that the condition was counterbalanced by special fitness otherwise.

It should be noted that medical officers, while required to conduct their examinations with due care and to the best of their judgment,

were not held responsible for the subsequent invaliding of candidates they had passed inadvertently, except in glaring cases of failure to notice patent defects.

Naturally, a considerable proportion of the original applicants were rejected by the recruiters at their preliminary examination. For example, taking the year 1939–40, 15,836 candidates applied to join the Royal Navy in the London Area (excluding artificer apprentices and writers). Of these, 3,109 or 19·6 per cent. were rejected on medical or dental grounds and 3,841 or 24·2 per cent. for other reasons (educational, character, etc.) by the recruiters. That is 6,950 or 43·8 per cent. of the applicants were dismissed before final medical examination.

Of the remaining 8,886 men forwarded by the recruiters to headquarters for final medical examination, 1,724 or 19·4 per cent. were rejected by the final examining medical officer, and a further 2,030 were subsequently rejected for various other reasons after medical examination. Thus from the original 15,836 candidates, only 5,132 or 32·2 per cent. were finally accepted.

Eyesight Standards. Admiralty Fleet Order 1924–38 laid down new standards of unaided visual acuity, regulations with regard to the wearing of glasses, degree of refractive error allowed, grade of colour vision, etc., required for all continuous and special service ratings on entry and described in detail the method of procedure to be observed as regards test types to be used, standard lighting of the test type and room, etc. This Admiralty Fleet Order continued in force throughout the war for all continuous and special service ratings, and the standard laid down therein was considerably higher than that required for 'hostilities only' ratings.

Colour Vision. The system of grading laid down in the Medical Research Council's Special Reports Series No. 185 (Colour Vision Requirements in the Royal Navy) was followed. The grading was as follows:

Grade I. Candidates were required to pass a complete Edridge Green Lantern Test.

Grade II. A modified Edridge Green Lantern Test using the second aperture without neutral or modifying glasses, and sufficient colours being shown to ensure that signal green, red and white were recognised without guessing.

Grade III. As for Grade II using the largest aperture.

Colour vision was tested and graded by the use of the Ishihara test cards and the Edridge Green Lantern, and in addition, at the beginning of 1939, the Martin Colour Vision Lantern was introduced at all headquarter recruiting stations. The Edridge Green Lantern was used in the grading of all candidates who, if Edridge Green perfect, were Grade I. All candidates were also shown the Ishihara cards, though a faulty

Ishihara did not necessarily disqualify for Grade I. The Martin Lantern was not used as a routine test, but was chiefly used when any suspicions arose that a candidate was not quite Grade I.

The following standards of vision were required on entry:

	Distant	Near	Colour Vision
Seamen (entered as boys)	6/6–6/6	D=0·5	Grade I
Seamen (special service)	6/9–6/9	D=0·5	Grade I
Signalmen (special service)	6/6–6/6	D=0·5	Grade I
W/T ratings (special service)	6/9–6/12	D=0·6	Grade II
Stokers	6/9–6/9	D=0·6	Grade II
E.R.A. entered as Apprentice *E.R.A. direct entry	6/9–6/9 6/9 both eyes together, worse eye not less than 6/18	D=0·5 D=0·6	Grade II
E.A. entered as Apprentice *E.A. direct entry	6/9–6/9 6/12 both eyes together, worse eye not less than 6/24	D=0·5 D=0·6	Grade II
O.A. entered as Apprentice *O.A. direct entry	6/9–6/9 6/12 both eyes together, worse eye not less than 6/24	D=0·5 D=0·6	Grade II
Shipwright entered as Apprentice Shipwright, direct entry	6/9–6/9 6/12 both eyes together, worse eye not less than 6/24	D=0·5 D=0·6	Grade II
Blacksmith, plumber, joiner, painter	6/12 both eyes together, worse eye not less than 6/24	D+0·6	Grade II
Sick berth staff	6/12 both eyes together, worse eye not less than 6/24 (without glasses)	D=0·6 in each eye separately (with glasses if required)	Grade II
Writers, supply ratings, stewards, cooks	6/12 both eyes together, worse eye not less than 6/24 (without glasses)	D=0·6 in each eye separately (with glasses if required)	Grade III

	Distant	Near	Colour Vision
Royal Marines	6/9–6/9	D=0·5	Grade II
R.M. bandsmen	6/12–6/12	D=0·6	Grade II
Air apprentices	6/9–6/9	D=0·5	Grade II
Air fitters, air riggers and air mechanics (A), (E), (L) and (O)	6/12 both eyes, worse eye not less than 6/24	D=0·6	Grade II
Air gunners (entered as boys)	6/6–6/6	D=0·5	Grade I
Air gunners (entered as ordinary seamen)	6/9–6/9	D=0·5	Grade I

* Candidates for direct entry as Artificers, who were required to pass a trade test before entry, were not rejected for defective colour vision, provided the defect was not sufficient to prevent them performing their technical duties.

Note: W/T = Wireless Telegraphy
E.R.A. = Engine Room Artificer
E.A. = Electrical Artificer
O.A. = Ordinance Artificer

For men who re-entered the Service within less than twelve years from the date of original entry, the visual standards were the same as on entry, except for W/T ratings, who could be re-entered subject to a visual standard of 6/12, provided that the defect of vision was due to errors of refraction only, and not to disease.

If twelve years or more had elapsed since the original entry the visual standards were as follows:

Distant Vision.

Seamen and Royal Marines (except bandsmen) . . . 6/12 both eyes together, worse eye not less than 6/24.

Signal ratings . . . 6/12–6/18.

W/T ratings . . . 6/24 both eyes together, worse eye not less than 6/36. Capable of correction by glasses to 6/12–6/12 at least.

Sailmakers . . .
Electrical Artificers . .
Ordnance Artificers . .
Artisans . . . } 6/24 both eyes together, worse eye not less than 6/36. With glasses 6/12–6/12 at least.

Engine Room Artificers .
Mechanicians . .
Chief Stokers . .
Stoker petty officers . } 6/18 both eyes together, worse eye not less than 6/36. With glasses 6/6–6/9 at least.

Leading stokers . .
Stokers . . . . } 6/18 both eyes together, worse eye not less than 6/36.

Regulating branch . . 6/12 both eyes together, worse eye not less than 6/24.

Sick berth ratings Writers Supply branch ratings Cook ratings Officers' stewards and cooks Bandsmen	6/60–6/60. With glasses 6/12–6/12 at least.

Nervous Instability. In June 1940 instructions were issued for the rejection of men suffering from nervous instability. Following these instructions, all men were questioned with regard to any previous illness of a neurotic or psychological nature, and also concerning a family history of such illness. A man with a history of such a breakdown in the past was rejected. A note was made as to the mental and nervous condition of each candidate. If there was any reason to doubt the candidate's stability, a recommendation for special medical observation during training was made.

Further details of the observation and training on these lines is given under the section of this history devoted to neuro-psychiatry.

Under Clause 8 of the Military Training Act, 1939, the Admiralty established a Royal Naval Special Reserve for the training of such men who were liable under the Act for compulsory service, and who had expressed a desire for Naval or Marine training rather than training with the Army or Royal Air Force.

No candidates were, however, actually entered under the Military Training Act before the outbreak of war in September 1939, when the National Service (Armed Forces) Act 1939 was passed. During this transition period, the naval recruiting organisation for continuous and special service continued to function unchanged.

When the National Service (Armed Forces) Act 1939 came into force, all naval recruiting out-stations, with one or two exceptions, were closed and all candidates for continuous and special service were sent by the recruiters to the existing headquarter stations (which remained open) for their complete examination (medical, educational, etc.). The final examining medical officers continued to work at these stations as before the war.

The combined recruiting centres opened under the Military Training Act were staffed by representatives of all three Fighting Services and the Ministry of Labour to deal with the selection of men called up for service under the Act and volunteers for 'hostilities only'.

Naval recruiters were allocated to each centre and were responsible for the selection of men for the various branches of the Royal Navy and Royal Marines, whether such men were called up under the National Service (Armed Forces) Act (having expressed their preference for the Royal Navy), or had volunteered to serve in the Royal Navy or Royal Marines for the period of hostilities.

During the progress of the war, the numbers of candidates for continuous and special service varied considerably as the requirements of

the various branches were satisfied, but for some time continued to approximate to pre-war figures. Later the recruitment for continuous and special service was gradually curtailed and the needs of all branches were chiefly met by the supply of men called up under the National Service (Armed Forces) Act and by volunteers for 'hostilities only' from the combined recruiting centres.

As regards candidates for 'hostilities only', the medical standards accepted were those laid down in M.R.B.1 (Instructions for the Guidance of Medical Boards under the National Service (Armed Forces) Act). This publication was frequently amended, and was revised and reprinted in November 1940 and April 1943. But as regards the Royal Navy, the general grading remained unchanged.

Visual Standards. Men were classified according to the following standards:

Standard 1. Unaided vision not less than 6/6 in one eye and not less than 6/9 in the other (this was required for signalmen and naval airmen).

Standard 2. Unaided vision less than Standard 1 but was either not less than 6/12 in each eye or not less than 6/6 in right eye and not less than 6/36 in left eye. This was required for seamen, stokers and marines, general service.

Standard 3. Unaided vision was less than Standard 2 but vision could be corrected to at least Standard 2. (In those cases where unaided vision was below 6/60 in either eye the men were referred to an ophthalmologist, and where a myopia of more than minus 7 in any meridian was found he was placed in Standard 7.) This was required for all other ratings.

Standard 4. Unaided vision less than Standard 2 and vision could not be corrected to Standard 2 but could be corrected to at least 6/12 in one eye and to at least 6/36 in the other (this standard included men whose left eye was the 'master' eye and whose vision, with or without correction, was not less than 6/12 in the left eye and not less than 6/36 in the right eye). Standard 4 was allowed for such ratings as artificers, shipwrights, air fitters and mechanics, sick berth attendants, writers, band and similar ratings.

Standard 5. The conditions in Standards 1 to 4 could not be attained but vision could be corrected to at least 6/24 in each eye.

Standard 6. Vision in one eye with or without glasses was not less than 6/12 and in the other was less than 6/36 with or without glasses or had been lost or practically lost and investigation as to the cause of the loss was satisfactory (Standards 5 and 6 were, generally speaking, unfit for naval service except in special cases).

Standard 7. Vision was below Standards 1 to 6.

No man with strabismus of any degree was placed in a higher standard than Standard 4 irrespective of his visual acuity.

Men whose visual acuity was in Standards 1 to 4 were, so far as eyesight was concerned, placed in Grade I. Those whose visual acuity was in Standards 5 and 6 in Grade II. Those who visual acuity was in Standard 7 were placed in Grade IV. Standard 7 was unfit for any form of naval service. During the war these standards were slightly modified from time to time.

Colour Vision. Until July 1941, naval 'hostilities only' personnel were not tested or graded for colour vision until they were finally called up and reported at a Naval Final Entry Establishment. The medical boards did not test for colour vision. This was found to entail expense and inconvenience in cases of seamen who, on joining these establishments were found to be colour blind and had to be discharged as 'unfit' or transferred to other branches. The Ishihara test cards were therefore introduced at the combined recruiting centres and the test was carried out by members of the Women's Royal Naval Service in conjunction with the 'selection test'. A man found to be defective in the Ishihara test was deemed to be unsuitable for seaman or signalman, but was accepted for all other branches. Later in the war, Grade I was required for seamen and signalmen and for all other ratings at least Grade III was required. Borderline Grade III men could undergo a practical test involving the maximum colour perception need for their special duties, e.g. connecting up coloured leads or recognising coloured markings on dials, pipes, etc.

Standards of Hearing. Men were classified in the following standards:

Standard 1. A man could hear a soft whisper with each ear separately. The examiner himself occluded the ear not under test and whispered towards that ear.

Standard 2. Hearing was less than Standard 1, but the man standing with his back to the examiner and using both ears could hear a forced whisper at a distance of 10 ft.

Standard 3. Hearing was less than Standard 2, but the man could easily hear a speaking voice under the conditions specified in Standard 2.

Standard 4. Hearing was less than Standard 3.

Standard 1 or 2 were required for such ratings as signalmen, seamen, royal marines, naval airmen, telegraphists, but other ratings were allowed Standard 3.

Throughout the war the number of preferences expressed for naval service was far in excess of those which could be absorbed, being about one-third of the whole number registered over the period of the war.

NUMBERS RECRUITED AND REJECTED

The number of candidates for continuous service engagements for the war years (boys, apprentices and marines) was as follows:

	1939	1940	1941	1942	1943	1944	1945
Accepted .	19,527	6,107	3,412	1,912	1,840	1,826	5,659
Rejected medically .	20,590	5,807	3,511	3,149	2,815	2,548	5,705
Rejected, other reasons .	37,257	27,277	20,266	14,641	7,632	4,488	9,628

Throughout the war candidates for R.N. and R.M. were generally required to be Grade I for unskilled branches and Grade I or Grade II (*a*) (feet) for the skilled branches. Candidates in Grade II were, however, entered in such branches as seamen for mine watchers or controlled minefields, harbour defence operations or ratings for local defence duties.

To meet with increased requirements in 1943 candidates who were in Grade II or Grade II (*a*) (vision) were accepted for ground staff branches of the Fleet Air Arm. In March 1943 men under the age of 35 who were Grade II (*a*) (vision) or (feet) or Grade II (but not placed in Grade II because of varicose veins, nervous or mental instability, skin diseases or obesity) were selected for entry as ordinary seamen probationers, forwarded to H.M.S. *Bristol* for special training and allocation after entry to the most suitable branch.

Relaxation of the visual standards for most branches was also adopted, while adhering to the Medical Grade I, and failure in colour vision did not disqualify for seamen. These relaxations, including the forwarding of men to H.M.S. *Bristol*, ended in November 1943.

In 1942 a limited number of men in certain ratings serving as mobilised reservists or 'hostilities only' ratings, either volunteers or those serving under the National Service (Armed Forces) Act, were allowed to transfer to special service engagements subject to certain conditions with regard to medical standard, character, age, etc. These men were not, however, allowed to transfer to continuous service.

In 1945 similar 'hostilities only' ratings were allowed to transfer to regular engagements, if fit (12 years with the option of completing 22 years for pension). This applied to nearly all branches and was subject to certain conditions with regard to age, qualifications, character, medical standard, etc. Ratings of whatever class or age were required to conform to the medical and visual standards laid down for the entry of recruits for continuous service.

During the period April 1, 1939 to March 31, 1945, the following numbers of men were entered into the Royal Navy:

	Normal engagements			Hostilities only	
	Naval ratings		Royal Marine Forces C.S.	Naval ratings	Royal Marines
	C.S.	S.S.			
1939/40	11,285	4,373	2,201	30,294	3,840
1940/41	1,463	3,318	302	102,232	11,492
1941/42	1,862	1,332	491	117,798	17,645
1942/43	1,711	—	581	134,356	18,818
1943/44	1,744	—	423	172,662	10,467
1944/45	1,746	—	418	43,425	2,014
Totals	19,811	9,023	4,416	600,767	64,276
Grand total, 698,293					

Of 5,029,628 men examined by the civilian medical boards between June 8, 1939 and March 29, 1945, 80 per cent. were either Grade I or Grade II, and of these 64·4 per cent. were Grade I.

As an example of naval recruiting during the war years, the following figures extracted from the records of a large naval recruiting centre are of interest, and may be accepted as typical of the state of affairs in other large centres.

War-time recruiting in this particular centre may be said to have commenced a year before the outbreak of hostilities. It was found that in the early summer of 1938, the number of recruits applying for entry and medical examination increased rapidly, and this increase was even greater from September onwards. During 1938 a total of 1,838 volunteers were examined, as opposed to 1,321 in 1937, and 984 in 1936. This pre-war increase was maintained in 1939, when 1,729 were examined up to September 2.

During the actual war years it was found that the main causes of rejection on medical grounds were defective vision and physical deformities, though dental defects played some part.

Relevant figures for continuous service ratings were:

Total number examined	3,775
Total number unfit	1,139

Of those medically unfit, defective vision accounted for 364, defective colour vision 164, and dental defects 196. Of the remaining 415 rejected, the most frequent causes were pes planus and spinal curvature.

In the case of a recruiting centre devoted to candidates for the Naval Air Arm, it was found that surgical conditions were not necessarily a bar to the acceptance of a candidate provided his physique was good, and there was no interference with general bodily and mental function. The paramount need was considered to be the elimination of potential sufferers from flying strain.

In a specimen group of 1,000 cases examined, 125 were rejected. The causes of rejection were visual defects 52, cardiac irregularities 41, aural defects 11, respiratory abnormalities 7, minor surgical conditions 4, nervous instability 8, glandular deficiencies 2.

OFFICERS

During the war years the complement of officers on the active list, in all branches of the Royal Navy, was augmented from various sources. On the outbreak of hostilities, retired officers on the emergency list were recalled, as well as active list officers of the Royal Naval Reserve and Royal Naval Volunteer Reserve. Further numbers of retired officers were re-employed from time to time.

With an eye to the future, 13-year-old and Special Entry into the Royal Naval College, Dartmouth, continued uninterrupted.

It had always been obvious, however, that an even greater number of officers would be required than was available from the above-mentioned sources, and this view was confirmed as the war progressed and naval commitments grew. As may be imagined, the requirements of the Naval Air Arm alone were very great, as were those necessary to build up an organisation connected with Combined Operations.

On September 11, 1939, H.M.S. *King Alfred* was commissioned for the purpose of training the large number of junior temporary officers which it was expected would be required.

The first group of officers was composed of direct entries who had been enrolled in the Royal Naval Volunteer Supplementary Reserve between 1936 and 1939. These were mostly private yachtsmen and others with seagoing experience, as well as a number of retired Merchant Navy officers. To this group was added a number of direct entries, e.g. from universities, who did not possess practical experience, but were nevertheless entered directly into the Service with a view to early training as naval officers.

A further solution of the officer shortage was effected by a scheme whereby selected 'hostilities only' ratings were granted R.N.V.R. commissions after a satisfactory period of service on the lower deck afloat. Various other schemes were instituted for entering temporary officers into the Navy, but they are of little interest from the point of view of the medical historian.

The medical requirements naturally varied according to the branch of the Navy concerned and the method of entry. The medical examinations of the R.N.V.S.R. officers had originally been carried out either by R.N.V.R. medical officers or by civilian practitioners before the outbreak of war. Owing to lack of equipment and experience, it was inevitable that a proportion of these candidates were accepted for service although below the necessary physical standard. Also, in some cases the medical state of candidates examined as early as 1936 had deteriorated

by 1939. Thus it was found that of the original 1,500 R.N.V.S.R. officers, about 10 per cent. failed to achieve the necessary standard on final medical examination carried out on joining H.M.S. *King Alfred.*

The later candidates for direct entry were examined by a naval medical board. In this case, the standard demanded and achieved was high. For example, a visual standard of 6/9, 6/12, was necessary, as opposed to 6/12, 6/18 in the early entries.

In the case of ratings selected from the lower deck, being already in the Navy, and subject to Service medical discipline, the physical evidence was more simple to assess. Before such a candidate came before a preliminary selection board he was examined medically, and again before interview for final selection. Successful candidates joined H.M.S. *King Alfred* in batches of 100 and were again medically examined before commencing training.

H.M.S. *King Alfred* was accommodated in Lancing College, Sussex, and at Hove. The medical organisation was aimed not so much at dealing with routine ailments, as at constant observation of the physical and mental make-up of each candidate, with a view to assessing his final suitability to undertake the responsibilities of a naval officer at the end of his period of training.

The first six weeks were spent at Lancing, after which candidates were transferred to the other section of H.M.S. *King Alfred* in Hove. Here three weeks were spent, after which the candidate was required to pass an examination in various subjects. If successful the candidate again appeared before a selection board, following further medical assessment. If suitable in every respect, the candidate was granted a commission, and after a further period of training was sent to his first appointment.

From the objective viewpoint many observations of medical interest as affecting the trainee were revealed. In such a concentrated period of training it was inevitable that mental anxiety should be expected around the time of the passing out examinations and statistically it was found that there was more physical illness following the examinations than during the weeks beforehand. Statistics also suggested that trainees who joined the establishment immediately following a few months afloat, were more prone to catarrhal and upper respiratory infections. It was suggested that some immunity to these infections was lost while at sea, to the detriment of the trainee on joining a crowded establishment ashore.

H.M.S. *King Alfred* closed down in August 1944. Altogether approximately 21,000 trainees passed through the establishment. It should be noted that these remarks are intended only to apply to the organisation which was built up with a view to combating the shortage of executive officers during the war years. Naturally, the training of temporary officers was not confined to the particular establishment which has been described. Training was carried out in many places in accordance with the technical requirements of the special branch for which the prospective officer was a candidate.

CHAPTER 4

THE ROYAL NAVAL SICK BERTH STAFF

CONDITIONS OF SERVICE AND MEMBERS

THE profession of male nursing is a vocation presenting fundamentals which often appear strange to the observer unfamiliar with it. The operative word is 'vocation', which embraces that peculiar power which attracts a certain type of individual gratuitously to perform a certain type of work. The term may be modified by replacing the gratuitous element by a reward for a service rendered. But such modification still permits a true vocation to be consistent with payment, for the service itself takes priority over the reward.

The vocation of nursing, calling for an inherent sympathy towards the sick, and complete lack of distaste for those menial tasks and indignities associated with the sick room, is one of which the essence is unselfishness. The true principles of nursing are not easily adapted to a system of conscription or compulsory service, for this means that the vocational aspect tends to be lost.

When a compulsory task, normally vocational, is combined with features of naval organisation and routine which seem unnecessarily cumbrous and inadequate, judgment tends to be harsh, particularly when meted out by a young male generation which considers itself destined to effect a simplification of existing conditions in time of war.

Obviously, the increased medical commitments of the Navy during the war years demanded a greatly augmented male nursing complement. It is also obvious that the large numbers required could not altogether have been obtained without some resort to compulsory service, no matter how desirable it was to maintain a voluntary system as far as possible. Thus it came about that the war complement of sick berth staff consisted of a nucleus of active service members, to which were added pensioners, reservists, volunteers and men entered under the National Service (Armed Forces) Act 1939. Among the latter was a certain number to whom the thought of nursing and matters medical was unattractive, if not actually repulsive, and in justification, common sense can but admit the thwarted desperation of a man who, having imagined himself pulling a boat or firing a gun, finds himself scrubbing a bed-pan instead. Such cases were not uncommon, yet it was rare to hear of an instance where any natural aversion or disinclination was not overcome after a period of trial. It is true that a certain number of sick berth staff were transferred to, and even gained commissions in other branches of the Navy as the war progressed, and were able to

fulfil their desire for combatant duties. But in all such cases, a period of satisfactory nursing duties had first been performed.

At no time in the war was there a breakdown in the male nursing requirements of the Navy, either ashore or afloat in any part of the world, and the greatest credit is due not only to those who joined during the war years, but to the training carried out and the example set by the small number of peace-time active service and reserve personnel. To that small body, many of whom gave their lives and their health, must be paid the greatest tribute for the way in which the traditional standard of duty and personal service of the Sick Berth Branch of the Royal Navy was constantly maintained at the highest level.

The Sick Berth Branch is that section of the Medical Branch of the Royal Navy which is devoted to nursing and medical administrative duties in naval shore establishments and Her Majesty's ships afloat. Though an integral part of the Royal Navy as a whole, and subordinate to the Naval Executive, the Sick Berth Branch is ancillary to and directed by the Royal Naval Medical Service and has a direct relationship with the Royal Naval Dental Service, and Queen Alexandra's Royal Naval Nursing Service.

In peace-time sick berth ratings were recruited on a voluntary basis, and signed for a period of 12 years with an opportunity to re-engage for a further period to complete time for pension. On entry, newly joined probationer sick berth attendants were absorbed into either the Portsmouth, Chatham or Devonport Port Division. After a disciplinary course of six weeks, probationers were transferred to a naval hospital for a course of professional training which lasted for approximately nine months. At the end of this training period, those who passed a qualifying examination were rated as sick berth attendants, suitable to be appointed for service anywhere ashore or afloat. It was customary, however, for the newly qualified man to be retained for a further period of months as a member of the staff of his training hospital, thus permitting him to acquire further experience and a sense of responsibility.

At a later date in the man's career, advancement could be achieved to leading sick berth attendant, sick berth petty officer and sick berth chief petty officer. Advancement to these higher grades depended upon character, service record and the ability to pass professional examinations which included anatomy and physiology, signs of special diseases, general nursing, first aid, dispensing, cooking for the sick, and a knowledge of surgical instruments, documentation and general administration. In these examinations, which were partly written and partly oral, a high standard was demanded, especially for advancement to petty officer and chief petty officer.

It was further possible for an outstanding sick berth chief petty officer to achieve promotion to warrant rank and become a member of the wardmaster officers branch of the Navy. Vacancies were few, however,

and approximately only 2 per cent. of the numbers of the sick berth staff were ever likely to achieve warrant rank. Promotion to the wardmaster branch was by selection, and depended upon a consistently outstanding service career to date, the possession of a higher educational certificate and the passing of a special examination, the scope of which was very far reaching.

In a limited number of cases further promotion was possible in the wardmaster officers branch, to commissioned wardmaster, occasionally to wardmaster lieutenant, and very occasionally to wardmaster lieutenant commander. Such advancement depended very much on the age of the officer concerned, and the vacancies which fell due in this very small special branch of the Navy.

During their careers, suitable members of the sick berth staff were permitted to specialise in certain professional subjects, and to become qualified as physiotherapists, radiographers, laboratory technicians and operating room assistants. Ratings who qualified as specialists were granted extra pay, as well as certain privileges. The number of specialist appointments in peace-time permitted such qualifications to be obtained by approximately 18 per cent.

The nursing situation at the outbreak of war has already been touched on in Chapter 1 of this History, where it was described how an increase of 2,230 was estimated originally as the probable requirement of the sick berth branch, of which the majority were available from reserve sources, the figure including a number of V.A.D. nursing members.

At the outbreak of war, the sick berth staff consisted of 2 wardmaster lieutenants, 4 commissioned wardmasters, 16 warrant wardmasters, 125 sick berth chief petty officers, 268 sick berth petty officers, 301 leading sick berth attendants and 471 sick berth attendants, making a total of 1,187. By 1943 the numbers had risen to 5 wardmaster lieutenant commanders, 14 wardmaster lieutenants, 4 commissioned wardmasters, 17 warrant wardmasters, 73 temporary warrant wardmasters, 540 sick berth chief petty officers, 1,057 sick berth petty officers, 1,488 leading sick berth attendants, 3,949 sick berth attendants, 60 dental sick berth petty officers, 95 dental leading sick berth attendants, 239 dental sick berth attendants, and 200 miscellaneous specialist ratings entered for 'hostilities only', making a total of 7,541 altogether.

By the end of the war the number of wardmaster officers employed was 138, and the sick berth branch had reached a total complement of approximately 12,000.

On the outbreak of war immediate measures were put into motion for placing the sick berth staff complement on a war-time footing. All serviceable pensioners were recalled from civil life, totalling about 750. Mobilisation of the Royal Naval Auxiliary Sick Berth Staff Reserve was effected, totalling a further 1,500. Later increases were effected by recruiting under the National Service (Armed Forces) Act.

Pensioners and auxiliary reservists were regarded as trained men on mobilisation, though it was well realised that the degree of efficiency to be expected would be likely to merit some form of revision and modernising wherever possible.

Most of the pensioners were experienced nurses, and fully conversant with naval procedure. Naturally, a large number were clinically out of date, a fault which could be remedied relatively quickly. The greatest difficulty to remedy in the case of the pensioner was the fact that in most cases he was a man of some seniority, having retired from the Navy as a petty officer or chief petty officer. Almost all were over 40 years of age, and the great majority, either by virtue of seniority, or on medical grounds, were not really suitable for active service afloat or ashore overseas. Nevertheless, they were eminently suitable to hold key positions in home shore establishments and did most valuable work in training the younger element.

The Royal Naval Auxiliary Sick Berth Staff Reservists were mostly men who had adopted medical work as a spare-time hobby in civil life. They numbered among them miners, mill hands and allied occupations with medical experience gained in the St. John Ambulance Brigade and other local ambulance and first-aid organisations. Their experience of the Navy was confined, in most cases, to one week's annual training in a naval medical establishment. The inadequacy is obvious, but these reservists made up for their inexperience by their enthusiasm and interest in medical work. Many were sent immediately to ships afloat, including destroyers and small craft, where they were left on their own responsibility. Their knowledge of naval administration was small, but their clinical knowledge and practical ability were extremely sound, and from them some excellent and really reliable sick berth ratings were produced in a remarkably short space of time.

Immediately before the war the number of wardmaster officers was increased by four, three of whom were appointed as additional instructors in the Naval Hospitals at Haslar, Plymouth and Chatham.

With the necessity for providing large numbers of medical establishments at home and abroad, as well as a number of hospital ships, further increases in the complement of wardmaster officers became imperative. In this case, expansion was a more gradual process than that of the sick berth staff as a whole. The policy adopted was to maintain a steady increase by promoting a number of pensioner sick berth chief petty officers and an approximately equal number of active service sick berth chief petty officers to temporary warrant rank as new ships were commissioned and new appointments created. A number of retired wardmaster officers were recalled into service, but on account of age and health, were for the most part only employable in shore establishments at home. A disadvantage here was that the younger newly promoted wardmaster officers were frequently sent to newly commissioned

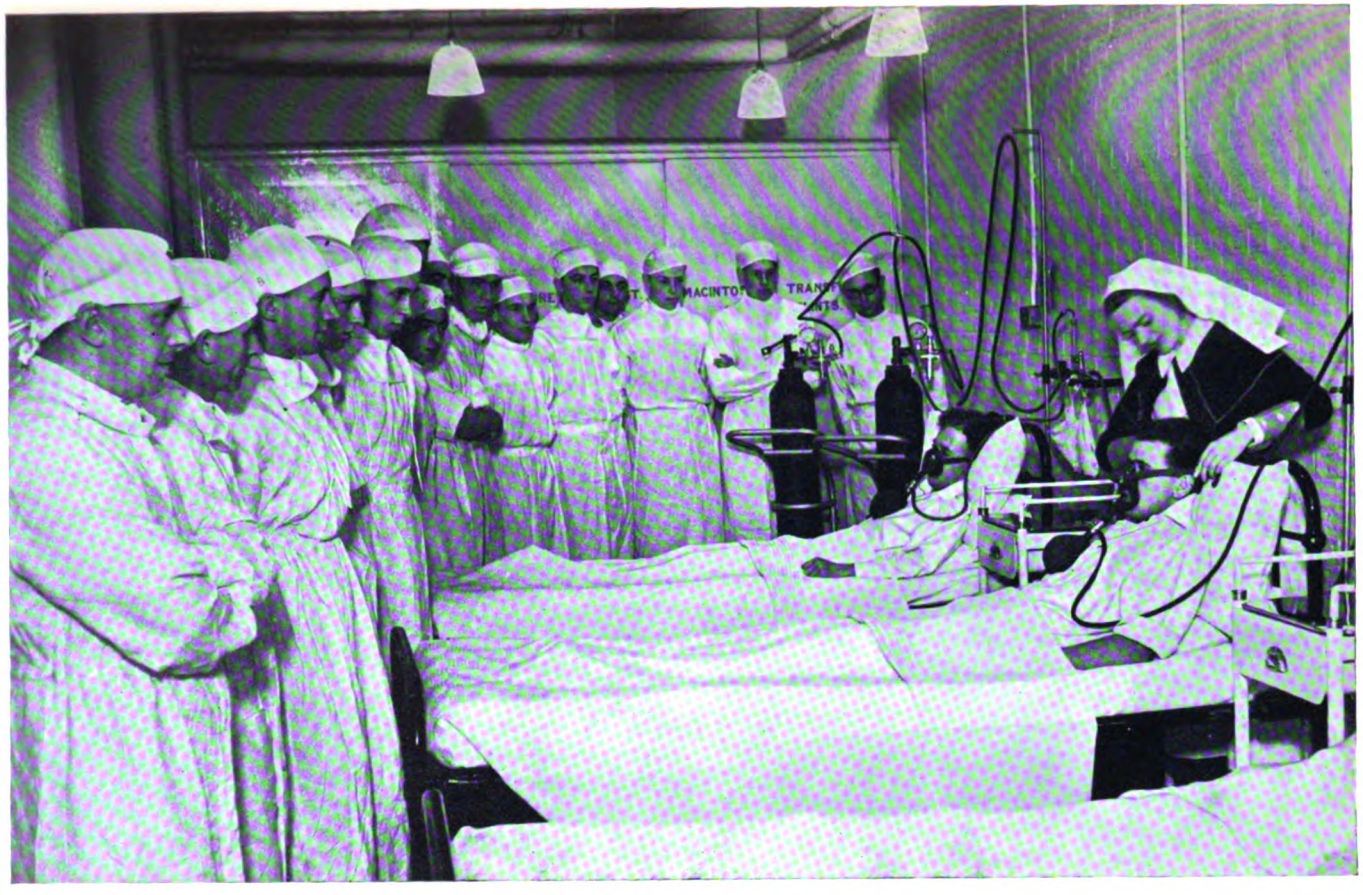

PLATE I. Sick berth ratings under training by sister tutor. [*Topical Press*

[*Facing page* 40

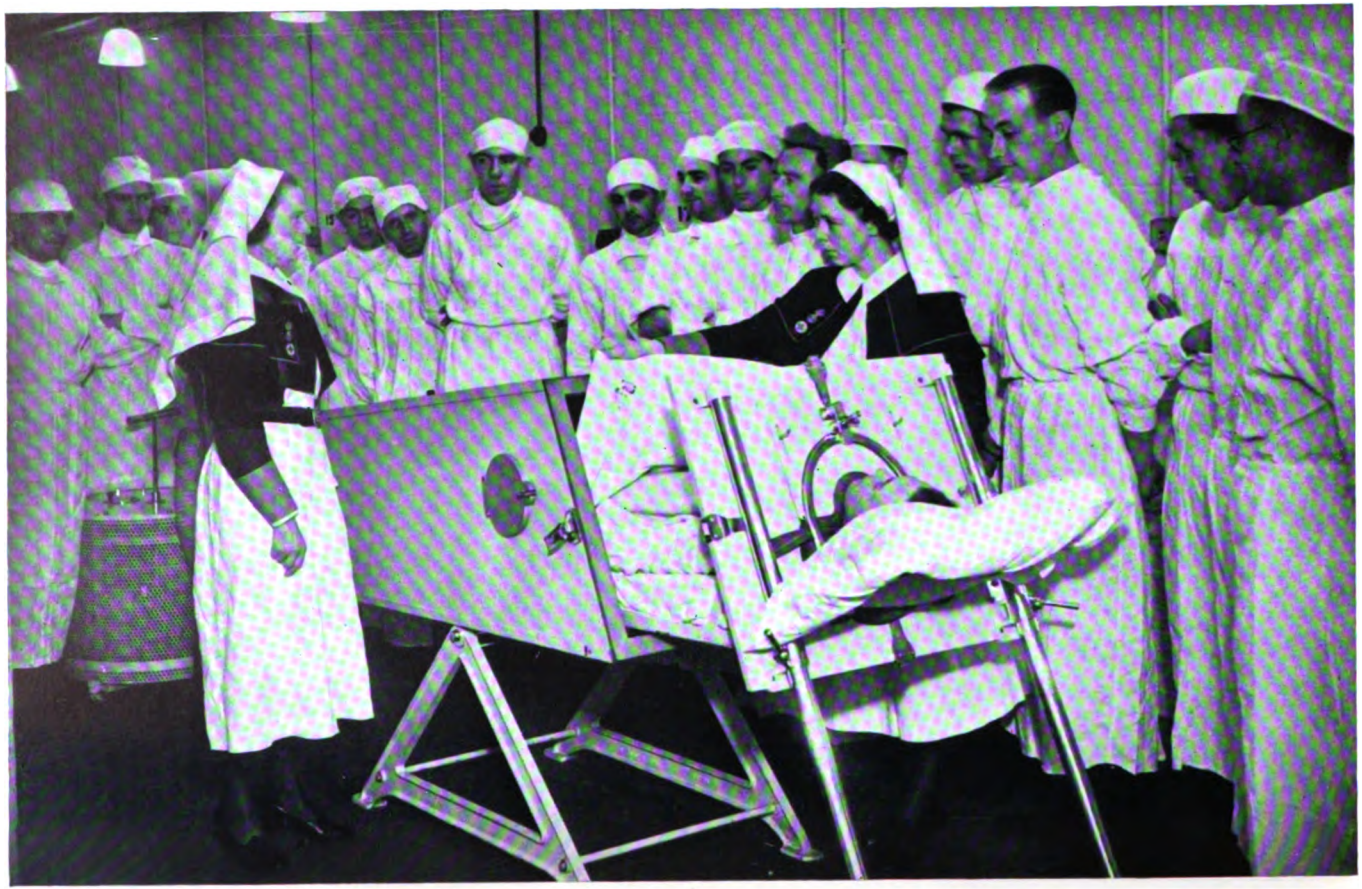

PLATE II. Sick berth ratings under training by sister tutors. [*Topical Press*

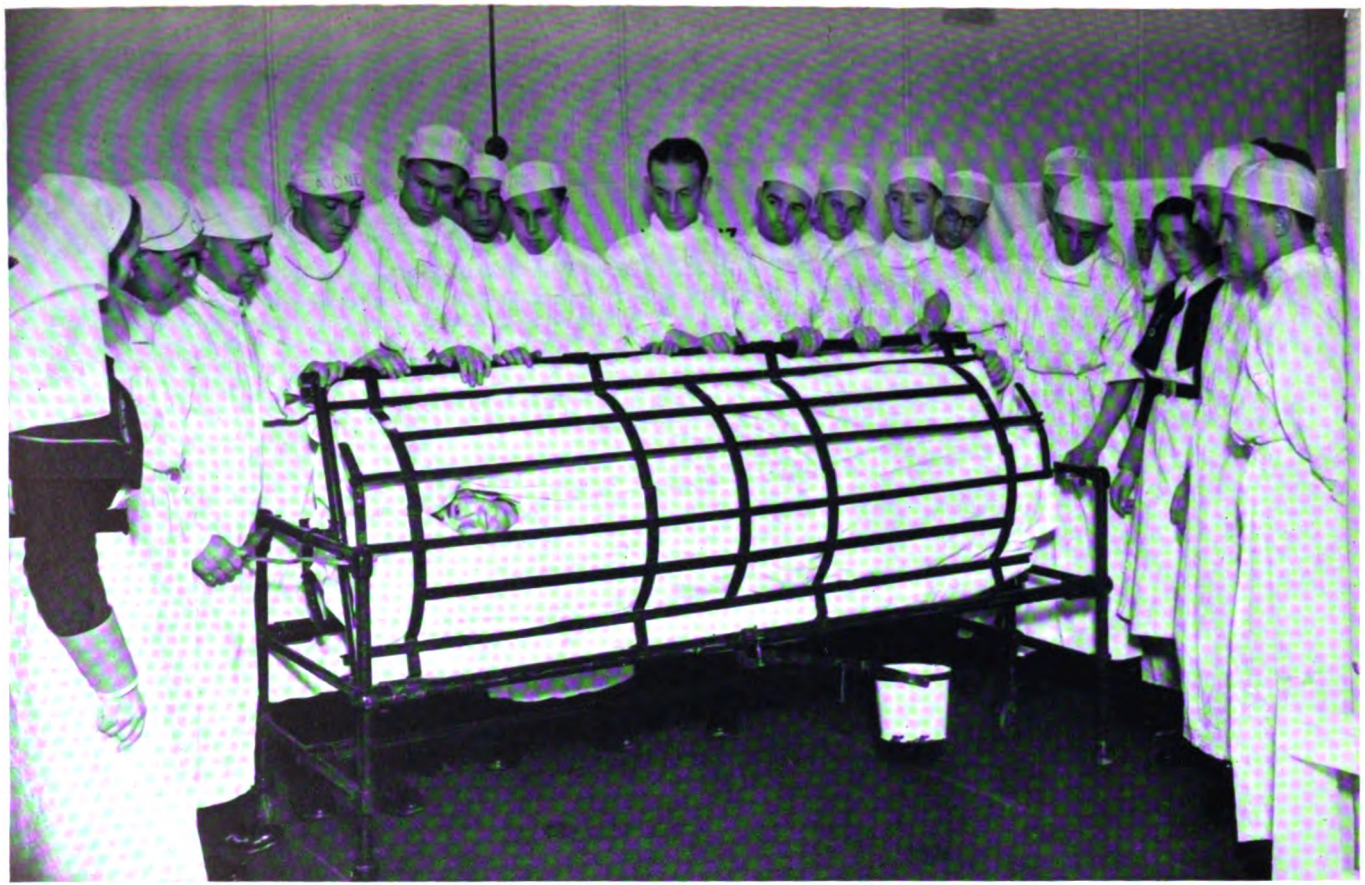

PLATE III. Sick berth ratings under training by sister tutors. [*Topical Press*

establishments with little actual working experience behind them. At the same time these officers showed themselves more than capable of accepting responsibilities which, in the normal course of events, would not have come their way for many years.

TRAINING

As in the other Fighting Services, the entry of 'hostilities only' ratings for medical duties under the National Service (Armed Forces) Act was carried out with a view to meeting numerical commitments. Desirable as it might have been to observe a voluntary system, compulsory entry was impossible to avoid. Where possible, men were chosen who already had some previous medical training, for example, junior medical students, civilian dispensers, hospital porters, etc. It must be admitted, however, that previous medical experience of this kind was no guarantee of practical ability. The knowledge of most junior medical students was usually confined to academic subjects, and in any case was rarely of a high standard. The end-result was that it became necessary to regard all 'hostilities only' ratings as totally untrained personnel, irrespective of their previous walks of life, and to subject them all to a full course of training on entry. The material provided for training represented an average cross-section of any British male community, for the most part lacking in medical knowledge, but willing to learn. The aim of the preliminary training course was to instil into this virgin soil the elements of marine medicine, and to produce the type of male nurse peculiar to a seafaring environment. In short, a private citizen had to be quickly converted into an expert first-aid man, a storekeeper, a reasonable cook, something of an accountant, a general handyman, and last but not least, a sailor.

Naturally, the peace-time training course of nine months had to be modified, and this was effected by eliminating much of the academic instruction, and concentrating on practical medical requirements and naval routine. The abridged course permitted little individual attention to pupils, owing to the large size of the training classes. Neither was it possible for every trainee to be given very much practical experience in the actual nursing of the sick. Additional difficulties were caused by enemy air activity, and the multiplicity of extraneous upheavals and distractions occasioned by war.

In the early phases the training courses were limited to ten weeks. Later on it was possible to extend this to twenty weeks, but with the approach of the final offensive campaigns, it was necessary to revert to the ten weeks period.

Apart from fitting into this brief period training in medical duties and naval routine, allowance had to be made for a knowledge of chemical warfare and passive defence, including fire fighting. It was also necessary to give a brief 'assault course' in preparation for landing operations.

Others had to be trained at the Army School of Hygiene to fit them for tropical service. Later, new entries proceeding to the East received further training in the Naval School of Tropical Hygiene in Ceylon.

Bearing in mind the multifarious duties which a sick berth attendant may be called upon to perform in any theatre of war, the courses were made extremely strenuous physically as well as mentally. Attention was therefore paid to physical training under qualified naval physical training instructors. This revealed that a percentage of the older trainees were unfit to stand any marked degree of physical strain, and though regrettable at the time, did at least eliminate the possibility of a man breaking down at a later date on active service and leaving a serious gap in some vital medical organisation.

Training courses were carried out at the Royal Naval Hospitals, and the Royal Naval Auxiliary Hospitals. Each course was directed by an instructional naval medical officer, assisted by one or more sister tutors, a wardmaster officer and a staff of senior sick berth staff ratings specially selected for their professional knowledge and instructional ability. In each of these establishments the training methods employed varied according to local opinion and environment though a common framework was maintained. Generally speaking, the most difficult part of the task was the provision of suitable accommodation for the instructional staff and the trainees themselves. (Plates I, II and III illustrate sick berth ratings being trained by sister tutors.)

Taking the Royal Naval Hospital, Plymouth as an example, the new arrivals were of a wide variety, their previous occupations ranging from a gipsy to a University lecturer of four years' standing. Training was carried out on as 'strict' terms as possible under the war-time conditions. Classes were formed averaging 40 to 48 probationer sick berth attendants. The ages in each class varied from 18 to 42 years.

It was noted on a number of occasions, that ratings who had left school perhaps some fifteen to twenty years previously, and had had some training with the British Red Cross or St. John Ambulance Brigade showed more intelligence, and certainly more initiative than those ratings who had left school just before joining the Royal Navy.

With the increase of reserve ratings, pensioners and probationer sick berth attendants, accommodation was very limited. The sick berth staff quarters was insufficient to accommodate the numbers borne, with the result that the top wards of various medical and surgical blocks had to be utilised for this purpose. These wards could be immediately vacated by the sick berth staff should they be required for the reception of casualties.

The following numbers of probationer sick berth attendants qualified for sick berth attendant during the war at this particular hospital :

1939	..	..	..	53
1940	..	..	..	315
1941	..	..	..	616
1942	..	..	..	452
1943	..	..	..	436
1944	..	..	..	460
1945	..	..	..	48
			Total	2,380

Altogether some 1,200 probationary sick berth ratings were trained over a period of three years, each man having a period of twenty weeks' training. Trainees were received in batches of 50 from the new entry establishments, a total of 200 being accommodated at a time. The training system adopted produced some excellent sick berth staff.

In peace-time, the proportion of sick berth staff qualified for specialist duties totalled about 18 per cent. and was never more than was actually required, the custom being to train and qualify new men only when it became apparent that difficulties would occur in the near future by reason of retirement or promotion. There was never an overlap, and at times there was an actual shortage while waiting for new men to qualify.

War-time expansion demanded an increase in specialist sick berth ratings, and the problem of supply became acute at an early date. Every effort was made through the recruiting centres to obtain men from civil life capable of undertaking the duties of laboratory assistants, operating room attendants, masseurs, radiologists, dispensers, mental nurses and even chiropodists. The response was good. Unfortunately, however, the recruiting authorities did not always realise the qualifications required. In consequence, in addition to men with genuine specialist experience, a large number were enlisted whose qualifications were doubtful. For example, in one case a man's laboratory experience in civil life was found to have been confined to testing samples of dried milk, while in another case a man claiming to be a mental nurse had actually been a hall porter in a mental hospital. Likewise a number of the ostensibly qualified masseurs possessed in reality only imposing certificates of competence from correspondence colleges. Nevertheless, many of these pseudo-specialists were excellent men, possessing trained minds which rendered them suitable for specialist courses. Added to a large number of truly experienced specialists, they went far towards solving those early difficulties of naval medical organisation in the war. Later on, a scheme was instituted which enabled all naval hospitals and hospital ships, both at home and abroad, to train on the spot such selected ratings already serving who were considered suitable to hold a specialist qualification.

DISTRIBUTION AND DUTIES OVERSEA

During the war the sick berth staff of the Royal Navy were distributed ashore and afloat throughout most of the theatres of activity. Their accommodation, working conditions and environments varied enormously, and extended from North Russia and Iceland across the world to Australia and the Pacific.

The multiplicity of duties that the average sick berth rating was called upon to perform called for a tenacity of purpose and versatility which is unique in the Senior Service. It would be easy to compile a separate volume, devoted to this particular subject, but isolated examples must suffice. Naturally the primary function of a naval sick berth rating would appear to be concerned with fulfilling medical requirements in men-of-war, with hospital ships and shore establishments forming additional commitments. But the experience of war showed that this was by no means the end of the story, and that there were few tasks which the sick berth rating might not be called upon to do.

The wardmaster officers found themselves employed in naval hospitals in all parts of the world, hospital ships and carriers, naval bases and dockyards. Others were directed to tented hospital units, combined operations, the Naval Air Arm, mobile naval base defence organisations and mobile naval air bases. Others performed whole-time medical transport duties, instructional duties in medical schools and training establishments, liaison duties in civil hospitals, and administrative tasks associated with the Naval Blood Transfusion Service.

One wardmaster officer was appointed to the staff of South East Asia Command Headquarters at Delhi, and accompanied this Headquarters in its travels. His main function was to organise a medical intelligence section, and to supervise a staff consisting of an American sergeant, a British corporal, an R.A.F. corporal, a sergeant of the W.A.A.F. and a rating of the W.R.N.S. That he was able to achieve a high degree of success over a prolonged period, with such a mixed staff, is itself a most creditable reflection on the medical branch of his own Service.

The travels of a group of sick berth ratings attached to a tented hospital unit are also of interest. Commencing with a few months afloat, these ratings were landed and saw service in North Africa. From there they were transferred to Crete, where they served through the German invasion. At the close of the Crete Campaign with the aid of a single ambulance and a farm wagon they contrived to transfer all their patients to the beaches for a late evacuation.

The unit next re-formed in Egypt, and then saw service in Palestine. After some months the unit was returned to Egypt and absorbed into a Combined Services Hospital.

After being in commission twelve months the unit was again re-formed and transferred to Bombay. It then made its way down through India and across to Ceylon, and from Colombo was sent to the Maldive

Islands, where it took over the medical and hygiene organisation of Addu Atoll. The hygiene hazards of this island are recorded in Chapter 12 of this volume, and represent some of the greatest difficulties with which the Naval Medical Service had to contend throughout the whole war period. Even drinking water had to be transported some hundreds of miles from Ceylon. The pioneer work of these ratings included jungle clearing, the digging of wells, and the medical supervision of the local native population. Recreations were few, and confined to fishing, shell collecting, and an attempt at gardening.

Throughout this 'Robinson Crusoe' existence the morale of this small unit of 45 sick berth ratings remained exceptional. Their pioneer work was of the utmost value in the early period of the war with Japan, and it is considered an obligation to record in this history that 80 per cent. developed malaria, and 5 per cent. scrub typhus during their early work in getting these diseases under control.

Very different were the experiences of the small number of sick berth staff employed at Hvitanes, a hamlet of a few small crofts situated on the southern bank of Hvalvefjord, 30 miles inland from Reykjavik in Iceland. Here, in a climate of snow and ice, medical work was augmented by digging and building shelters and barriers to achieve protection against wind and cold.

Other sick berth ratings, serving in hospital ships, proved that, in addition to their medical duties, they were capable of performing seamanship tasks, the stowing of provisions, and were always ready to paint or 'coal ship'. In one hospital ship a record was achieved when the sick berth staff embarked 250 cot casualties, 50 walking casualties, and three tons of medical stores in exactly two hours.

Other sick berth ratings saw service in a hospital train in the Tropics, while a number, employed with the Naval Air Arm, became experts in aviation medicine and the carriage of casualties by air.

The average layman's conception of a naval sick berth rating tends to identify his sole duty with the provision of purgative pills to sailors. But this brief outline shows how the conditions of service of the sick berth ratings during the war ranged from the monotony of humdrum routine to the hectic activity of enemy action, from modern medicine in a well-equipped hospital to jungle clearance and digging wells under a tropical sun, and from the freezing loneliness of the Arctic wastes to the terrors of evacuating wounded men from beach-heads under enemy fire.

Further accounts of sick berth staff activities appear in the Operational Volume of this History, but the experiences of two young sick berth attendants are considered worthy of inclusion in this present section which is devoted to the Sick Berth Branch of the Royal Navy.

Early in January 1940 these two sick berth attendants left Oban in the S.S. *Barneveldt* (Dutch) on passage to Malta via the Cape. When

three days out of Freetown, southward bound, the ship was sighted by the *Admiral Scheer* at 1430 hours, January 20. The men were transferred to the *Admiral Scheer* as prisoners-of-war, and remained in her for eight days, during which time they were only allowed on deck for a total of five hours. On the ninth day they were transferred to the *Nordmark*, which was masquerading as the S.S. *Dixie* (U.S.A.).

They remained on board for a month, whilst the *Nordmark* carried out replenishment of U-boats and raiders in the South Atlantic. They were then transferred to the S.S. *Portland* (Hamburg-America) *en route* to Germany.

During the voyage these men took part in an attempted revolt, which was unfortunately unsuccessful, and resulted in 28 naval personnel being brought to trial in Germany, and given sentences ranging from six months' imprisonment to death. These sentences were not carried out.

The story has a happy ending. Both sick berth attendants were repatriated in September 1944, and later were able to visit their old prison ship, now renamed H.M.S. *Bulawayo*, and flying the White Ensign. In his report of their visit, the Commanding Officer of H.M.S. *Bulawayo* was happy to remark that both men appeared to have come through their experiences with great credit to themselves and to the Service.

With the modified period of training and the rapid turn-over necessitated by the increased tempo of war, it might naturally be assumed that the professional standard of the Sick Berth Branch of the Royal Navy deteriorated during the war years. But on deeper reflection and after diligent investigation, the conclusion is not so easy to justify. When considering the professional efficiency of a medical section of a Fighting Service whose members have been greatly multiplied under active service conditions, allowance must be made for facts which did not exist in time of peace. These included conditions under which casualties were nursed in war-time, problems concerning food and accommodation, the lowered physical standards permitted for recruits and the rapid increase in medical knowledge consequent upon research. When such allowances are made, comparison of mere figures of successes and failures is unreasonable.

It was found that a fully qualified male nurse, with no experience of the sea, did not of necessity shine when called upon to care for simple cases of sickness in a small man-of-war, with no medical officer to direct him. On the other hand, it was frequently found that a lad, semi-trained professionally, but with sea-going experience, accepted such responsibilities as part of his work, and proved most capable. Also with the assistance of modern chemotherapy there was little to choose between the record of success of the highly skilled nurse ashore and the semi-skilled one afloat.

In fact, to arrive at the correct picture, the professional standard of the sick berth branch of the Navy must be based not on the successes achieved in the modern up-to-date hospital ashore, but on the versatility and adaptability displayed in treating sick and wounded under every conceivable type of adverse condition afloat and in the advanced operational theatres.

In 1940 the medical officer of one of His Majesty's ships reported on the mental and professional deficiencies of his sick berth attendant. He drew attention to his lack of training, his limited degree of knowledge, and the fact that his peace-time occupation was that of a butcher's boy. He also suffered from seasickness. At the same time, his enthusiasm, perseverance and willingness to learn were commented upon.

Three months later a further report was made on the same sick berth rating, following the second Battle of Narvik. Throughout the action this man remained cool and calm. He was suddenly called upon to care for 18 dangerously wounded men. The care of these men in a mess deck already crowded with other less serious casualties was a herculean task for one semi-trained man. Nevertheless, he kept them comfortable, fed them, attended to their demands, and carried out the instructions of his medical officer with a meticulous devotion to detail. In closing, the report stated that, in fairness to the man it would be unwise to keep him in a small ship throughout another winter, owing to the fact that continued seasickness was rendering him physically helpless at times.

This type of report, which is typical of many hundreds of similar reports, gives a true conception of the work carried out by the average sick berth rating.

Casualties. A total of 327 members of the Sick Berth Branch of the Royal Navy gave their lives during the war; 63 were made prisoners-of-war.

Honours. Some 106 members were decorated for gallantry and devotion to duty, and 173 mentioned in despatches.

It is fitting to conclude this section of the Naval Medical History of the War by recording the posthumous award of the Albert Medal to a young sick berth attendant whose ship came under heavy fire in a hazardous operation off the North African coast. Many of her company became casualties. The sick berth attendant was himself badly wounded, but devoted himself to the task of attending to his shipmates, and to removing them to places of greater safety. The official citation describes that 'he spent his last strength in the care of others, working till he could no longer stand, and until he fell and died of his wounds'.

There can, in truth, be no higher standard possible in the duty of serving the sick, than the personal sacrifice of life in its performance.

CHAPTER 5

QUEEN ALEXANDRA'S ROYAL NAVAL NURSING SERVICE*

To describe adequately the work carried out by Queen Alexandra's Royal Naval Nursing Service in the Second World War would call for more space than has been allocated in the framework of this History. It is therefore only possible to give a condensed account of the more outstanding activities of this great Service, the members of which displayed an ability, versatility, courage and endurance which, though not unexpected, will long be remembered.

Upholding the highest principles and traditions of the nursing profession in a naval environment against a background of war, their devotion to the nursing needs of their patients was undaunted by the hazards and adversities with which they were frequently faced on land and sea, at home and abroad. It is to their greater credit that tribute has been paid, not only by many men and women of the Allies, but also of the enemy nations who owed their lives to the members of this Service.

STRENGTH AND DISTRIBUTION

In the preliminary planning it had been estimated that approximately 180 nursing sisters would be required, and that about 85 would be available on declaration of war, and 168 in reserve. This total of 253 gave a surplus of 73 over estimated requirements.

From the beginning of 1939 there was no dearth of suitable candidates for the Regular Naval Nursing Service, and enrolment in the Nursing Service Reserve had improved considerably. A reserve nucleus was therefore made ready of women with valuable nursing experience, who were capable of undertaking both nursing and administrative responsibility at short notice as later developments proved.

In August 1939, the members of Q.A.R.N.N.S. numbered 85. At this time 55 reserve sisters were entered, and before the actual outbreak of war, a number of these had already left for Ceylon and Alexandria and the Hospital Ships *Atlantis*, *Vasna* and *Isle of Jersey*.

During this month home hospitals in operation were Haslar, Chatham, Plymouth, Port Edgar and the Royal Naval Sick Quarters, Shotley and Dartmouth. Oversea, 13 regular sisters were employed in Malta and Hong Kong.

* Compiled from the records of Dame Matilda Goodrich, D.B.E., R.R.C. and bar, Miss Olga Franklin, C.B.E., R.R.C. and Miss Emily Frances O'Driscoll, A.R.R.C.

On September 3, 1939, 127 nursing sisters were available for immediate duty at home, and naturally this number had to be further augmented during the remainder of 1939 in order to provide staff for auxiliary hospitals at Barrow Gurney, Kingseat, Aberdeen, Idsworth, Invergordon, Newton Abbot, as well as the Naval Wing of the 64th General Hospital, Alexandria. In addition staff were provided for R.N. Hospital, Portland, R.N. Sick Quarters in Grimsby and at Douglas, Isle of Man, and for Hospital Ships *Oxfordshire*, *Aba* and *Amarapoora*.

During 1940 the expansion continued. Sick quarters were established in towns as far north as Lerwick, and in particular were necessary wherever the W.R.N.S. was undergoing training or working in large numbers. In each of these sick quarters at least one and often two nursing sisters were required.

Oversea, the R.N. Sick Quarters, Simonstown, received a staff of reserve nursing sisters recruited in South Africa, and three nursing sisters were appointed to the Royal Naval Hospital, Bermuda.

In the auxiliary hospitals and larger sick quarters it was necessary to have a matron or a superintending sister, according to the size of the hospital and the number of beds. At this period re-employment was offered to a number of retired matrons and superintending sisters, and ten of these ladies re-entered the Service for varying periods of duty. A number of matrons and superintending sisters already due to retire, continued to serve, and thus early in the war, a total of 105 experienced matrons and superintending sisters was available, who ultimately rendered most valuable service in general administration and training duties.

In the year 1940, a further 115 nursing sisters were entered, and during the remainder of the war, constant expansion necessitated the staffing of 269 medical establishments at home and abroad. To meet requirements 110 nursing sisters were entered in 1941, 229 in 1942, 288 in 1943, 290 in 1944, 76 in 1945, reaching a peak of 1,129 actually borne in April 1945, and a grand total of 1,341 during the whole war period.

By the end of the war, naval nursing sisters had seen service all over the world, including Ceylon, Egypt, Singapore, India, North and South Africa, Hong Kong, and later Normandy and Germany.

CONDITIONS OF SERVICE

At Home. In general, it was not found necessary to alter the basic existing arrangements of the nursing staffs in the main Naval Hospitals, but the administrative work of each was increased beyond recognition. In the larger hospitals the nursing staff was more than doubled because extra beds were added, and each hospital became a receiving and drafting centre for sisters joining and proceeding to other establishments. On joining, reserve sisters had to be given a comprehensive course of instruction to cover naval medical administration, passive defence and casualty reception.

The actual nursing in a naval hospital in war-time is a very different occupation for a sister from nursing in peace-time. In peace-time, the nursing staff of the average ward will not number more than five sick berth ratings under the guidance of one sister. More often than not the number is four. In war-time the majority of the subordinate staff of sick berth ratings and V.A.Ds. are largely untrained, and extra sisters are necessary to supervise nursing as well as to give constant practical instruction. As the war progressed, the necessary ratio of nursing sisters was found to be one to each 20 beds, making an average of two sisters in each ward. In acute wards receiving casualties, it was found that three sisters were not too many, though not always possible.

The sister's training function was most vital to the sick berth staff and V.A.Ds. In the case of the sick berth staff, a ward sister was required to devote as much of her spare time as possible to giving practical nursing instruction to men whose training time in hospital would be short, and who would soon be required to undertake the sole nursing responsibility of sick and wounded in small ships afloat. In the case of V.A.Ds. a more gradual process of instruction could be effected, for their time in hospital was continuous, and they were unlikely ever to be left to their own responsibilities. With the expert guidance of a capable sister many of these nurses fell quite naturally into nursing duties and became most reliable. In 1943, naval medical commitments became so wide that it was necessary to introduce for V.A.Ds. the same intensive course of training as for the probationary sick berth staff.

One of the greatest requirements in a naval nursing sister is a thorough knowledge of operating-theatre work, and in some naval hospitals in times of emergency, it was found necessary to employ as many as eight operating theatre sisters, each actively engaged for many hours a day. In this respect the Navy was fortunate in having among its nursing reserve several experienced theatre sisters from the civil teaching hospitals.

Drafting commitments were such that in the larger naval hospitals it was found impossible to retain nursing sisters for any length of time, and the only appointments, apart from the matron and superintending sister, which could be regarded as in any way permanent, were those involving a specialised branch of work. Ultimately, a sister, appointed as sister tutor, for theatre duties, for resuscitation duties or for casualty reception, was retained in her appointment for a period of one or two years. This had the advantage of providing not only an efficient service to the hospital of the branch of work involved, but also allowed adequate training of other sisters to be carried out.

In 1943, the Report of the Rushcliffe Committee was published to provide for the nursing profession a national scale of salaries and a uniform standard of conditions of service. In order to bring the three Fighting Services into line with this new scheme, a number of meetings

took place between representatives of the Navy, Army and Air Force Nursing Services, and of the Treasury and Ministry of Health. Following recommendations of this small committee, on April 1, 1943, revised rates of pay, and changes of title were approved. Nursing officers now ranked as nursing sisters, senior sisters as matrons, principal matrons, and matrons-in-chief in the same way as in Queen Alexandra's Imperial Military Nursing Service and Princess Mary's Royal Air Force Nursing Service. Relative naval ranks were granted at the same time.

As regards hours of duty, annual leave and general conditions of service, the Naval Nursing Service had for some years already conformed to the recommendations of the Rushcliffe Committee, but salaries were much lower, and ranks were limited.

On the introduction of the new titles, matrons became principal matrons, superintending sisters became matrons, and senior sisters became a newly created rank. The principal matrons were employed in hospitals of 600 beds and over. Matrons were employed in smaller hospitals. Senior sisters were employed in the small hospitals and sick quarters.

The more senior of the nursing sisters, both regular and reserve, proved eminently suitable for promotion to posts of responsibility and administration. The nursing staff in auxiliary hospitals, sick quarters and hospital ships was, during the war years, almost entirely under the administrative control of reserve sisters promoted to the higher ranks.

In relation to conditions of service, nursing sisters and V.A.Ds. received the same allowances for messing and laundry. Oversea and colonial allowance was paid to each.

The problem of housing and catering for an increased nursing staff was always formidable, and had to be dealt with on its merits in each naval hospital. In the main hospitals the residences of medical officers were commandeered, and in each house all the rooms except one were used as bedrooms for several sisters. The remaining room was used as a sitting-room. It was necessary for two, three or even more sisters to share a bedroom, and this emergency measure was willingly accepted by even older sisters who for some years had been accustomed to the privacy of a separate bedroom, and often a sitting-room as well. All meals were served in a central sisters' mess, and in most hospitals a relay system was necessary.

Sickness among sisters was uncommon, but the medical care of nursing sisters in the naval hospitals, including examination on entry and sickness during service, was undertaken by a nominated medical officer of adequate seniority in each establishment.

For nursing sisters a duty plan of ninety-six hours per fortnight was in operation throughout the war years, and this was rigidly adhered to, except in times of emergency, when volunteers for extra duty always exceeded requirements.

Leave was granted at the rate of ten days for every four months of home service. Foreign service leave, as distinct from local leave while abroad, was cumulative, and granted on returning to the United Kingdom at the rate of fourteen days for each completed year oversea, plus a proportion for periods less than twelve months.

Towards the end of the war in Europe, all nursing sisters who could be spared from medical establishments at home were transferred oversea, to Australia, Ceylon, India and to hospital ships. Immediate requirements were 160 sisters in Sydney, 27 for Brisbane, with further numbers necessary to serve some 2,000 extra beds distributed between Colombo, Diyatalawa and Bombay. Later on, additional staff became necessary at Trincomalee.

Naturally during the early war years, nursing sisters serving in naval hospitals in the British Isles had to face the hazards and hardships occasioned by enemy air activity, but fortunately a casualty amongst the female nursing staff of any hospital was almost unknown. At the Royal Naval Hospital, Haslar, several high explosive bombs fell in the grounds, buildings were hit and set on fire, but there were no personnel casualties. In Plymouth some nursing sisters had remarkable escapes when the houses in which they were living were completely destroyed. At Cullercoats, Great Yarmouth, Lowestoft and Portland the same can be recorded. In all these medical establishments, there was usually so much work to be done by the nursing staff that the dangers passed unnoticed. They were nevertheless constantly present.

The Royal Naval Hospital, Portland, had no female nursing staff in peace-time. On the outbreak of war a female staff was appointed, consisting of one superintending sister and six nursing sisters. Early in the war this staff became accustomed to nursing a steady flow of casualties from various sources. In 1940, the hospital received such heavy air attacks and so much damage, that the nursing staff had to be transferred to Minterne Magna, where a private house was converted into a temporary sick quarters.

Abroad. Nursing sisters in naval medical establishments oversea were subjected to a variety of experiences depending upon the operational theatre in which they were employed. In some establishments there was so much work to be done that little time could be allowed for rest and recreation, while in others, the chief hardship consisted of long periods of inactivity and monotony, so apt to occur in a widespread medical organisation which must of necessity insure against every likely contingency.

In Durban, for example, twenty-five nursing sisters waited for more than a year for the Royal Naval Auxiliary Hospital to be completed. During this waiting period the whole staff worked voluntarily in local hospitals. But with completion, the nursing staff was more busily

employed, and gained valuable experience, particularly in the nursing of tuberculosis patients who were transferred to Durban from the Far Eastern Theatre.

In the case of the Royal Naval Auxiliary Hospital, Sydney, preliminary preparations were made by an advance party of forty-five nursing sisters who left England for Australia in November 1944. On arrival in Sydney they found themselves faced with the task of rendering suitable for occupation a hutted hospital covering an area of 170 acres, which had been unoccupied for six months. Living conditions were of necessity austere, and it is impossible to assess too highly the work of this advance party, which resulted in the hospital being ready and equipped to receive patients within seven weeks. The staff was later increased to 160 nursing sisters, who carried out every kind of medical and surgical nursing duty for a large number of patients from the Far Eastern Theatre of War.

In the immediate aftermath of hostilities the nursing duties in Sydney were greatly increased, and the commitments of the hospital called for versatility by the nursing staff, and an intricate administrative organisation. The hospital became a reception and rehabilitation centre for prisoners-of-war released from Japanese prison camps. It became an evacuation centre for recovered prisoners-of-war proceeding to England under the care of nursing sisters. In addition it became a drafting centre for nursing sisters required for transport duties ashore and afloat, and for duties concerned with the reconstruction of medical organisation in many areas evacuated by the Japanese. It was in Sydney that history was made by the formation of an Air Evacuation Unit.

In the Royal Naval Sick Quarters, Mombasa, the nursing staff carried out their duties in a number of huts, thatched with banana leaves, and with walls of sacking stretched over a wooden frame and treated with cement. Sanitation was fairly primitive. Nursing sisters employed here gained great experience in tropical medicine, and 75 per cent. of the cases which they nursed consisted of sub-tertian malaria and amoebic and bacillary dysentery.

Records are necessarily scanty, but it needs no great feat of imagination to appreciate the part played and the ordeal endured by the nursing staff in the Royal Naval Hospital, Malta, during a large part of the war. By the end of 1940 this hospital had been so damaged that the nursing staff was transferred to the military hospital at Imtafa, a few miles away. During 1941, when air raids were almost continuous, only a skeleton staff was employed in the naval hospital, which by now could only be used as a centre for out-patients and minor casualties. During this time, naval nursing sisters in Malta were accommodated in deep underground shelters, and towards the end of the siege were grateful to be able to receive the barest necessities of life. The conduct and bearing of these ladies was at all times most admirable.

In February 1944, it became necessary to employ a small number of naval nursing sisters in a sick quarters established at Ferryville, North Africa, to serve the needs of His Majesty's Ships entering Bizerta. In addition to general nursing duties, the staff dealt with sickness among the local Arab population, and survived an epidemic of plague.

The Royal Naval Auxiliary Hospital, Bombay, established in 1944, was not completed and equipped for several months. During this period of waiting, the nursing staff were loaned for duty to Colaba Military Hospital. A small number also assisted in St. George's Civil Hospital, Bombay, where most of the naval surgical work was carried out. The nursing staff also assisted in the preliminary organisation involved in the opening of the first Royal Indian Naval Hospital to be established in India, and the Royal Indian Naval nursing staff welcomed the guidance of their more experienced Royal Naval nursing colleagues.

In 1945, the Naval Auxiliary Hospital, Bombay was officially opened by Lady Louis Mountbatten, and functioned for several months after the end of the war with Japan. In general, medical cases predominated, and the nursing staff gained good experience in the nursing of dysentery, malaria and the usual tropical fevers.

It is regretted that the early history of this hospital was marred by the sad death of one naval nursing sister following acute polio-encephalitis, which was of dramatically sudden onset and short duration.

LIAISON WITH OTHER SERVICES

In accordance with the policy which was developed early in the war with a view to pooling medical and nursing resources, Queen Alexandra's Royal Naval Nursing Service played an active part in effecting the harmonious liaison which eventually became the hallmark of the few Combined Services Hospitals. In time of war, in an area in which two Fighting Services are functioning, it is obviously an economy in medical and nursing man-power to combine the resources of each Service inside a single hospital, rather than to permit two separate hospitals to exist, each probably only half occupied. To the layman it would appear to be an easy matter to effect such a combination. But in practice, experience has proved that it is a most difficult matter to unite inside a single building the medical branches of two different Fighting Services, each of which possesses its own unique characteristics. Nevertheless, in several areas during the war such a combination was effected with success, and the medical and nursing members of the Royal Navy and Army worked to a common routine in complete harmony. In such cases, the essence of the success achieved was the personal tact and tolerance of each nursing service towards the other, with the constant realisation that the highest priority to flow from the process of liaison was the welfare of the sick and wounded.

The main examples of such combined establishments were found in Egypt and Ceylon, and as will be seen, the problems presented in each country were very different, being complicated by the inclusion of Asiatic nursing staff farther east.

In Egypt, the 25th General Hospital, Alexandria, later known as the 64th General Hospital, was originally built up in October 1939 from nursing personnel of the military hospital at Ras-el-Tin and a small naval unit. The latter was sent out from England a few days before war was declared. The combined staff consisted of 20 naval nursing sisters to attend wards totalling 600 beds, and about the same number of military nursing sisters. The Army unit was later augmented to a maximum of 60, and the total number of beds became 1,400. Before all the temporary buildings were completed for the main hospital, which was accommodated in Victoria College, Alexandria, the sick officers section was housed in part of the civil hospital at Rond Point, some eight miles distant.

Although it became customary to speak of the 'Naval Wing' of the 64th General Hospital, in effect the establishment was under Army administrative control, resources were pooled, and no attempt was made to place a dividing line between the two Service elements. Nursing duties were directed by an army matron, assisted by the senior naval nursing sister, who acted as assistant matron. Charge of the wards was allotted impartially to naval and military nursing sisters according to seniority, and most wards had two or more sisters. Subordinate ward staffs were composed of naval V.A.Ds., R.N. sick berth staff and R.A.M.C. orderlies. As time went on, the nursing staff was augmented by Italian prisoners-of-war.

Sisters and V.A.Ds. shared the same quarters, and their welfare received the constant attention of the Army Director of Medical Services, and the Principal Matron of Q.A.I.M.N.S. in Cairo.

Nursing duties in this hospital were largely concerned with battle casualties of the North African Campaign, and during the retreat to El Alamein the nursing staff found itself involved in long hours of work against the background of an advancing enemy, with the possibility of being made prisoners-of-war within a few days. This latter contingency was allowed for by drawing lots to decide which members of the staff should be evacuated and which should remain with the patients. In spite of such anxieties, long hours of duty, and the trying conditions under which they frequently worked, nursing sisters of the two Services in the 64th General Hospital worked magnificently side by side. When occasional difficulties did arise there is no doubt that differences of opinion were due more to individual temperament rather than to the fact that two different Services were working in conjunction.

With the end of the war in North Africa the 64th General Hospital was closed, and the naval staff was transferred to the Royal Naval

Auxiliary Hospital, Alexandria, which was opened in September 1944.

In Ceylon several naval nursing sisters were loaned in 1943 to the military hospital at Rogama outside Colombo, and did excellent work.

In 1944, other sisters were loaned to this hospital from the Royal Naval Auxiliary Hospital, Diyatalawa, to assist with the nursing of African troops. Naval nursing sisters also served in the 48th Indian General Hospital, Kandy, and established a happy liaison with both their British and Indian Army nursing colleagues.

The Combined Services Hospital, Trincomalee, was under naval direction. This hospital originally functioned as the 54th Indian and British General Hospital, under Army administration. A small number of naval nursing sisters and V.A.Ds. were later loaned to the hospital, and this number was increased concurrently with the naval demands of the hospital. At that time, the staff was a mixture of British and Indian Army sisters under a European matron. With these the naval nursing sisters worked and messed, and established an excellent liaison. In 1945, as the number of naval patients greatly exceeded those from the other Services, it was decided to form a Combined Services Hospital under naval direction. This was the only instance of a Combined Hospital being placed under the administrative control of the Royal Navy, though for some weeks in 1945 the Combined Services Hospital at Cochin, Southern India, although administered by the Indian Army, had had a Surgeon Commander, R.N., in charge.

In Trincomalee the naval female nursing staff consisted of a naval acting principal matron, senior sister, nursing sisters and V.A.Ds. The Army element consisted of a matron, British and Indian Army nursing sisters and Indian Army Nursing Service V.A.Ds. Nursing commitments included both British and Asiatic members of all the Fighting Services.

With a view to achieving complete harmony, an intricate system of delegated responsibilities was evolved. After a period of initial difficulty, largely due to the promotion, by the military authorities, of the Army matron to the rank of acting principal matron (subsequently replaced by an Army senior sister), the nursing administration ran smoothly until the end of 1945, when the hospital ceased to be a Combined Services establishment, and was converted into a purely Royal Naval Auxiliary Hospital.

SERVICE IN HOSPITAL SHIPS

Early in 1939, when planning the conversion of merchant vessels into naval hospital ships, the Board of Admiralty's preliminary policy was that female nursing staffs should not be borne afloat. The reason for this somewhat drastic decision was to reduce the problems with which the Director of Naval Construction was faced in relation to planning living spaces and sanitary annexes in these ships. Shortly before the

outbreak of war, however, the policy was abandoned, and it was decided that despite restricted accommodation, female nursing staffs must be carried afloat in the interests of patients.

The complement of naval nursing sisters in hospital ships varied according to the number of cots. The minimum number was four in the smaller, and eight in the larger ships. In each case this number included a matron or senior sister in charge of nursing administration.

Living accommodation in hospital ships varied according to the size of ship. In general, nursing sisters messed with the Navy medical officers and Merchant Navy officers in a common saloon.

In any theatre of war a hospital ship represents a unit in a large medical organisation which aims at making provision for every possible contingency. It thus frequently happens that such units are not called upon at all, having been in fact, included in a policy of over-insurance which could not be avoided. This problem is one which has always attended the employment of hospital ships in time of war, and it is a most difficult one to eliminate. One of the unfortunate results is that, being given little work to do, and being moored in anchorages deliberately far from shore and combatant ships, a hospital ship tends to become lonely and isolated. Those on board are subjected to long periods of boredom, in which the same faces are seen in close proximity day after day. Shore-going and recreational facilities are frequently difficult to achieve. Such an environment calls for the constant display of tact and tolerance between individuals. For this reason a policy was devised whereby nursing sisters should serve in hospital ships on a voluntary basis where possible, and most appointments were limited to one year, particularly in ships where the work was not of a very rigorous nature. Nevertheless, the monotony described was certainly not the lot of every naval hospital ship, and in some cases naval nursing sisters serving in these ships performed strenuous nursing duties for long periods, and sailed many thousands of miles about the world. For example, H.M.H.S. *Vasna*, which served the Home Fleet in Scapa Flow and was then commissioned in 1942 to sail in Eastern Waters, served successively in West, South and East African Waters and in the Madagascar Campaign. She was then transferred to the Mediterranean and served in connexion with the North African and Italian Campaigns. This was followed by a period of service in the Indian Ocean, Persian Gulf, and finally in the Bay of Bengal in connexion with the Burma Campaign. During this itinerary, the nursing sisters had the experience of two collisions at sea and of nursing casualties of many Allied and enemy nationalities, including Americans, Africans, Indians, Germans, Italians and Japanese. They also nursed all sorts of tropical diseases, including scrub typhus and leprosy.

Other hospital ships such as the *Amarapoora*, *Vita*, etc. had similar experiences in the Mediterranean and Indian theatres of war, as

well as in the Far East in connexion with the Japanese Campaigns. Some came under enemy fire on more than one occasion and H.M.H.S. *Vita* nearly became a total loss as the result of enemy action.

At the end of the war, H.M.H.S. *Amarapoora* was called to the Far East to perform duties which demanded remarkable physical endurance and professional and social versatility on the part of the nursing staff. The task upon which the ship was first engaged was the repatriation of sick Japanese surrendered personnel to Japan from Malaya and Batavia. The cases included tuberculosis, dysenteries, general medical and surgical conditions, and one case of leprosy.

To assist in caring for these patients, four Japanese medical officers, thirty Japanese nursing orderlies and two interpreters were embarked.

Many of these patients were dangerously ill. Six died during the first few days and one patient threw himself overboard and committed suicide a few hours after the ship had put to sea from Batavia.

The naval nursing sisters caring for these Japanese obeyed their professional instincts, and carried out their duties according to the finest traditions. Each sister assisted a Japanese medical officer, and had a number of Japanese orderlies under her control.

Suffice it to say that these Japanese prisoners had obviously expected no medical care at all, and their response to impartial treatment was an interesting psychological study. It is a tribute to the Naval Nursing Service that at the end of the voyage the Japanese patients compiled a testimony of thanks to the nursing staff, and at Ujema the nursing sisters were formally presented with bouquets of flowers from the Imperial Government of Japan.

During this period, the nursing sisters of this hospital ship were permitted to view the devastation at Hiroshima.

This outline gives some idea of the work performed by naval nursing sisters serving in hospital ships. A more detailed account is given in Chapter 8, which deals with hospital ships and their administration.

SPECIAL DUTIES OVERSEA, ASHORE AND AFLOAT

So far some account has been given of the more orthodox duties carried out by naval nursing sisters during the war. In addition, less orthodox duties were demanded in all parts of the world, and from the historical angle it is necessary to place some of these on permanent record, if only to give posterity a knowledge of the versatility displayed by their predecessors.

In 1942, a naval nursing sister was appointed to the Island of Tristan da Cunha. Nursing duties were not confined to the small naval garrison on the island, but came to include the local inhabitants as well. In course of time this sister dealt with all the midwifery on the island, instructed the infants, and taught needlework in the local school. To augment the requirements of the sick, she bred chickens, geese and

goats, and eventually catering difficulties were greatly eased by using the produce of her small farm.

Following the Normandy landings, a small number of naval nursing sisters was sent to France as part of the medical organisation necessary to care for the needs of the various naval parties engaged there. The sisters selected for this particular duty were of French extraction, who had done their nursing training in England but had lived in France for some years. In two cases the parents of the sister had not been heard of since the German occupation, and each sister on arriving in France, was fortunately able to trace and meet her relatives.

In general, these sisters were accommodated in scattered billets adjacent to the battle area. For a time living conditions were primitive, with no lighting or heating, and an inadequate water supply. Until conditions improved, however, the hardships occasioned were cheerfully borne, and with the aid of oil lamps and stoves, and a hand-carried water supply, the immediate needs of the sick were met.

A small number of naval nursing sisters served in troopships, including the S.S. *Strathaird* and S.S. *Queen of Bermuda*. On one voyage from the United Kingdom to Colombo two sisters, assisted by a small staff of V.A.Ds., attended 1,500 cases of sickness, which included 100 serious cases of food poisoning and one fatal case of heat exhaustion.

History was made towards the end of the war by the appointment of selected naval nursing sisters to certain of His Majesty's Ships engaged on miscellaneous transport duties. The ships concerned were mostly aircraft carriers.

In H.M.S. *Victorious*, one nursing sister and six V.A.Ds. were appointed to accompany 655 Australian brides, wives of Royal Naval personnel, from Sydney to the United Kingdom. Seventy-four of the passengers were expectant mothers, of whom six suffered miscarriages during the voyage. A number of cases of dysentery were kept under treatment, and a large number of reactions among the 90 per cent. of passengers vaccinated on board.

In January 1942, a nursing sister was detailed to attend on a number of Norwegian refugees who arrived in the Orkneys after fleeing from Norway in a fishing smack. The party numbered 70 men, 50 women and 45 children, of which 6 were infants in arms. Included in the impedimenta was a number of goats and ducks, German prisoners, and 'quislings' who had been captured at the time of leaving Norway. The duties of the sister were mainly to attend to the needs of the party during the sea journey from the Orkneys to Scotland in a small Danish vessel. The journey though short, called for a large variety of nursing incidents among the women and children already suffering from exposure. The weather was rough and space inadequate, and conditions were made worse by the failure of the drainage system. Two Army V.A.Ds. appointed to assist, were prostrated with

seasickness, and during this nightmare passage, the naval sister carried on alone. The journey was safely completed, and the sister had the satisfaction of knowing that her charges, on arrival, had recovered sufficiently to boo the Germans and 'quislings' when they disembarked.

In the Royal Naval Auxiliary Hospital, Sydney, an Air Evacuation Unit was formed in March 1945. The unit had its base near the main Fleet anchorage at Manus, in the Admiralty Islands. Its function was to fly approximately 20 patients a day from Manus to Sydney, a distance of 1,600 miles.

Six naval nursing sisters were appointed to the unit. They first received a course of training at Melbourne, with members of the Women's Auxiliary Australian Air Force. The course of instruction included strenuous physical training, and covered the nursing care of patients at high altitudes and the elements of air sea rescue. The sisters were accommodated in the American Hospital at Manus, and made a round trip about every eight or nine days. Each sister completed six round trips before the unit closed down.

On one such trip, while flying at 15,000 ft., the sister found herself confronted with a severe secondary haemorrhage in a patient suffering from abdominal wounds. The aircraft communicated with an American hospital on one of the islands, and eventually effected a safe emergency landing at a point where medical assistance was standing by. Meanwhile a blood transfusion had been started in the aircraft. The patient unfortunately died soon after landing, which was a disappointing ending to the brave efforts made by the naval nursing sister to save his life.

In September 1945, three aircraft carriers were directed to undertake the repatriation of prisoners-of-war and internees who had been in captivity under the Japanese. Each ship carried five naval nursing sisters and twelve naval V.A.Ds. to assist in nursing duties. In each case the nursing staff was appointed from the Royal Naval Auxiliary Hospital, Sydney.

The first ship utilised for this particular function was H.M.S. *Implacable*, which left Sydney for Leyte and Manila on September 13, 1945, carrying large quantities of medical stores and equipment, Red Cross supplies, and 2,000 beds.

On passage to Manus, the nursing staff had the task of clearing and converting the upper hangar of the ship into a 280-bed hospital. Long rows of cots were erected in double tiers, and equipped with toilet requisites and essential clothing. One section was curtained off for officers. Separate cot accommodation was also arranged for contagious and infectious cases. Electric food-containers, kettles and flasks were fitted fore and aft, and sanitary and washing facilities were installed on either side of the hangar. Shipwrights, under the direction of the senior sister, constructed and fitted bins for soiled linen, dangerous drug and medicine cupboards, and miscellaneous equipment. Preparations were completed by September 23. Two days later, 2,127 officers and men

from Japanese and Korean camps were embarked at Manila, many of whom were in need of nursing care. In addition to nursing duties, each sister and V.A.D. undertook the moral welfare of a group of passengers, the essence of which was to encourage the men to talk about themselves and regain their self-confidence.

After calling at Pearl Harbour on October 5 the *Implacable* reached Vancouver on October 11, where the passengers were disembarked, already improving mentally and physically.

During the short period spent in Vancouver, the ship was open to visitors, no less than 20,000 of the local population arriving on board. This created additional work for the nursing staff, who were called upon to treat 350 cases of minor injuries.

Implacable left Vancouver on October 18 and, after calling at Hong Kong, arrived at Manila on November 3; 2,112 Dutch officers and men were now embarked from prison camps and were carried to Balikpapen, Borneo, where they were landed on November 10.

Twenty-four hours later, 2,126 Australian ex-prisoners-of-war were embarked, and repatriated in Sydney on November 19.

Needless to say, the naval nursing sisters employed on this task performed their duties with the utmost efficiency. Their personal welfare was cared for by the captain and officers of the ship. The sisters messed in the Wardroom, and were granted full use of its privileges. The warrant officers' mess was handed over to the V.A.Ds. The personal accommodation of the nursing staff was arranged in the Admiral's Quarters, on the basis of two sisters or four V.A.Ds. to each cabin. The senior sister had a cabin to herself. In addition two extra cabins were placed at their disposal for recreational purposes, and stewards were specially selected to attend to their wants. During excessively hot weather in the Tropics the nursing staff slept on stretchers placed on a curtained-off space of the quarter deck each night.

It cannot be denied that at first, the inclusion of women as extra complement in a man-of-war was something of a novelty. But such is the adaptability of seafaring men that within a few days their presence on board was accepted as normal, and in addition to her nursing duties, each sister and V.A.D. soon found her spare time fully occupied with mending and darning for the ship's officers and men. In her report, the senior sister recorded matters which experience proved to be of great importance to sisters subsequently employed on similar duties. Among other things, it would seem that laundry facilities presented a constant problem, and valuable recommendations were made regarding the type of uniform most likely to minimise this difficulty.

Perhaps the greatest tribute which was paid to this particular group of naval nursing sisters was the fact that each was elected to Honorary Life Membership of the Wardroom of H.M.S. *Implacable*, a rare privilege for a member of the female sex.

On September 26, 1945, four nursing sisters and twenty-one V.A.Ds. joined H.M.S. *Glory* at Sydney, and sailed to collect and repatriate prisoners-of-war from Japanese prison camps.

As in the case of H.M.S. *Implacable*, the nursing staff was responsible for converting and equipping the main aircraft hangar as a temporary hospital.

Ports of call during the next three months were Manila, Esquimalt, Pearl Harbour, Hong Kong and Borneo.

In the case of H.M.S. *Glory* the repatriates included a larger proportion of sick, and approximately 250 cot cases were constantly under treatment. The majority of these patients had been working in the mines in Formosa, and in consequence were suffering from pulmonary tuberculosis, beriberi, and pyrexial illnesses of the typhoid group. One patient with miliary tuberculosis died and was buried at sea. With so much work to be done, in this ship welfare took second place to strict nursing duties. The 'hospital' was divided into two sections, with a sister in charge of each section assisted by seven V.A.Ds. One sister and three V.A.Ds. were employed on night duty, and the senior sister supervised the whole arrangements and relieved the other sisters in off-duty hours. Night duty was worked in shifts of six nights at a stretch.

It was found easier to nurse strict bed patients on the top-tier bunks, where they got more ventilation and head room, and the difficulties of bed-making and washing proved to be less than in the lower bunks.

Feeding arrangements went very smoothly. Full diet meals were cooked in the ship's main galley, and special diet meals were cooked separately in the captain's galley. Under the supervision of the sisters, meals were transported and served by teams of volunteers from the ship's company. In the Tropics it was found necessary to employ one nurse full time to keep drinking mugs filled.

The nursing staff was given every assistance towards the smooth running of their 'hospital' by the officers and ship's company. Everything possible was done to minimise their difficulties, and at the request of the senior sister the speed of the ship was maintained at a rate which caused least vibration, and on occasion alterations in course were made to minimise the inconvenience to patients of exhaust gases from the ship's funnel.

It would be easy to compile a separate volume of the personal experiences of naval nursing sisters during the war. A survey of the records available reveals both tragedy and comedy. For example, the story could be told of sisters in Malta who found themselves bathing, in order to keep clean, in a part of the harbour in which dead bodies were floating; or how Dutch and English sisters worked side by side with no knowledge of each other's language; of the manual unloading and checking of hospital stores in a downpour of monsoon rain; and

how nursing staff in one area, accommodated in a vicarage, nursed sick officers in a 'Home for Fallen Girls'. But in every story is shown a sense of humour and that lack of criticism or complaint traditional in Queen Alexandra's Royal Naval Nursing Service.

In 1940, a naval nursing sister was a passenger in a merchant ship bound for India, which was sunk in the South Atlantic by an enemy raider. The ship was attacked early in the morning, and was shelled continuously for an hour, after which the passengers were given half an hour in which to abandon her. The naval sister found it difficult to obtain a place in a lifeboat, for most of the boats had been badly damaged by gunfire, and the first boat in which she was able to take a place immediately sank when it touched the water. The raider then sank the ship, leaving a mass of burning oil on the sea in which a heavy swell was running, and great numbers of passengers lost their lives at this moment. The naval sister was eventually picked up and found herself one of 63 survivors in an overloaded lifeboat. Of the 63 there were only three women, and the 60 men included 25 Asiatics of uncertain temperament. The boat was leaking badly, and continuous baling out was necessary. Even so the survivors were constantly immersed in water up to their knees. It was estimated that the nearest land was 700 miles away, and it was at once realised that in such tropical waters the chances of ultimate survival were remote.

The first task to which the naval sister applied herself was the treatment of the injuries of several of the survivors, with a small first-aid outfit which she found in the boat. Under the direction of the senior officer in the boat she took charge of the small supplies available, which consisted of ten gallons of water, a few waterlogged ship's biscuits, and six tins of Nestlé's milk. This supply she divided into a daily ration of one ounce of water night and morning, two biscuits, and a teaspoonful of Nestlé's milk. At first the milk ration was spread upon the biscuits, but later on when their mouths became too dry to swallow, she taught her fellow survivors to lick the milk off their hands.

By the end of the second day, several survivors had collapsed from heat stroke, all were painfully blistered by sun and sea water, and their legs were swollen by cramp and immersion. The sister helped wherever she could, advised each person to suck buttons and coins, and cut a single apple into tiny fragments, providing a piece for each. With no space to lie down and nothing to lean against, sleep was almost impossible.

On the third day, the survivors refreshed themselves by bathing in the sea in turn, while others kept a lookout for sharks. On the evening of that day one male survivor lost his reason and jumped overboard, but with some difficulty he was rescued and survived.

On the fifth day, the remaining water ration was cut to 1 oz. a day, and in the absence of rain the prospects of survival now seemed remote.

On the night of the sixth day these survivors were rescued by a neutral ship, and the fact that they were still sixty-three in number must be regarded as a phenomenal achievement by the officer-in-charge, who himself gave much of the credit to the personal example of cheerfulness and discipline which was displayed by the naval nursing sister during their time of ordeal.

EXPERIENCES IN HONG KONG AS PRISONERS-OF-WAR

It is considered that an account of the experiences of the three members of Queen Alexandra's Royal Naval Nursing Service who fell into the hands of the Japanese in Hong Kong, should be recorded in some detail in this History.

Immediately before the outbreak of war with Japan the commitments of the Royal Naval Hospital, Hong Kong, had been reduced as far as possible, as a precaution against the possible ultimate occupation of the Colony by the Japanese. The female nursing staff consisted of a superintending sister, and two nursing sisters.

On December 8, 1941, when the assault on Hong Kong started, all patients whose condition permitted it were discharged to their ships and establishments. The remaining patients were accommodated on the ground floor, and a casualty reception station was fully prepared. One sister took charge of the reception station, and the nursing of medical and minor surgical cases. The second sister took charge of the operating theatre and the acute surgical ward. The superintending sister undertook general nursing, catering and administrative arrangements. She also undertook periods of night duty when necessary.

At 0200 hours on December 11 enemy shells started to fall in Hong Kong itself, and as pre-arranged, the nursing staff immediately packed their gear, and a proportion of medical stores, equipment, food, china and cutlery, all of which was to be transferred to the local Industrial School at Aberdeen, some miles away, when the hospital became no longer tenable. Unfortunately, the Aberdeen area itself came under enemy shell fire within a few hours, and so evacuation of the hospital to this district became impossible.

The pharmacists' store was now utilised as an air raid shelter, and from December 11 onwards the nursing staff used it for eating, sleeping and rare periods of rest. On December 12, the Sisters' Mess was completely wrecked, and the Chinese domestic staff deserted. Before running away the latter had looted the belongings of the staff to some extent, and articles of clothing and money were stolen which were sadly needed later on. On December 14 the staff were placed on Service rationing, and after payment of a personal cheque, the superintending sister managed to obtain two sides of bacon, four large boxes of cheese, some cases of dried apples and tinned food which was of the greatest use later when rations became limited.

After five more days of increasing enemy bombardment and air attacks, gas and electricity supplies failed, and on December 19 the water supply to the hospital failed also. These defects entailed work being carried out by candlelight not only at night, but also in the daytime, because all the windows of the hospital had been shattered, and such windows as remained had to be kept closed, both for warmth and as protection against bomb splinters and shrapnel. Naturally, all electrical medical equipment was now useless, including sterilisers and X-ray plant. All drinking water had to be collected by hand and boiled on open fires. The lack of water presented the most serious problem, and a time came when water stored as a precaution against fire had to be used for drinking and cooking instead. On two nights after dark it was possible to obtain a water supply by trailer pump, but after that the pump was rendered useless by shrapnel. The strictest economy now had to be observed in using the small supply of water available. One bowl of water had to be used for washing as many as twelve patients, and for scrubbing-up purposes one bowl had to suffice between the whole nursing staff for many hours of duty.

All refuse was buried in pits dug outside the wards.

In addition to their nursing duties, the nursing staff had to compete with fire and demolition duties during air raids and shelling. For instance, on one occasion a bomb fell outside a ward and wrecked everything inside it, burying the patients and staff in debris. Nevertheless, within half an hour the ward had been cleared up and was in running order again. The major and minor operating theatres were completely wrecked and operations had to be carried out by candlelight in a passage between two wards. The hospital was hit by bombs and shells approximately 100 times; nevertheless casualties were minimal.

The capitulation of Hong Kong took place on December 25, 1941, and the immediate reaction of the nursing staff was one of relief at being able to give more adequate attention to their patients. Temporary repairs were effected where possible, and with an influx of casualties of all Services and nationalities, an enormous volume of work was now undertaken.

After a few days a temporary supply of water was restored, and for payment in rice a Chinese laundry staff was obtained to wash the vast accumulation of soiled linen.

Food was now scarce, and mainly from tins. Occasionally chicken or deer was obtained, but owing to lack of cold storage, was usually on the point of going bad. Patients gradually became very hungry and thirsty. Owing to pilfering and the threatening attitude of the Japanese guards, food, cigarettes, and even drinking water had to be kept under lock and key.

After a few days a concert was arranged to try to create a diversion for the patients and staff, but as soon as the Japanese heard of it they

gave orders that there was to be no music, clapping or cheering. Nevertheless, in accordance with these instructions several entertainments were held successfully, but without music or applause. It is amusing to record in relation to this prohibition, that on one occasion the superintending sister was alarmed to hear the National Anthem being played on a piano. On hastening to warn the offender she found that the culprit was in fact a Japanese sailor, who proceeded further to demonstrate his musical prowess by rendering as an encore 'The Bluebells of Scotland'.

On the first Sunday after the capitulation, an English chaplain was allowed to visit the hospital and conduct a service for patients and staff.

For the first few days strolling enemy soldiers caused some apprehension to the nursing sisters, but apart from having their wrist watches demanded they suffered no physical harm. There is no doubt that at this time such immunity was largely due to the situation of the hospital on a hillside high above the main road, for, as all the world realises, things were very different in the other hospitals in Hong Kong.

However, at midnight on December 30 some Japanese Army officers entered the hospital and ordered the principal medical officer to lead them to the women's quarters. The principal medical officer temporised, and sent a message that the sisters were to lock themselves away as best they could while he delayed the men. He then led the Japanese officers, in the dark and at the point of a revolver, to the sick berth staff mess, where they occupied themselves in removing watches, rings and fountain pens from the staff. There is no doubt that owing to this act of courage, the naval nursing sisters were spared the treatment suffered night after night by the nursing staff of other hospitals. This incident was reported to the Japanese Authorities, who immediately placed a naval guard around the hospital. Nevertheless, the presence of these Japanese sentries was a constant embarrassment to the nursing staff, for they moved silently in felt shoes and would appear by day or night in the Sisters' Quarters without warning. The sentries also wore masks of white gauze, and the sisters would frequently have no idea of their presence until a light flickered on a bayonet and drew attention to the masked figure standing nearby.

During these few days several burials of dead took place in the hospital grounds, and later a common grave was provided and covered with a granite stone with a suitable inscription. The grave was dedicated by a Buddhist priest and the ceremony attended by a number of Japanese naval officers.

Without warning, on January 18, 1942, the Japanese Authorities gave orders that the Royal Naval Hospital, Hong Kong, was to be evacuated by 1700 hours that day. The nursing staff were given no option but to obey, and were permitted to take with them only a minimum of

clothing and personal belongings, and even then were thoroughly searched before leaving.

Due to the forethought of one of the sisters, a certain amount of clothing, drugs and extra bed linen was concealed in stretchers upon which patients were removed, and was thus smuggled out of the hospital. The nursing staff was now accommodated in St. Albert's Convent, and on February 25 they were transferred to work in the Military Hospital, Bowen Road.

Here the three naval nursing sisters were accommodated with fifty or sixty other sisters and nurses of the various medical services, in a ward on the top floor. The building had been severely damaged, and the lack of doors and windows rendered living conditions primitive and cold. For a few weeks, however, they had the comfort of electric light and a warm fire and hot bath until fuel ran out. At this time their nursing duties were mainly concerned with cases of tuberculosis and dysentery.

After a time the senior sister, assisted by an R.A.M.C. orderly, organised the messing and catering for all the nurses. At this time it was possible to obtain a certain amount of rice, and to cook it over an open fire. Later this was not possible as there was no fuel to burn.

Lack of money to purchase necessities was a serious handicap, and in June 1942 officers of the R.A.M.C. organised a fund from which nursing sisters were paid seven military yen per month. In addition the Naval Principal Medical Officer managed to pay each naval nursing sister ten yen per month.

Notwithstanding this assistance, the sisters continued to be hungry and short of food, and at times considered themselves fortunate to obtain dry bread to eat. Frequent promises of a regular money allowance were made by the Japanese authorities, but never materialised. It was indeed exasperating to suffer from lack of food which at that time could have been easily obtained had money been available. In the summer of 1942 the diet of the sisters was:

8 a.m. Two slices of dry bread, with tea.
1 p.m. One slice of dry bread, rice and vegetable stew, with meat occasionally.
6 p.m. Two slices of dry bread, tea, sweet potato and sometimes dates.

Until Army stores of food were exhausted, a little butter, jam, sugar and tinned milk was available. Later these items of diet were lacking, though occasionally sugar and salt were provided by the Japanese. Eventually, meat was lacking, and replaced by a ration of whale and octopus.

On August 10, 1942, the female nursing staff was ordered to leave the Military Hospital, and a unit composed of sisters and nurses of the various Services was paraded before Colonel Tggunak, the Japanese commandant of prisoner-of-war camps in Hong Kong. The ladies were

addressed by this officer through an interpreter, and were informed that although it was realised that they had been doing valuable work for the sick and wounded, nevertheless orders from Tokio were that they were to be transferred to the Civilian Internment Camp at Stanley, Hong Kong. They were also informed that within a short time they would be returned to their homes.

In Stanley Camp, the nursing unit consisted of eleven nursing sisters of Q.A.I.M.N.S., three nursing sisters of Q.A.R.N.N.S. and two nursing sisters of the Royal Canadian Army Medical Corps. For reasons of convenience administrative control of the unit as a whole was placed in the hands of the Senior Army Sister.

The unit was accommodated in a building in charge of Chinese Superintendents, who checked its members twice daily. The guards were Indians and Chinese. The building had been considerably damaged during hostilities. The sisters occupied a single cubicle between three of them. These cubicles, 10 ft. by 14 ft., had wooden floors and whitewashed walls which were very dirty. Every cubicle was bug-ridden. The windows were all smashed and stuffed with rags and cardboard. One broken European lavatory was available in a bathroom, but the bath had to be kept full of water in order to flush the lavatory. A washroom was available containing three showers, and two long slabs on which basins could be placed. Warm water was never available. These facilities served altogether seventy women and children, and the washroom sufficed for the washing of persons, clothing and dishes. At first, no bedding was obtainable, and the sisters had to sleep on the bare floor, or on boxes and trunks. Later, by the efforts of the Director of Medical Services, Hong Kong, each sister was provided with a camp bed.

At first, the food in Camp Stanley was better than that in the Military Hospital, and consisted of two reasonable meals daily:

10 a.m. Rice, soup, and bread.
5 p.m. Rice, soup, meat pie, or meat and vegetable stew.

Tea was obtained three or four times a day. After January 1944 three meals a day were given:

8 a.m. Rice congee with bran.
11 a.m. Rice, and vegetable soup.
5 p.m. Rice, soup, vegetable hash or fish.

From this time onwards they received no meat for sixteen months, but fish was supplied every second or third day. The quantity of fish was, however, very small and the issue gradually became less frequent. For instance, during February 1945 the only fish received was a ration of one teaspoonful of shell fish, and that only on one day in the month. After January 1944 no bread was available, and vegetables had to be cooked in sea water owing to lack of salt. There was no sugar ration.

In June 1945, when the trend of war had changed in favour of the Allies, a ration of meat was provided once a week, and in August 1945, when peace was in sight, an ample supply of meat was provided twice a day.

Fuel for cooking was usually inadequate, and had to be supplemented by grass fires. In due course doors, banister railings and the floor boards had to be used as fuel, and during the winter of 1944–5 hot water for tea could only be prepared once a day.

Cooking was done by volunteers and many devices were evolved for supplementing the diet. Crisp rice left round cooking utensils was scraped off and given to the infants to chew. All meat bones were ground into powder and given to the children. Fish heads were distributed in rotation. In addition kitchen refuse was used in the garden as manure, and a soap substitute was manufactured.

By October 1944 electric light was no longer available.

Water was always in short supply, and was usually rationed at four pints a day for washing and cooking, and one pint for drinking.

In course of time these naval nursing sisters found that the scanty clothing which they were wearing at the time of internment was starting to wear out, and there was no means of obtaining new clothing. Footwear was the greatest problem, and part of the time they were forced to go barefoot. The problem was partially solved later by making clogs and rope-soled sandals.

In addition to general hardships and discomfort, in 1945 these internees had to face the hazards of Allied air activity over the district. No cover or shelters were provided by the Japanese, and it was not until a number of bombs fell inside the camp killing 14 internees and injuring others, that International White Cross signs were exhibited. In July 1945 ten bombs, which appeared to be practice bombs, fell inside the camp and inflicted casualties and damage.

By this time the nursing unit had organised itself into first aid, fire and demolition parties to deal with renewed hostilities which it was considered would attend Allied attempts to re-occupy the Colony.

On August 30, 1945, Hong Kong was re-occupied by the Royal Navy, and on the following day the naval nursing sisters were taken on board the Hospital Ship *Oxfordshire*.

During the whole of this long period of ordeal they contrived to lead a comparatively normal life within the Camp community, and kept themselves constantly occupied with a variety of mental and physical distractions. At no time did they fail to cope with the many unusual situations which they had to face, and by their fearlessness, adaptability and resource they fully lived up to the traditions of their Service and their profession.*

* A full account of the conditions in Hong Kong during the Japanese occupation will be found in Chapter 3, Part I, The Colonies, of Volume II of The Civilian Health and Medical Services.

STANDARDS OF NURSING

Shortly after the end of the war, reports were invited from matrons-in-chief, principal matrons and matrons who had served during the war years, the object being to gain an over-all assessment of the standard of nursing in the Royal Navy. In some cases opinions varied, depending largely on the type of nursing requirements in the districts from which these reports were made.

In general, sisters who joined Queen Alexandra's Royal Naval Nursing Service on the outbreak of war, though of all ages and of varying experience, were thoroughly trained in the elements of practical nursing. To their pre-war training could be added their enthusiasm and their willingness to acquire a knowledge of Service routine and to accept in good spirit the difficult conditions then prevailing. Therefore the standard of nursing during the first part of the war was well up to that of the pre-war years. This high standard was largely maintained, albeit with difficulty.

Towards the end of the war, the general impression gained was that newly-entered sisters lacked the incentive and initiative of their predecessors, and required more supervision with regard to nursing details. These defects were almost certainly due to their training under war-time conditions in civil life, and to a system which permitted a nurse to qualify at an earlier age from a series of scattered hospitals, without the firm background of tradition supplied by the peace-time training hospital. The system was really to blame, as an inexperienced nurse found herself a sister before her time, and frequently not yet ready to accept the full dignity and responsibility of her new status.

Nevertheless any decline was merely transient, and soon rectified by the continuity of training which was carried out by the serving nucleus of the regular and more senior reserve sisters.

The result was that, on the whole, the standard of nursing was maintained at a high level, as is evidenced by the recovery rate of casualties set down in naval records.

UNIFORMS

It is considered that this History would not be complete without a record of the styles of uniform which were worn by naval nursing sisters during the war, particularly as in peace-time their uniform offered less variety than the uniforms of the other nursing services.

The uniform now worn by Queen Alexandra's Royal Naval Nursing Service has been built up from the design approved by Her Majesty Queen Alexandra when she became President of the Nursing Service in 1902. Any marked changes since made have been in outdoor uniform only. The greatcoat was introduced in 1915, and the tricorne hat in 1937. Early in the war the naval nursing sister found herself at a disadvantage compared not only with her colleagues in the other Services,

but also with V.A.Ds. Her sole outdoor uniform was the greatcoat. In 1942 the deficiency was remedied by the introduction of the uniform coat and skirt. In addition mess dresses, though not generally worn, were permitted to be made from serge instead of silk, thus providing an extra comfortable garment for wear off duty.

As regards tropical uniform during the war, white piqué dresses and capes for off-duty or ceremonial occasions were largely replaced by white overalls, being cooler and more easily laundered. The original tropical panama hat was also replaced by a white felt hat, owing to the shortage of straw.

The only distinction between regular and reserve sisters was that the badges of the latter were worked in silver thread instead of gold, and bore the word 'Reserve' on the lower end.

Naturally, the official uniforms frequently proved unsuitable for the variety of duties which this versatile Service was called upon to perform, and in course of time a number of unofficial uniforms, none the less practical, began to appear. For example, sisters appointed to aircraft carriers for transport duties found that the normal uniform was quite impracticable for life in a man-of-war. They were therefore issued with navy blue slacks and shirts, and a khaki replica in the Tropics, badges of rank being worn on the shoulders. By dispensing with caps, collars and aprons this uniform proved far more comfortable and convenient for the particular conditions, as well as effecting economy in laundry. Ordinary uniform was worn in the evenings, when off duty, and on Sundays.

Sisters working with the Air Evacuation Unit in the Pacific were supplied with the same uniform as that worn by the Australian Air Force Nursing Service, which consisted of green poplin slacks and shirt, boots, and forage cap or 'digger' hat. Their badges were worn on the shoulders and cap, and included a wing and the letters R.N.A.E.U. struck in brass. This was quite unofficial, but greatly treasured, and the uniform as a whole proved most suitable for the type of work involved, and also complied with anti-malarial precautions.

WASTAGE

Though 1,341 nursing sisters served in the Royal Navy during the war, the wastage rate was always fairly high. Invaliding was relatively low, consistent with the small incidence of sickness, and it is gratifying to record that marriage provided the greatest cause of wastage. During the war 327 nursing sisters married and retired, which, it is submitted, is a tribute to the charm of the Service as a whole.

Even more gratifying is the fact that the deaths due to enemy action numbered only two, a surprisingly low figure among nursing members of a fighting service in time of war. It borders on the uncanny that these two deaths were indirectly connected, the victims being members

of the W.R.N.S. Sick Quarters, Gibraltar. One sister was travelling to Gibraltar in a troopship which was torpedoed, with the loss of all on board. The sister whose place she was taking in Gibraltar left for the United Kingdom by air at about the same time, escorting a sick patient. On the journey the aircraft was shot down and she lost her life. Numerous other sisters took passage in many ships which were sunk, but all were eventually safely rescued.

In addition to these two deaths by enemy action, six naval nursing sisters died on active service.

HONOURS

Honours and Awards to members of Queen Alexandra's Royal Naval Nursing Service during the Second World War were:

D.B.E.	*C.B.E.*	*O.B.E.*	*Bar to R.R.C.*
2	2	1	4

R.*R.C.*	*A.R.R.C.*	*Order of St. John of Jerusalem*
17	84	1

VOLUNTARY AID DETACHMENTS

No history of the nursing services of the Royal Navy in time of war would be complete without a reference to the valuable work performed by V.A.D. members of the British Red Cross Society and Order of St. John of Jerusalem.

These societies trained and provided V.A.D. members as nurses, cooks, clerks, and dispensers for naval hospitals on the outbreak of war. Many of these nurses had received regular training in naval hospitals in peace-time. In all, 5,281 were employed in the Royal Navy during the war.

The uniform was that authorised by either the Red Cross Society or the St. John organisation, but the distinguishing mark of a blue and red anchor flash for the left arm was worn by all those serving with the Royal Navy. Red braid rank badges denoted senior, head or supervising members.

In Royal Naval Hospitals, V.A.D. commandants were in charge if their numbers reached thirty, and if there were over 100, an assistant commandant was appointed in addition. It was the duty of the commandant to organise V.A.D. messes, to do the catering and generally supervise the welfare of the girls. Where the establishment was not large enough to carry a commandant, the matron or a senior V.A.D. was responsible.

In all places where W.R.N.S. were borne, a sister and V.A.Ds. were carried to staff the sick bay or a ward for women patients. V.A.D. nurses were accommodated in W.R.N.S. petty officers' messes.

The principal function of V.A.Ds. was to replace the sick berth staff who had been drafted to ships, but it was also necessary for them fully to staff the wards for sick Service women. Training was given and V.A.Ds. specialised in radiography, and as dental and laboratory assistants, the latter becoming of great use with the blood transfusion units.

Hundreds of V.A.Ds. were sent for duty overseas to Alexandria, Simonstown, Durban, Colombo, Australia, Malta and other places where naval establishments were opened. Great kindness was shown by the Dominion and Colonial families in entertaining them.

V.A.Ds. who joined at the beginning of the war and during hostilities were keen, interested, and eager to help in any way whatsoever, fitting into ward routine, getting their own quarters organised, adapting old buildings or old houses as sick quarters, etc. Their spirits were excellent and, as they received continual instruction from the sisters and became more experienced, their work greatly improved and could be relied upon. Nursing in the Navy encouraged many girls to take up nursing as a career, and in several cases, those who were V.A.Ds. at the beginning of the war left, took a general training, and re-entered as sisters. Others were allowed to take the intensive courses of nursing arranged by the Ministry of Health to enable them to train in a shortened period. In many cases, V.A.Ds. were enrolled as State Registered Assistant Nurses.

After hostilities ceased, V.A.Ds. were gradually released in Age and Service Groups unless they chose to remain for the Emergency. Those who remained continued to do invaluable work under difficult conditions in hospitals suffering a shortage of trained staff and disruptions due to the continual change of medical officers, sisters and sick berth staff during demobilisation.

CHAPTER 6

THE WOMEN'S ROYAL NAVAL SERVICE*

RECRUITMENT AND MEDICAL SUPERVISION

THE Women's Royal Naval Service was brought into being in April 1939, when the prospect of war became imminent; until a state of emergency was declared the Service was, with the exception of small staffs at the Admiralty and the Home Ports, purely voluntary. Before enrolment, members were required to undergo a form of medical examination by their own doctors and at their own expense.

On September 12, 1939, a woman medical officer was appointed as a Civilian Admiralty Surgeon and Agent, to undertake the medical examination of W.R.N.S. candidates at W.R.N.S. Headquarters. Candidates applying in the Home Ports or at Naval Establishments were examined by a naval medical officer locally.

In due course, the Director of W.R.N.S. considered that a woman medical officer should be attached to her staff, and on November 28, 1939, the original woman surgeon and agent was appointed as Medical Superintendent of the W.R.N.S. This appointment continued until June 13, 1940, when it was replaced by an appointment to the Staff of the Medical Director-General of the Navy, and granted to the holder the rank of surgeon lieutenant R.N.V.R. This event is of some historical interest as representing the first appointment of a woman doctor to the Senior Service. (See Plate IV.)

The first document devised for recording the medical examination of recruits was inadequate, having been drawn up before the outbreak of war, when there was no conception of the variety of duties which W.R.N.S. would be called upon to undertake as the war progressed. In retrospect, it is obvious that this document bore a suggestion of that natural reticence with which the Royal Navy, at that time, approached the medical problems relating to the Women's Service. The document was later amplified to include more detailed medical information.

The preliminary arrangements worked satisfactorily and continued until early in 1942. Responsibility for the examination of all recruits was then transferred to the Ministry of Labour, whose medical documents were subsequently used.

Candidates recruited in Northern Ireland and the Isle of Man were examined by specially selected general practitioners, in accordance with the instructions laid down for the guidance of medical practitioners

* Compiled from the records of the late Dr. Genevieve Rewcastle, O.B.E.

[*London News Agency Photos Ltd.*

PLATE IV. The late Surgeon Lieutenant Commander Genevieve Rewcastle, O.B.E., R.N.V.R.

[*Facing page* 74

under the National Service Acts. British women entered in the United States were examined by a naval medical officer with the approval of the Ministry of Labour.

Medically speaking, the W.R.N.S. was a carefully selected Service. It was considered that the best insurance against subsequent sickness was to accept only those candidates who were medically fit in all respects, and adherence to this policy was made possible by the fact that the supply always greatly exceeded the demand. In the early days of the war the burden of medical examinations largely fell on the shoulders of busy medical practitioners acting as Admiralty surgeons and agents. The whole position in regard to the employment of W.R.N.S. was then so fluid that it was impossible to devise any form of medical examination to be applied to individual types of employment. The result was that though recruits were being entered as cooks, stewards, writers, messengers, telephone operators, transport drivers and telegraphists, the general practitioner could only base his decision of medical fitness on a routine examination coupled with the applicant's own statement regarding her previous health. Many applicants had no scruples in withholding information about previous illnesses, and though this reticence was inspired by patriotism, many young women with apparently blameless health records were found to be unfit for service within a few months of joining. These inaccuracies were later eliminated by the requirement that all reports of medical examinations should be scrutinised by an experienced naval medical officer, who might be relied upon to exercise his discretion in the light of his knowledge of Service requirements. This system provided a useful insurance against the employment of women in categories for which they were medically unsuitable, and it also made possible the follow-up of remediable defects noted on enrolment.

Until 1941 an applicant officially below visual standard was obliged to purchase spectacles at her own expense if she still wished to enter the W.R.N.S. After 1941 spectacles were supplied to recruits on enrolment at public expense.

Likewise, until 1943, candidates with dental defects were not accepted until treatment had been obtained at their own expense. After this date dental defects noted on enrolment were remedied at public expense.

Nevertheless, the popularity of the W.R.N.S. was such that candidates notified of such defects almost always hastened to have them remedied in order to obtain entry. This was all the more remarkable, as similar defects would not have prevented an applicant from entering one of the other Women's Services.

In January 1940 the first new entry depot for the W.R.N.S. was opened in King's College, Campden Hill, London, and from that date an organised system of medical examination on entry, and final decision as to acceptance or rejection was made possible. At that time a probationary

period of 14 days was instituted, and made it possible to discharge border-line cases as unfit for enrolment after a period of trial. But it was soon found unwise to resort too readily to this practice, because of the far-reaching psychological implications to the girls concerned. Joining the Navy was an achievement marked with considerable ceremony, and subsequent rejection on medical grounds after a probationary period meant some damage to self-respect, and was not the best recommendation for re-employment in civil life.

In order to co-ordinate the policy of the three Services when the National Service Act became applicable to women in February 1942, it was decided to transfer to the medical boards set up by the Ministry of Labour responsibility for the medical examination of all applicants for the W.R.N.S. Since volunteers were still numerous, it was still possible to exercise rigid selection, and to accept only those applicants who were medically Grade I. It was not the duty of the Ministry of Labour actually to categorise applicants, and final correcting was carried out by the Naval Medical Authorities.

Early in 1943 when the demands upon woman-power throughout the country were very great, it was no longer found possible to accept only those candidates for the W.R.N.S. who had volunteered for that Service, and since the conscript did not enjoy the privileges of the volunteer, who was at liberty to leave the Service at any time during the probationary period, a further revision of the medical organisation became necessary.

The scrutiny of medical examination records before call-up was abolished and it was decided to make applicable to women the machinery devised for the disposal of male 'H.O.' ratings found medically unfit on entry. An Admiralty Fleet Order (1437/43) was accordingly issued, which laid down that:

1. Women who have been found medically fit for service in the W.R.N.S. by Ministry of Labour Civilian Medical Boards are never to be rejected as unfit without the approval of the Admiralty.
2. Those found to be medically unfit at the first medical examination after arrival at the entry establishment are to be discharged immediately the Admiralty decision has been received; they are to be paid up to the date of discharge, and no extension of pay is to be allowed.
3. Those who develop disabilities after arrival, or whose disabilities are not discovered until after one week or more of service, are to be brought forward for survey and disposed of in the usual way.

Since this order militated against the early disposal of tuberculous cases it was shortly afterwards superseded by A.F.O. 3921/43, which was identical in terms with the previous order except that paragraph 1 was amended and that two new paragraphs were added, as follows:

1. Women who have been found medically fit for service in the W.R.N.S. by Ministry of Labour Civilian Medical Boards are never to be rejected as unfit without the approval of the Admiralty unless they are

found to be suffering from tuberculosis, in which case they may be discharged as "medically unfit for service" on the authority of the Commanding Officer of the Establishment at which they report themselves for entry.

4. The discharge of women suffering from tuberculosis should be notified by the Naval Medical Authorities to the Medical Officers of Health of the districts from which the women come.
5. The medical history sheets of all women discharged under this Order are to be forwarded to the Medical Director-General of the Navy when the discharge has been recorded thereon.

From this date, August 26, 1943, therefore, the problems of medical examination as to fitness for entry, medical examination on entry, and disposal of candidates found unfit on entry were adequately covered.

FURTHER MEDICAL EXAMINATIONS AND TREATMENT

Medical examination for promotion to officer rank, medical examination for foreign service, medical examination before discharge or temporary release and eventually before dispersal and final release were instituted as a normal part of administrative routine.

In December 1943, when King's Regulations and Admiralty Instructions, Article 1393 became applicable to the W.R.N.S. (A.F.O. 6215/43) bi-annual medical examination of W.R.N.S. was instituted. This proved a very valuable check not only on tuberculosis, but on other forms of disease. The facilities provided for mass miniature fluorography greatly enhanced the value of these examinations.

The first Regulations to cover sickness on service in the W.R.N.S. ruled that a W.R.N.S. rating absent from duty on account of sickness should receive pay only for a maximum period of twenty-eight days unless the sickness was considered to be attributable to her service. If attributable, pay was allowed up to a maximum of six months. Officers were allowed two months' full pay for non-attributable sickness, and six months' pay where attributability was proved. In retrospect it might be argued that such cases should have been treated by the Naval Medical Authorities until recovery, and retained in the Service. But it must be remembered that in these early days, facilities for the medical care of women did not exist in the Royal Navy.

The first Admiralty Fleet Order (4144/39) defining arrangements for medical and hospital treatment of the W.R.N.S. was published on September 28, 1939, and while it laid down that sick bays should be instituted in W.R.N.S. hostels, and that they should be suitably staffed for the treatment of cases not sufficiently serious to warrant removal to hospital, the medical supervision of these cases was by no means easy.

In the ports a naval medical officer was available, but in many other areas reliance had to be placed on the services of the Admiralty surgeons and agents who could spare little time from their general practices.

In this Order it was also stated that should the sickness or disability be such as could not effectively be thus treated and it became necessary to send the W.R.N.S. rating to her home or lodgings, instructions for attendance on her should be given to the nearest surgeon and agent or civilian medical practitioner under contract.

In regard to hospital treatment, it was stated that unless facilities could be provided within the existing resources of the R.N. hospital or sick quarters adjacent to the place of employment, a member of the W.R.N.S. in need of hospital treatment should be sent to the nearest civil hospital, arrangements for her admission being made through the local naval medical service if possible.

The number of sick quarters for W.R.N.S. was exceedingly small and beds were rarely, if ever, available for W.R.N.S. in naval sick quarters. Naval hospitals, moreover, primarily designed for the care of male patients, found themselves unable to accept female personnel until certain structural alterations had been carried out and certain hitherto unnecessary equipment had been provided. Finally, the eligibility of W.R.N.S. personnel for treatment in civilian hospitals included in the Emergency Hospital Scheme had not, as yet, been clearly defined.

The accounting arrangements associated with the medical treatment of members of the W.R.N.S. were similar to those followed for naval personnel generally, inasmuch as surgeons and agents were expected to include the charges for treatment of W.R.N.S. patients in their quarterly claims rendered to the Admiralty, supported by the usual documents. Claims by civil medical practitioners were, equally, dealt with as laid down for naval personnel, the proper forms being rendered and completed.

Accounting arrangements in regard to the accommodation of W.R.N.S. personnel in civil hospitals required claims to be transmitted by the appropriate naval establishments to the Admiralty for settlement, accompanied by a statement giving the following details:

Nature of disability.
Identity of the officer or rating.
Confirmation of the period covered by the claim.
A reference to any report sent to Admiralty in confirmation of the instructions in para. 5 Admiralty Fleet Order 3597/39, i.e. in reference to the question of attributability or otherwise in the cases of sickness likely to extend beyond the periods during which full pay was allowed.

Furthermore, officers and ratings of the W.R.N.S. who received treatment in hospital at the expense of the Crown were, during the period of such treatment, made subject to the deduction prescribed for accommodation, food, etc. of £75 a year and 20s. a week respectively.

Admiralty Fleet Order 4144/39 laid especial stress on the fact that no liability would be accepted by the Admiralty for any expenses incurred by a member of the W.R.N.S. who declined to accept or failed to comply with the procedure outlined in this order.

On June 27, 1940, it was notified for general information and guidance in Admiralty Fleet Order 2360/40 that Officers and Ratings of the W.R.N.S. equally with naval personnel and members of the V.A.D. were normally eligible for free maintenance and treatment in E.M.S. hospitals at the public expense.

The publication of this Order put an end to the confusion which had existed in many places and in many minds in regard to hospitalisation of W.R.N.S. and from this date forward accounting was greatly simplified, as cost of maintenance and treatment was borne in the first instance by the Ministry of Health.

It was not until January 1941 that a comprehensive Admiralty Fleet Order (120/41) was issued, which re-affirmed the responsibility of the Medical Director-General of the Navy for the medical arrangements for W.R.N.S. personnel. This Order emphasised the necessity for the appointment in each establishment of a special medical officer to the care of W.R.N.S. and of the institution of sick bays in W.R.N.S. quarters under the charge of a nursing sister. Any hostel accommodating 50 or more W.R.N.S. was considered large enough to require the services of a nursing sister, and one or two V.A.D. nursing members in accordance with the size of the sick bay and the number of W.R.N.S. in the immediate locality. This Order also emphasised the necessity for discussion with the local Senior Naval Medical Officer, and if necessary with the Medical Officer of Health of the Command, in regard to plans for new accommodation. This Admiralty Fleet Order might be summarised by saying that the medical arrangements for the W.R.N.S. followed the same pattern as that laid down for the Royal Navy inasmuch as sick quarters and sick bays were instituted in the areas where W.R.N.S. were serving and the Naval Health Officer in each Port Division supervised accommodation and all matters affecting the health of the Service. Moreover, medical officers appointed to the care of the W.R.N.S. were mainly drawn from the R.N.V.R. because of their previous experience in general practice and in the treatment of women.

Remembering the care that was taken to admit only fit women to the Service, it is not surprising that the incidence of gynaecological diseases was exceedingly small. For all that, it was early and wisely decided by the Medical Director-General that the appointment of civilian consultants in gynaecology was desirable and the names of three were published in this same Admiralty Fleet Order, one for the South of England, one for the North of England, and one for Scotland. It was laid down that application for the services of one of these consultants should be made by medical officers to the Medical Director-General in grave and obscure cases.

The steady increase in the size of the Service in the various Commands soon rendered desirable further appointments, and as the war progressed consultants in gynaecology were appointed in London, Plymouth,

Bristol, Edinburgh and East Scotland, Glasgow and West Scotland, and Northern Ireland. It was represented to the Medical Director-General, and he accepted the suggestion, that a woman consultant in gynaecology should also be appointed in order that the W.R.N.S. should have their choice of a man or woman doctor.

The naval medical authorities held the view that W.R.N.S. personnel should be eligible for sick leave under the conditions and subject to the limitations prescribed for naval personnel, and pressed constantly for this reform.

In 1941 Board approval was obtained for the proposal, and on August 21 of that year, an appropriate A.F.O.(3594/41) was introduced. Medical arrangements now worked smoothly and medical officers were no longer in doubt as to how to deal with sick W.R.N.S. Unfortunately, a single omission frequently resulted in immobile W.R.N.S. sick on shore being returned to units when fit to travel, and, owing to the absence of sick accommodation for immobiles, having to be returned to their homes for convalescence.

A further A.F.O. laid down that immobile W.R.N.S. sick on shore should not be returned to units until fit for duty, and emphasised the necessity for supervision of such cases while sick on shore and for the rendering of periodic medical certificates.

In November 1940 inquiries of the Ministry of Health revealed that the War Office had opened a convalescent depot for the A.T.S. at Cornwall House, Kingham, Oxfordshire. The possibility of having members of the W.R.N.S. admitted to this depot was explored but without success. In May 1941 it was suggested that some of the rooms in Altachorvie House, Lamlash, then a W.R.N.S. quarters, should be allocated as convalescent accommodation. The value of this accommodation was extremely limited, owing to the remoteness of the place and the difficulties of transport particularly in the winter. It was, however, used and greatly appreciated by W.R.N.S. discharged from hospitals or sick quarters in Scotland and continued to be so used until September 1942, when with the great increase in the complement of W.R.N.S. serving in Lamlash it was regretfully decided that no accommodation could in future be available for convalescing W.R.N.S. ratings from other establishments as formerly.

In June 1941 the British Red Cross Society and St. John War Organisation arranged that officers and ratings of the W.R.N.S. requiring convalescence might be admitted to Lowesby Hall Convalescent Home, Leicestershire. The admission of officers to this hospital was a temporary arrangement, however, and the need for officer accommodation became so acute that arrangements were made in December 1941 whereby sick W.R.N.S. officers of the Chatham Area could be sent, when convalescing, to the Frederick Andrew Convalescent Home, West Malling, Kent.

B.R.C.S. Convalescent Hospitals had, by 1942, begun to spring up all over the country, and although occasionally slight embarrassment was caused by the fact that various convalescent homes designed for the reception of women patients were suddenly required instead to accept men patients and *vice versa*, great kindness and co-operation was received from the British Red Cross Society and St. John War Organisation, and many members of the W.R.N.S. enjoyed profitable periods in their convalescent homes. A valuable feature of many of these homes was that A.T.S. Physical Training Instructresses were attached to them and W.R.N.S. had the advantage of P.T. and remedial exercises during convalescence.

All these B.R.C.S. Convalescent Hospitals formed part of the Emergency Medical Services scheme and the cost of accommodation and treatment for Service personnel was met from public funds. Towards the end of 1944 Osborne House, King Edward VII Convalescent Home for Officers was made available for those officers of the Women's Services requiring convalescence.

Medical history sheets for W.R.N.S. ratings were not considered necessary until April 1941, and then only for mobile ratings. In July 1941, however, medical history sheets became compulsory for all ratings of the W.R.N.S.

As regards medical and hospital treatment, arrangements were now generally satisfactory, but the machinery devised for the survey of W.R.N.S. medically unfit for further service demanded revision.

INVALIDING

The first A.F.O. (576/40) which defined the procedure for the discharge of officers and ratings of the W.R.N.S. laid down that if an officer or a rating was considered by the medical officer to be medically unfit for further service, the officer or rating in question was to be surveyed by a naval medical board who would decide whether she was a fit case for invaliding and whether her disability was due to service or not. In cases of invaliding, pay would be extended for a period of fourteen days after the date on which the member was reported medically unfit for further service in the W.R.N.S. The cause of discharge in such cases was to be rendered as appropriate, e.g.

medically unfit for further service or
medically unfit for further service in her calling.

This order was issued on February 22, 1940, and was in accord with the general policy at that time.

A new order (A.F.O.3461/40) was issued on September 12, 1940, in which it was laid down that personnel of the W.R.N.S. medically unfit for further service were to be brought forward for survey with a view to invaliding at the R.N. Hospitals, R.N. Auxiliary Hospitals and

R.N. sick quarters, the same forms and procedure to be used as in the case of naval ratings.

These arrangements worked well, but with the steady increase in the size of the Navy and of the W.R.N.S., naval hospitals and sick quarters found themselves unable to cope with the number of cases referred to them for survey. After careful consideration of all the factors involved and in order to avoid delay in disposal of such cases, the Medical Director-General recommended that in addition to existing arrangements medical surveys as to fitness for further service might be undertaken by two medical officers in the nearest W.R.N.S. sick quarters or at the naval establishment in which the individual was serving. This recommendation was approved and was embodied in a new A.F.O. 2140/41 which appeared on May 22, 1941.

In order to ensure strict adherence to naval regulations and to ensure careful assessment of the degree of disability and, where applicable, the fact of attributability or aggravation, it was emphasised that the appropriate naval forms should at all times be used, and that in the event of surveys being undertaken at any establishment not normally accustomed to undertake them, the forms should be rendered in triplicate to the Medical Department, Admiralty, together with the certificate of service, medical history sheet and hurt certificate (if any) for onward despatch and promulgation of the fact of invaliding.

From the date of publication of that Order, medical arrangements for survey with a view to invaliding underwent no essential change until January 1945, when it was laid down (A.F.O. 33/45) that invaliding procedure for W.R.N.S. was in future to be carried out as for male personnel through the establishments authorised to survey as to fitness for further service, and in accordance with current instructions regarding invaliding procedure.

RECRUITMENT OF WOMEN MEDICAL OFFICERS

It was not until the Autumn of 1942 that a decision was reached to enter a number of women medical officers in addition to the one already employed. Up to this time it would have been difficult to find whole-time employment for women medical officers with the W.R.N.S.

The policy now was that where the number in any establishment justified such an appointment a woman doctor should be employed for duty with the W.R.N.S.

The Medical Superintendent of the W.R.N.S. advised, and the Medical Director-General agreed that newly entered women medical officers should take their initial training in Royal Naval Barracks in accordance with the usual procedure for medical officers. The fullest co-operation was received from both the Executive Authorities and the Principal Medical Officer in the Barracks in Chatham, Portsmouth and Plymouth and by the W.R.N.S. Authorities who provided

accommodation for the women medical officers in W.R.N.S. officers' quarters.

Twenty-five women medical officers were entered in all, and they were given as wide and varied experience as the Service offered. Changes of appointment at reasonable intervals were arranged to permit of varied experience, and apart from the work done in naval hospitals, on air stations and in other naval establishments at home, four women medical officers had the opportunity to serve oversea—two in Ceylon, one in India and one in the Near East.

HEALTH OF THE W.R.N.S.

Approximately 100,000 women served in the W.R.N.S. during the war, the peak figure serving at any one time being 70,000. It was appreciated at the outset that women could not be expected to adapt themselves easily to the routine life of a Service essentially male by tradition. It was, in fact, well realised that fundamental psychological differences between the adaptability of the sexes must be catered for if serious repercussions on health and efficiency were to be avoided.

These factors were always borne in mind when selecting members of the W.R.N.S. for specialised forms of work. For example, a knowledge of languages or a degree in mathematics was not in itself sufficient to ensure that a woman would be able to carry out duties of a monotonous and sometimes apparently meaningless nature, unless she had the physical and mental capacity essential for such an occupation. Again, the necessity for secrecy in certain confidential categories was apt to give rise to anxiety symptoms in intelligent but highly strung young women. The watch system, designed primarily for ships at sea, but traditional in the Navy, needed considerable modification in the case of women employed on shore.

But before any comment can be made on the incidence and type of sickness in the Service, it has to be remembered that the W.R.N.S. was primarily a body of healthy women, comfortably and hygienically accommodated, well-fed and clothed, and provided with all the amenities which careful thought and good management could devise. The W.R.N.S. was never faced with the problem of hardening up or making fit poorer types, and the whole effort was directed towards the prevention of disease in a sound community.

It is not surprising therefore that the general standard of health remained at a uniformly high level, making due allowance for the seasonal incidence of the commoner infectious diseases and minor ailments, both at home and abroad. A careful perusal of medical officers' Reports and Quarterly Journals provides evidence of this fact.

In 1941–2 the Medical Officer-in-Charge, W.R.N.S., in an establishment on the South Coast, observed that the incidence of sickness among cooks, notably bronchitis, was relatively much higher than among

other categories. This he attributed to the fact that working hours began at 6.30 a.m. on alternate days, and also the sudden changes of temperature from the hot galley to the cold air outside, coupled with a journey of eight miles by ordinary Service transport in the winter months.

He plotted a graph showing that the sickness rate among cooks dropped steadily as the weather improved, and that the percentage in the succeeding winter months was considerably lower than it had been in the corresponding period of the previous year. This improvement he attributed in large measure to the fact that the journey to and from the quarters to the camp had been rendered unnecessary by the provision of accommodation within the camp for the W.R.N.S. in question, but a very considerable factor in the improvement of health was that the girls had by now settled down to the routine of Service life.

In the same graph he showed the sickness curve among two other categories—writers and messengers—and his observations are of interest in so far as both these categories worked ordinary office hours; the one indoor and sedentary, the other out-door and active. The writers ran a curve of sickness such as one might expect of the office worker—low in the summer months and slightly higher in the winter months, with perhaps the common cold in October causing an epidemic in a large office. The messengers, on the other hand, who spent their working hours cycling from one department to another in a widespread Establishment, and were therefore continually exposed to the weather, showed the lowest percentage of sickness in the summer months and by far the highest in the winter months. That was an interesting observation and does not conform to the popular conception that out-door occupation is the healthier. He found that the sickness rates among all indoor categories ran almost parallel with those of writers, and as these indoor categories included stewards, many of whom were immobile, above the average age, and in most cases endeavouring to run a household at the same time, he drew the interesting conclusion that there was no appreciable difference in the amount of sickness between mobile and immobile W.R.N.S. This is not borne out by other observers who found, particularly as the war progressed, that the additional strain of domestic duties and family responsibilities produced in many cases, physical and mental exhaustion. It is difficult to say whether these divergent observations prove very much either way, remembering the importance of the personal equation in matters feminine.

In 1944, the medical officer at a bleak northerly air station in the United Kingdom remarked more fully on the high incidence of sickness among cooks, and produced a table to show the relative sickness rates in different categories. It can be observed from this table that the sick

list rate for cooks was approximately five times that for writers and six times that for mechanics. The minor illness rate was 17 times greater than that for writers and four times that for mechanics. Minor injury rates for cooks and mechanics were approximately equal.

Remarking on the causes of this wide variation in the sick list rates, he gave it as his opinion that the hours worked by the cooks were primarily responsible for their higher rate—the three-watch system allowing insufficient time for rest and relaxation. His recommendations that the complement of cooks should be increased and that a four-watch system should be instituted were unfortunately impracticable at that time, the shortage of cooks being so great and the practice of night flying on the Station necessitating 24-hour service in the galley.

A medical officer in the Middle East, reporting in 1945 on the incidence of sickness and the causes thereof, while laying emphasis on the fact that accommodation was sumptuous rather than merely adequate, that working conditions were excellent, and that every preventive measure was strictly enforced, remarked that infectious diseases accounted for the greatest amount of time lost.

The incidence of gynaecological disease was very low, though not remarkably so in view of the high standard of fitness. The total number of cases referred to gynaecological consultants was 719, but it would be incorrect to assume that all of these cases were of major disease requiring special investigation and treatment. Indeed, if a criticism has to be made, it must be that consultants were used more frequently than the gravity of the symptoms merited, but in recognition of the physiological and psychological implications of even minor gynaecological disease, it was considered proper that early specialist advice should be sought where doubt existed as to the causation of symptoms or the eventual prognosis.

The majority of menstrual irregularities, in accordance with established clinical observation, resolved themselves without treatment in a few months, while persistent cases were treated and followed up to a successful conclusion. The percentages of known cases of menstrual irregularity would be scientifically valueless, for it cannot be doubted that many W.R.N.S., actively engaged in their normal Service duties, consulted and were treated by their family doctors.

Foot troubles were fairly common in the early years of war, particularly in the domestic categories, but the rigid exclusion of applicants with deformed and painful feet rendered this problem a comparatively small one. The provision of a well-fitting Service shoe did much to promote comfort and poise, but in certain other categories the change-over from an average high-heeled shoe to a Service shoe gave rise to considerable discomfort.

Medical officers constantly directed the attention of physical training officers to the harmful effects of too much squad drill in the case of

women, and played their part in promoting remedial work and the encouragement of dancing classes as a healthy and pleasant form of physical training. The care of the feet formed part of the routine lectures in hygiene given by medical officers in the New-entry Depots, and special attention was also directed to the importance of well-fitting stockings.

Vermin and venereal disease presented no problem in the W.R.N.S. The incidence was very small indeed, as was to be expected in a carefully selected Service, provided with every opportunity for normal social intercourse and every inducement to higher education and self-improvement.

The institution of mass miniature fluorography provided a means for early diagnosis of pulmonary tuberculosis and brought forward interesting data. Among other things, it revealed the fact that at all ages the prevalence of adult type pulmonary tuberculosis, judged radiologically, was lower than the corresponding level in males. Out of a total of 42,437 W.R.N.S., the number found on first fluorography to have radiological evidence of pulmonary tuberculosis was 346, giving a ratio of 8·2 per thousand examined. Out of a total repeat fluorography of 9,144 W.R.N.S., after an interval of approximately 18 months, 26 were found to have evidence of pulmonary tuberculosis, giving a ratio of 2·8 per thousand. The invaliding rate in the first group was 1·2 per thousand, and in the second group, 1·9 per thousand.

An analysis prepared in the Medical Department of invalidings due to disease revealed that the total invaliding rate for women fell sharply from 1941 to 1942, and that there was practically no difference between 1942 and 1943. The numbers borne, especially in 1941, were small, so that hardly any of the differences in the rates for individual disease groups are significant.

CHAPTER 7

NAVAL MEDICAL TRANSPORT

THE PRINCIPAL MEDICAL TRANSPORT OFFICER

On August 26, 1939, the appointment of a Principal Medical Transport Officer was instituted on the Staff of the Medical Director-General of the Navy. The magnitude of the duties for dealing with transportation of naval invalids and wounded expanded steadily as the war developed, with the increasing enemy air raids on ports, cities and industrial areas; the constant threat of invasion necessitating organisation of defence measures to counter such a possibility arising; and planning for the evacuation and hospitalisation of potential casualties. From 1942 onwards, as offensive action was steadily being planned and trained for, the P.M.T.O. took on the duties of Operational Medical Officer (A.D.G. Operations) at the Medical Department of the Admiralty. These entailed the supervision of the medical organisation for the treatment and evacuation of casualties in the successive assault operations planned by Combined Operational Headquarters.

The medical details, dealing with naval casualties afloat and ashore in the successive assault phases and operations for the combined landings and invasion of North Africa, Southern Italy, etc., up to Operation 'Overlord', which accomplished the invasion of Normandy, and finally the downfall of Germany, were co-ordinated by the P.M.T.O. The Medical Director-General was thus kept fully informed, so that his final decisions could be made as to the medical procedure to be adopted in each assault phase.

During 1945, after the successive surrenders of the enemy Fleets and Armies in Europe and Asia, the P.M.T.O. had to organise for the M.D.G. the transport and hospitalisation as necessary, of the repatriated naval prisoners-of-war. As this operation, however, was almost entirely conducted by the War Office and by the Prisoner-of-War Section of the Admiralty, the M.D.G. had comparatively little to do with the detailed organisation other than co-operate in the medical arrangements as they affected sick naval personnel.

Further duties which were added to the P.M.T.O.'s administration at the Medical Department of the Admiralty, other than medical transport, were to be the M.D.G.'s representative for co-ordinating the naval medical requirements into the Emergency Medical Service Scheme throughout the United Kingdom, Naval Liaison Medical Officer with the Medical Departments of the Allied Navies, Liaison Officer for M.D.G. with the British Red Cross and Order of St. John War

Organisation and their Scottish Branches, also with the Navy League (London and Glasgow), and all other societies and organisations dealing with the medical welfare and comfort of seafaring personnel generally.

The following pages deal with the Administration of the Medical Transport Unit in the Navy, as it was finally adopted after the additions and alterations which were found necessary from the trials and errors in the build up as practised during the early months of the war. The subject of the medical transport and evacuation of naval invalids and casualties was dealt with under three main headings, viz: ashore, afloat and by air.

ORGANISATION ASHORE

On the outbreak of war in 1939 Medical Transport Officers (M.T.Os.) were appointed to each of the more important ports and R.N. Hospitals, to work under the direction of P.M.T.O. On appointment, these officers reported at the Medical Department of the Admiralty, to be instructed by P.M.T.O. as to their particular duties. They were given the details of such transport organisation and regulations as had been detailed and were in practice up to the date of their appointments. They then took up their definite local duties on the staff of the officer commanding the base to which they were appointed. These duties naturally varied according to the importance and situation of the port or establishment concerned, but, in general, outlines were as follows:

1. To acquire from the Director of Stores, Admiralty, by requisition through the Medical Director-General, such ambulances as were considered necessary for road transport at their respective bases.
2. To arrange for the garaging, care and maintenance, and for the running repairs of such ambulances to be carried out at some local civilian garage, if service facilities were not obtainable at their base.
3. To take charge of and organise the routine of the drivers detailed for the ambulances.
4. To make personal contacts with all local transport authorities, i.e. the Military Embarkation Officer, the Base Sea Transport Officer, the medical staffs at the E.M.S. Hospitals in the neighbourhood, the Air Raid Precaution organisations, the railway officials at nearest terminus, the British Red Cross and Order of St. John Transport Officers, the St. Andrew's Ambulance Association, and generally to be in close touch with all transport facilities in the area, thus ensuring a smooth and ready co-operation at all times between road, rail, sea, and when possible, air transportation in the neighbourhood.

Sixteen M.T.Os. were found to be necessary for the above duties during the war, one at each of the following ports:

Aberdeen . .	On staff of the Flag Officer-in-charge (F.O.I.C.), Aberdeen
Avonmouth . .	The Medical Officer-in-charge, (M.O.I.C.) at R.N. Hospital, Durdham Down.

Belfast	On staff of F.O.I.C., Belfast.
Chatham	Appointed to R.N. Hospital, Chatham.
Glasgow	On staff of F.O.I.C., Glasgow.
Greenock	On staff of F.O.I.C., Greenock.
Grimsby	The M.O.I.C., at R.N. Sick Quarters, Grimsby.
Harwich	The M.O.I.C., at R.N. Sick Quarters, Harwich.
Liverpool	On staff of F.O.I.C., Liverpool.
Lowestoft	The M.O.I.C., R.N. Sick Quarters, Lowestoft.
Newhaven	The M.O.I.C., R.N. Sick Quarters, Newhaven.
Plymouth	Appointed to R.N. Hospital, Plymouth, and R.N. Barracks, Devonport.
Portsmouth	Appointed to R.N. Hospital, Haslar.
Rosyth	On staff of F.O.I.C., Rosyth.
Scapa Flow	On staff of Admiral Commanding, Orkneys and Shetlands at Lyness.
Southampton	On staff of F.O.I.C., Southampton.

The M.T.Os. in most cases were, at first, of surgeon captain's rank and they had sick berth chief petty officer pensioners to assist them and such additional staff as the activities of the more important ports rendered advisable. After two years or so, when the local medical transport administration had become established, it was found possible to reduce the personnel of the unit. The M.T.Os. were therefore absorbed into the general Base organisation doing sick quarters administration or definite duties in Port Medical Administration generally, thus relieving the ever increasing demand for medical officers which became so acute as time passed. The sick berth C.P.Os. and P.Os. in the smaller ports carried out the medical transport activities under the supervision of a medical officer at the base or establishment concerned. Thus by 1944 onwards, it was only found necessary to keep surgeon captain's rank for the M.T.Os. at five ports: Avonmouth, Belfast, Glasgow, Liverpool and Southampton, and these subsequently were dispensed with by 1946.

R.N. ambulances were supplied on requisition from the Medical Director-General by the Director of Stores, Admiralty, and were maintained, as far as was regionally practicable by the Naval Store Departments at the various ports and bases concerned; 945 Admiralty owned ambulances were brought into commission during the period September 1939 to August 1945. Of these, 615 saw service in the United Kingdom and 330 abroad. The reason for the relative smallness of the oversea figure was because in the Mediterranean and Normandy landings the Army catered for naval casualties on shore, and similar assistance was rendered in other theatres. Ambulances of one kind or another were generally available throughout the war from the Director of Stores, and in no outstanding instance can it be recorded that there was any serious failure to meet any demand for an ambulance where M.D.G. considered allocation justified.

The Types of Ambulances operated were as follows:

1. Morris 28 h.p. coach built ambulance. This was a specially designed ambulance developed in conjunction with M.D.G. and the makers, for Admiralty service.
2. 2 ton Austin K2 ambulance. This was the standard War Office type and it gave good general service, but it was not of a coach-built type. Production of the coach-built type ceased unfortunately early in the war and the Admiralty, being a relatively small user, was obliged to accept this type which was in general production, as man-power and material could not be diverted to specialised work. It was not as popular or as satisfactory as the Morris 28 h.p.
3. 2 ton Ford W.O.T. 16 × 4 ambulance. This was the R.A.F. type heavy 4 stretcher case vehicle very well fitted and equipped. It was too heavy and too big for general naval purposes. This type was used to some extent as a crash ambulance for R.N. air station purposes.
4. Morris 14 h.p. 4 case ambulance. This was a light field ambulance and proved useful as a standby alternative to the 2 ton Austin K2. It was, however, very much an emergency type of vehicle and, as such, had a limited local use.
5. Standard 12 cwt. 4 case ambulance. This was the R.A.F. equivalent of the Morris 14 h.p. and was employed to a limited extent in R.N. service when the Morris 14 h.p. vehicle was in short supply.
6. Converted Coaches. At the outbreak of hostilities 48 coaches, Green Line type, were converted into stretcher case ambulances for distribution amongst many U.K. ports and R.N. hospitals for dealing with mass movement of invalid naval personnel. They served a valuable purpose until the proper ambulance types were procurable.

In addition to the foregoing, three specialised types of medical transport vehicles were used in the R.N. Service:

1. Mobile Sick Bays: 14 of these vehicles were built on 3 ton Ford 4-wheel drive lorries to specifications agreed to between M.D.G. and Director of Stores. These provided for the use of the vehicles under tropical conditions. They were insect and mosquito proof and were fitted as portable dispensaries and consulting rooms.
2. Dental Trailers: These vehicles did valuable work by conveying a fully equipped dental unit to outlying and scattered units in the United Kingdom.
3. Insulated lorries for blood transfusion service.

All naval ambulances were attached to Establishment M/T Pools, wherever practicable, to ensure maximum use and the employment of minimum numbers of vehicles. Thus, for the main Admiralty Establishments dispersed in the London and Metropolitan area, the ambulance requirements were met from the central M/T Pools operated at Chiswick and the Admiralty, which ambulances also dealt with the movement of sick persons between London railway termini. Excellent arrangements were made throughout the whole of the United Kingdom,

and also abroad, regarding the pooling of ambulance resources between the Army, the Navy, the R.A.F. and civilian ambulance organisations. Special tribute is here recorded to the ever willing and widespread help to naval medical transport rendered by the British Red Cross Society and Order of St. John Ambulance services and that of the St. Andrew's Ambulance organisation. These organisations most generously met a large percentage of R.N. requirements in the United Kingdom particularly in dealing with the needs of remote and small R.N. and R.M. establishments and units, where the numbers of personnel involved did not justify the whole-time employment of a R.N. ambulance and driver. In this connexion valuable assistance was also rendered by municipal and local voluntary authorities.

Generally, R.N. ambulances in the United Kingdom were manned by civilian drivers or by W.R.N.S. ratings, except at Royal Marine establishments and certain R.N. air stations, where Royal Marine drivers were employed. In addition, where fleets of ambulances had to be maintained, e.g. at major ports, it would have been a waste of man-power to have had drivers standing by for twenty-four hours of the day, and the pooling system helped materially to avoid wastage in this respect. At certain establishments, however, local arrangements were made to draw drivers at short notice from local voluntary organisations and from municipal authorities or bus companies.

All Navy and Army vehicles for transport of stretchers by road or rail were, by 1943, able to take the Army pattern canvas stretcher, so that the casualty was able to be transported from sea to shore without necessitating removal from his original stretcher until arrival at hospital. But many of the civilian and voluntary ambulances in different parts of the United Kingdom would not take the Army pattern stretcher, which caused at times serious complications in the transport of patients.

During 1939–46 the transport by railway ambulance trains of naval casualties and invalids was conducted throughout the United Kingdom by a Central Movements Control for all Fighting Services and also civilian casualties. The only exceptions were the four railway coaches specially fitted to carry naval patients from Edinburgh to Aberdeen, which were stabled at Edinburgh, and the restaurant car coach converted into a railway ambulance coach to carry special naval patients by train, which was stationed at Bristol.

The medical officer in charge of the R.N. hospital or establishment requiring an ambulance train informed P.M.T.O. at the Medical Department of the Admiralty stating the number of patients to be transported, detailing categories of officers or ratings; cot or non-cot; surgical, medical, mental or infectious; any special requirements as to diet, nursing, etc., considered desirable, giving twenty-four hours' notice if possible. The P.M.T.O. informed the Railway Transport Officer at the Ministry of Health of the Admiralty requirements. Particulars of the

timetable arranged were then promulgated giving station siding and time of arrival of the ambulance train for entraining, the time the train was scheduled to depart on its journey, its destination and time of arrival at detraining station; the E.M.S. Hospital (or R.N. Hospital if necessary) detailed to receive the patients. The evacuating hospital was responsible for the road transport from the hospital to the ambulance train and for handing over nominal lists, baggage, bed tickets, etc., to the Medical Officer in-Charge of the ambulance train, who then became responsible for all details of the transportation until arrival at the point of detraining. The Medical Officer-in-Charge of the receiving hospital was responsible for reception of the patients on arrival at station of detraining, providing stretcher bearers and all road transport to his hospital.

As far as the Admiralty was concerned, during the war this railway ambulance transport of patients operated most satisfactorily, the only exception being that difficulties occurred at times, owing to the excessive baggage permitted to be carried by naval patients. The practice whereby naval invalids have to travel with their bags and hammocks, ditty boxes, private suitcases and other bulky impedimenta, was at times the cause of delay and dislocation of plans. Army and Air Force invalids travel with only the minimum of baggage, and the ambulance trains contained luggage vans suitable for such.

In 1944, during Operation 'Overlord' (combined invasion of Normandy, etc.), all Ambulance Trains, Civil Evacuation Trains, (C.E.T.) and Home Ambulance Trains (H.A.T.), were placed under the direct control of the War Office.

The R.N. Hospital at Haslar was held in readiness to admit the more serious casualties landing in the area, who required urgent treatment to save life and were not considered suitable to be transported directly to transit hospitals. Haslar admitted 1,102 such urgent cases from June 6 to July 31, 1944.

There were two instances where rail ambulance coaches were specially converted and used for naval medical transport and were not under the Central Movements Control of the Ministry of Health or War Office:

1. Between Edinburgh and Aberdeen a special railway ambulance transport was arranged during 1940 for the conveyance of naval patients from R.N. Hospital at Port Edgar to the R.N. Auxiliary Hospital, Kingseat, near Aberdeen. This consisted of two converted brake vans obtained from the London and North Eastern Railway. Each van was specially fitted to take 24 stretcher cases on suitable supporting racks. Also, two brake third vans were fitted to take six stretcher patients and provide seating accommodation for 24 non-cot cases. By this means, two units were available at Waverley Station, Edinburgh, each unit accommodating 30 lying and 24

sitting patients with their baggage. These vans were coupled on to the routine trains between Edinburgh and Aberdeen, thus the patients had a smooth railway journey of some five hours instead of a long and far from comfortable road ambulance journey of 120 miles or more, which had been the practice at the start of the war. These vans were heated and had facilities for serving hot fluids and light meals during the journey. The detraining arrangements at Aberdeen were most satisfactory, as the receiving road ambulances could drive on to the platform and draw up within a few yards of the coaches on their arrival at the railway station, the detraining being carried out under the protection of the station roof overhead.

2. Rail Ambulance Coach stabled at Bristol. During 1942, a 57-ft. composite railway restaurant car was specially converted into a railway ambulance coach for naval medical transport purposes. The conversion was most satisfactorily carried out. The original galley in the centre of the car was retained with certain alterations so that cooking could be maintained and suitable store cupboards, pantry racks, refrigeration, etc., provided for. The original third-class dining compartment was stripped and converted into a small ward for eight cot cases.

MEDICAL TRANSPORT AFLOAT

An account of hospital ships and carriers is given in Chapter 7.

In addition to hospital ships and carriers, medical transport afloat was effected by Convoy Rescue Ships, Landing Ship Tank, Landing Ship Infantry and Motor Fishing Vessels.

Although the rescue ships did not come in any way under the administration of the P.M.T.O. at the Admiralty, they performed such useful and gallant work during the war from 1941 onwards, by saving thousands of lives of ship-wrecked personnel on convoy service, that attention must be drawn to them in this History. These ships were a mixture of Royal and Merchant Navy both in personnel and in administrative control, and flew the blue ensign. They were in no sense 'Red Cross Ships', though their duties included that of hospital ships for the convoy they were attached to. They were vessels specially equipped for rescuing survivors from wrecked and blitzed ships in convoy. They accompanied convoys to Russia and Gibraltar, and from 1942 no convoy crossed the Atlantic in summer months without a rescue ship sailing in company. Their crews averaged about 70, being made up as follows: master, ship's officers and seamen crew, all of the Merchant Navy; one naval medical officer with two sick berth attendants; two R.N. signalmen, and a mixed gunnery crew of varying size, according to the armament carried, made up of Navy and Army gunners. They were 'hired' ships, mostly through the Clyde Shipping Company, of about

1,000 to 2,000 tons. Most of them were capable of making 10–13 knots and were coal burners having a range, without refuelling, of from 3,000 to 5,000 miles when specially bunkered. They had bed accommodation in tiers for 100–150 survivors and mattresses for as many more. They each had a well equipped sick bay and also carried complete sets of clothing for some 200 patients. The British Sailors' Society granted a sum of money for any special requirements, and many Naval Welfare Societies kept them well stocked with comforts and amenities. Twenty-one Rescue Ships were in service during the war at various times. Their administration was conducted by the Ministry of Sea Transport in conjunction with a special department at the Trade Division of the Admiralty, and they were under the direct control of the Commander-in-Chief, Western Approaches, who was assisted, for medical purposes, by the Senior Medical Transport Officer on the staff of Flag Officer-in-Charge, Glasgow.

The use of the Landing Ship Tank, specially fitted to carry casualties for limited distances, was adopted during the war for medical transport afloat and proved most valuable. In the assault phases—when only limited numbers of hospital carriers could be made available and as hospital ships could not be used before a port was captured, these L.S.Ts. were practically the only vessels used for evacuating casualties in the early stages. So far as the British assault area in Normandy was concerned, 70 L.S.Ts. out of the total employed in the operation, were specially fitted with stretcher racks on each side of the tank deck and a dressing station was arranged at the after end of the hold. The latter consisted of a small enclosure amidships aft, curtained off with a canvas screen, fitted with special lighting over an operating table, hot and cold water supplies, and a small basin and sink with suitable drainage sump. The tank deck of these ships was 176 ft. long by 30 ft. wide. Three-tier tubular steel stretcher racks were fitted along the port and starboard bulkheads secured by brackets and sockets, arranged in pairs 6 ft. 6 in. apart with a gangway 2 ft. wide between each pair. Also, an additional 80 single stretchers could be placed on the tank deck amidships and properly secured. Thus accommodation was available for 300 to 350 stretcher cases on the tank deck, whilst a further 160 walking cases could be carried on the troop decks on port and starboard sides of the main deck. Special medical staffs were embarked in each of these 70 medically fitted L.S.Ts., 40 being manned by R.N. medical personnel. These medical staffs consisted of:

Three medical officers, including a surgeon.

Sixteen sick berth ratings, including two operating room attendants.

Eleven seamen ratings and five Royal Marine other ranks to assist as medical orderlies.

Special landing hards were constructed for disembarking the casualties at Gosport, Stokes Bay, Southampton, etc.

Some 18,000 casualties were evacuated from Normandy to the United Kingdom by these Special L.S.Ts., until hospital ships could be satisfactorily employed.

Motor Fishing Vessels (M.F.Vs.) fitted to carry eight to ten cot cases and some twelve to twenty walking patients, were supplied through the Director of Small Vessels Pool at the Admiralty, whenever the Medical Director-General was satisfied such vessels were a necessary requirement. These M.F.Vs. performed invaluable duties for medical transport afloat as they were good sea-worthy craft capable of going alongside ships lying at anchor outside ports and harbours, and were employed for transporting invalids from one port to another by coastal routeing, as was found necessary in Iceland. They were of two sizes, 75 ft. and 61½ ft. Of the two, the 61½ ft. was found to be the more useful vessel, and in 1944 a new construction of this type of M.F.V. was finally decided upon for all future medically fitted drifters. Besides being supplied to Scapa, Greenock, and the larger ports in the United Kingdom, they were used extensively in most of the Mediterranean ports during the North African operations and assaults on Italy. A consignment was sent out to the Far East for ports in India and Ceylon and for South East Asia Command generally, and in December 1944 four were supplied to the Commander-in-Chief, British Pacific Fleet for Sydney, Brisbane and Freemantle. Some 50 medically fitted M.F.Vs. were in service during the war.

In 1944 certain Landing Ships Infantry were medically fitted so that as soon as the landing parties carried had been disembarked, the ship could function as an Emergency Hospital Carrier. None of these vessels was actually completed in time for operational use in the European theatre, but they performed valuable service off Burma in 1945.

MEDICAL TRANSPORT BY AIR

In April 1945 an R.N. Medical Air Evacuation Unit was instituted at Manus (Admiralty Islands) during the British Pacific Fleet Operations against Japan. This was found necessary, owing to the shortage of hospital ships, to obviate the long turn round required for a hospital ship to Australia and back to the Main Fleet Anchorage at Manus, and to allow medical cases to reach a more temperate climate as soon as possible. The unit consisted of a medical officer, R.N., a sick berth petty officer, six flying teams each composed of a R.N. nursing sister and a sick berth attendant, and sick quarters for the night staging of patients, with the necessary medical packs and equipment which were specially made up for use in aircraft. The flying staff all underwent intensive training before taking up their duties. Their training was based largely on experience gained by the Australian and American Air Services which had been successfully flying medical cases long distances in the Pacific for some time. This unit contracted to lift

20 patients a day on a two-day trip from Manus to Sydney, staying at Milne Bay, Townsville and Brisbane, making a total of 600 patients a month. Later, a second unit was trained and formed in order to extend the service to Eniwetok (Marshall Islands), but this, owing to the early cessation of hostilities, never came into effect. At the beginning of October 1945, the service was turned over to an R.A.F. Casualty Air Evacuation Unit. Owing to the low sickness rate in the Fleet, and to the small number of casualties, the unit was never fully extended, but it performed most valuable service and during its period of operation 556 patients were transported.

CHAPTER 8

ROYAL NAVAL HOSPITAL SHIPS

INTRODUCTION

In the period between the First and Second World Wars the Royal Navy had found it necessary to maintain in permanent commission only one hospital ship. This vessel, H.M.H.S. *Maine* (see Plate V) was placed more or less permanently under the direction of the Commander-in-Chief, Mediterranean Station. Her normal peace-time programme was to accompany the Mediterranean Fleet on its routine cruises, and between such cruises to perform the duties of base hospital ship for the Submarine and Destroyer Flotillas in Malta. On several occasions between the two wars the *Maine* had been detached for special duties when necessity arose. For example, in 1926 she was attached to the China Fleet for some months. In 1935, during the Italo-Abyssinian War, she was employed as base hospital ship in Alexandria for ten months. In September 1936 she was loaned to the War Office in connexion with the troubles in Palestine, and was based on Haifa. During most of 1937 and part of 1938 she was exclusively employed on the evacuation and repatriation of refugees between the opposing zones of the Spanish Civil War.

The *Maine* had been built in 1902 for the P. & O. S.N. Co. as a coal burning vessel of 8,599 tons gross, speed eight to ten knots, of limited endurance, and designed originally for the cattle trade to South America. During the First World War she was converted into a hospital ship under her original name, *Panama*. She was purchased by the Admiralty in 1921 to replace the original Hospital Ship *Maine*, which had become a total loss after running aground. During the late twenties and early thirties it had been increasingly obvious that the age of the *Maine* was such that periodic repairs were no longer able to keep abreast of her ever lengthening list of defects. In 1936 she was subjected to what was expected would be her last marine survey, and was granted final maximum duration of life of four years.

This state of affairs was well recognised by the Board of Admiralty, and in 1937 it was decided, for the first time in the Royal Navy, to build a vessel solely to be employed as a hospital ship. In 1938 the necessary expenditure was approved and a team of naval constructors and experienced naval medical officers was employed to draw up the necessary plans. These plans were elaborate, and the design contemplated aimed at perfection and the elimination of the defects and disadvantages known to have existed in all hospital ships throughout the world up to that time. In April 1939 the plans and specifications had been

completed and approved, and tenders for construction were invited from five selected shipbuilding firms. Unfortunately, by then the more important preparations for the Second World War were taking place, and necessary changes in policy resulted in the project being abandoned and the expenditure being diverted to a different purpose.

Therefore the situation which existed a few months before the outbreak of war was that the Royal Navy had in commission only one hospital ship, whose serviceability was known to be doubtful.

A number of ships was earmarked by the Ministry of War Transport early in 1939, to be requisitioned and converted for use as naval and military hospital ships on the outbreak of war. Those converted for naval use were the following:

Ship	Owner	Fuel	Gross tonnage	Speed	Date of building	Endurance in miles	Total no. of cots
Aba	Elder Dempster	Diesel	7,937	18	1919	5,000	450
Isle of Jersey	Southern Railway	Oil	2,143	18	1930	900	170
Vasna	B.I.S.N. Co.	Oil	4,820	13·5	1917	3,780	279
Amarapoora	P. Henderson & Co.	Coal	9,342	12	1920	5,420	503
Oxfordshire	Bibby Bros.	Oil	8,646	14	1912	4,320	505
Vita	B.I.S.N. Co.	Coal	4,691	13·5	1914	3,220	240
Tjitjalengka	Dutch	Oil	10,972	14	1939	15,800	504
Ophir	Dutch	Oil	4,115	14·5	1928	3,300	346
Gerusalemme	Italian	Oil	8,052	13·5	1920	6,000	388
Cap St. Jacques	French	Coal	8,009	11	1922	9,250	299
	In addition this Fleet was augmented by :						
**Empire Clyde*	City Line	Oil	7,515	14	1925	7,590	411

* ex *Leonardo da Vinci* captured from Italy and converted in 1943

The Second World War confirmed once more that to provide, staff, maintain and suitably distribute a fleet of hospital ships constitutes a major problem when planning ahead. Since the days when fifteen hospital ships were allegedly attached to the Spanish Armada the questions involved have constantly recurred in successive wars, and no matter how great the care and foresight have been, it would seem that post-war criticism has been inevitably adverse.

The basic requirements must always aim at an equitable compromise between adequate provision for the sick and economy in shipping, and a happy medium is never easy to attain. On the one hand experience shows that to allow for every possible, in addition to probable, medical contingency results in a policy of safety being transmuted into a policy of over-insurance which cannot always be accepted. As will be seen in this History, a hospital ship which foresight regards as essential may

in practice barely justify its existence. This fact is well realised by an experienced Ministry which is called upon to divert for purely hypothetical medical use some 80,000 tons of shipping already urgently needed for other purposes. The natural result is to proceed on lines which aim at cutting losses, and to provide as hospital ships vessels which have largely outlived their use for other purposes. The system has frequently been condemned, but on grounds which may appear unsound when all the factors involved are carefully considered. In fact, to provide a fleet of hospital ships to suit the requirements of the majority of critics would prove impossible on the grounds of economy and construction. Perhaps the best answer to the sceptic is that a major breach in the hospital ship services in time of war is almost unknown.

Nevertheless, the hospital ship situation during the war was a constant anxiety to the Medical Director-General of the Navy, for although naval and military hospital ships could be pooled to some extent, an essential difference between the requirements of the two Services was that, while the military hospital ship was mainly needed for carrier duties, the naval equivalent aimed at a floating general hospital capable of affording full medical and surgical facilities to a large Fleet, and at times to accompany the Fleet on its travels.

In 1944 and early 1945 a major crisis was narrowly survived in the provision of hospital ships for the various campaigns against Japan. During the period of planning it transpired that the original estimates of bed accommodation in converted hospital ships needed to be modified when such ships were to be utilised in tropical waters, and in undertaking the long voyages involved in the Far Eastern theatre. It was considered that the original accommodation of 500 had to be reduced to 300, which meant an eventual readjustment of the number of hospital ships required for the Far East, and seriously embarrassed the Ministry of War Transport. The shortage of shipping was such that the difficulty was never really overcome, and early in 1944 a somewhat doubtful compromise was reached between naval and military requirements, whereby the Navy accepted with reluctance a reduction by two out of the five additional hospital ships originally allocated for operations against Japan. The situation was aggravated by the proved unserviceability of several of the hospital ships remaining, and it was suggested that a breakdown in the hospital ship services to the British Pacific Fleet was only averted by the timely collapse of the Japanese. This suggestion, though made by knowledgeable observers at the time, is now only of academic interest. From the factual viewpoint it can only be recorded that such a breakdown did not occur; and experience suggests that, having regard to the Royal Navy's genius for medical improvisation, there would have been no failure of the hospital ship services even if the Japanese surrender had been delayed.

RECORDS OF THE NAVAL HOSPITAL SHIPS

H.M.H.S. Maine

Though necessary repairs were still overdue at the end of 1939, *Maine* was then on a complete war footing as regards medical stores, equipment and complement. She reached Malta at the beginning of 1940. She remained in the Mediterranean during 1940, 1941 and 1942, for the most part as a base hospital ship at Alexandria, where in effect she became a casualty clearing station and base for specialist consultants. Only urgent surgical work was performed on board and all but short term cases were transferred to shore hospitals. The average number of patients each day rose from 80 at the outset to 143, and the number of consultations per week from 130 to 329.

In 1941, the ship was damaged during an enemy air raid on Alexandria. Material damage was fortunately confined to the officers' wards, which were not full at the time, and to medical officers' cabins and bathrooms. Fire mains, electric circuits, and the ship's plumbing and water supply were all extensively damaged. No patients were harmed, but four members of *Maine's* complement were killed, and 12 wounded. Among the former was the Senior Medical Officer of the ship. He was killed while asleep by a bomb splinter which struck him in the head. Despite the disruption of the ship's medical organisation, treatment of all casualties had been satisfactorily completed within 11 hours and it was later recorded by the Principal Medical Officer that some good had flowed from the tragic circumstances of the disaster by virtue of the fact that the medical and nursing staff, having seen the effect of immediate casualties among themselves, were evermore likely to be lenient in their criticism of the preliminary first-aid measures adopted in the case of casualties which they frequently received from other of His Majesty's Ships.

From December 1942 to February 1943, *Maine* was in dockyard hands for a refit, including the installation of a new X-ray plant.

Early in 1943, *Maine* was lent to the Army as a hospital carrier covering a variety of North African ports, steaming 22,388 miles and carrying 5,602 patients. She was returned in October and entered dockyard hands for the repair of numerous leaks in deck heads, renewal of the ventilation system of the operating theatres and for disinfestation. From January to September 1944, when she underwent refitting, *Maine* was again employed as base hospital ship at Alexandria.

From October 1944 to January 1945, the ship took part in operations concerned with the liberation of Greece. When troops ashore were cut off from shore hospitals she became the only surgical centre for battle casualties and in addition received large numbers of civilians including women. *Maine* sailed to Salonica in January 1945, embarking 72 patients who were subsequently transferred to hospitals ashore at Piraeus. The rest of 1945 was spent first at Alexandria and later at

Malta, where, with the close of war, the ship reverted to peace-time duties.

During the whole war period, approximately 13,500 patients were admitted to *Maine* in addition to which large numbers of out-patients attended the ship. This record shows that, in spite of her age, *Maine* performed valuable work and it is a tribute to her complement that, although her defects were many, her periods out of commission were few and relatively short.

H.M.H.S. Aba

H.M. Hospital Ship *Aba* was requisitioned by the Admiralty in September 1939, but was employed as a naval hospital ship for only six months, being transferred to the War Office in March 1940.

H.M.H.S. Isle of Jersey

Isle of Jersey was requisitioned by the Admiralty from the Southern Railway in August 1939. Having been employed on the Channel Islands passenger service in peace-time, and with an endurance of 900 miles only, the *Isle of Jersey* was obviously suitable as a hospital carrier, and the original intention was that she should perform the function of accommodating 170 invalids for short voyages.

In addition to the master and Merchant Navy officers and ship's company, she carried sick berth staff, four nursing sisters, and medical officers under the command of a surgeon captain, R.N.

The medical staff included specialists in medicine, surgery and radiology.

It soon became obvious that the original intention to employ the *Isle of Jersey* only as a hospital carrier must be modified, and her presence at Scapa Flow became so commonplace that with the passage of time her function became accepted, more by usage than intent, as base hospital ship, Home Fleet. Except during June and July 1944, the ship's routine was to spend three or four weeks in Scapa Flow, and then to proceed to Aberdeen and transfer her complement of patients to the Royal Naval Auxiliary Hospital, Kingseat, 14 miles away. The ship would then return to Scapa Flow to recommence this routine.

During June and July of 1944 the ship was attached to the fleet of military carriers for the Normandy invasion, and she received the thanks of the War Office for her valuable work in evacuating casualties during this operation.

During the whole war period approximately 10,144 patients were admitted to *Isle of Jersey*, in addition to which 31,767 out-patients attended the ship for various reasons.

H.M.H.S. *Isle of Jersey* was released to her owners in July 1945 after a valuable period of war service, during which she carried out perhaps the most useful duties of any of the naval hospital ships in relation to her size.

H.M.H.S. Vasna

This ship was normally employed on the passenger service between Bombay and Karachi and the Persian Gulf. She was taken over by the Admiralty from the British India Steam Navigation Co. in August 1939. She carried, in addition to master and Merchant Navy crew, a medical staff consisting of nine medical officers, sick berth staff and nursing sisters. Her invalid accommodation was 279.

In contrast to the *Maine* and *Isle of Jersey* the story of the *Vasna's* activities during the war makes very different, and at times distressing, reading.

Beginning in September 1939, the vessel was converted into a hospital ship by the Mazagon Dock Company in Bombay under the supervision of the Principal Sea Transport Officer of the Royal Indian Navy. The chief difficulties of conversion were concerned with the provision of accommodation and annexes for treating a large number of patients in a comparatively small ship. It became obvious, even during conversion, that the wooden deck structures added were badly planned and crudely finished, and after construction left little deck space for recreation. Also, the wood used was unseasoned for lack of any other available material, and within a few weeks seams were gaping and deck structures were no longer weather-proof.

Accommodation for medical officers and nursing sisters was barely adequate for tropical service, but was accepted with slight modifications. On the other hand the accommodation of sick berth staff was unsatisfactory, an example being a space 40 ft. long, 9 ft. wide, 7 ft. high, adjacent to the engine room and the galley, in which 22 sick berth attendants were expected to live and sleep. Sanitary arrangements were poor, the main fault being a tendency for lavatories to flood, and lack of fresh water bathing facilities. The ship carried a space for storing ice, but no refrigerating plant. In contrast to the above defects, ventilation was adequate and satisfactory throughout the ship.

The ship was commissioned on October 2, 1939, and the first patients were received on October 17. Soon after commissioning, the presence of large numbers of rats in the ship became evident, and this proved a major annoyance during the whole of her war service.

Vasna served in the Indian Ocean in 1939–40, at Scapa Flow and in West Africa in 1940–41, Scapa Flow in the latter half of 1941, the Azores and with the Eastern Fleet in 1942, seeing service at Mombasa, Seychelles and Madagascar and carrying invalids to Colombo and Bombay from Seychelles, Diego Garcia and Addu Atoll. In the first half of 1943 she was at Colombo and other places mainly as a hospital carrier, and in the latter part of that year was transferred to the Mediterranean. Thence she carried invalids to the United Kingdom, returning to the Mediterranean in October 1943. In 1944 she rejoined the Eastern Fleet at Karachi (where there was an epidemic of smallpox

resulting in one fatal case on board) and served as a hospital ship for the Army, an experience not without difficulties. At times the number of patients actually carried greatly exceeded the number expected; women patients had to be carried without warning and at times European patients had to share accommodation with Asiatics. To transport tuberculous patients and leprous cases was never easy, but a very real problem was created when mental cases had to be carried.

Early in 1945 the ship took part in landings on the Burma coast, where the work of the medical officers, nursing sisters and sick berth staff was recorded as being of a high order. In July 1945 she joined the British Pacific Fleet, and after the Japanese surrender was employed in the transfer of invalid prisoners-of-war to Australia. She was released to her owners in March 1946.

During the whole war period approximately 12,400 patients were admitted and 30,767 out-patients attended the ship.

Vasna was in dockyard hands on eight occasions from the time of commencement of her war service, two of them for the repair of damage caused by collision. In retrospect it might be considered that *Vasna* should never have been employed as a hospital ship, for there is no doubt that, in addition to being a constant source of worry and expense, the ship spent approximately one-third of her commissioned war service in dock. Nevertheless, it must be remembered that there were periods of serviceability during which this ship, in spite of her defects, covered many thousands of miles in several theatres of war, and that her medical staff performed most useful work whenever possible.

H.M.H.S. Amarapoora

H.M. Hospital Ship *Amarapoora* was requisitioned by the Admiralty in September 1939. She carried in addition to master and Merchant Navy crew, a medical staff consisting of nine medical officers, sick berth staff and nursing sisters. Her total invalid accommodation was 503, including 54 officers. Until November 1942 *Amarapoora* was employed as base hospital ship in Scapa Flow, with the exception of short refitting periods. From then until September 1943 she was occupied in carrying British and U.S. Army patients, first between North Africa and the United Kingdom and subsequently between North African ports.

On September 13, 1943, *Amarapoora* anchored off the landing beaches at Salerno Bay, being one of a number of hospital ships in company which was attacked by enemy aircraft earlier in the day with the loss of the military hospital ship *Newfoundland*. The anchorage suffered repeated air attacks, and *Amarapoora* was frequently narrowly missed by bombs. Work was not interrupted however, and on September 13 a small number of casualties was embarked from the beaches. On the 14th, 306 casualties were embarked, and 26 were received from the S.S. *Bushrod Washington* which was bombed a short distance away. The ship left

Salerno on the evening of the 14th, and on the 15th three of the casualties received died on board and were buried at sea. The remainder of the patients were transferred to hospitals ashore at Bizerta on September 16.

On September 18, the ship returned to Salerno Bay where 323 military casualties were embarked. During embarkation intermittent shelling of the anchorage continued; one shell fell 20 yards from the stern of the ship, but did no damage. On the 22nd she left and the casualties were transferred to hospitals ashore at Bougie on September 24. Of the 323 casualties carried, 110 were American and the remainder British.

On September 25, the ship left Bougie, and after calling at Algiers, arrived at Oran on the 30th. Up to this time in 1943 a total of 4,206 casualties had been carried, of which 2,031 were American and the remainder British.

On October 6, 1943, the ship left Oran, and after calling at Malta, arrived at Taranto on the 11th. 345 patients were embarked including 17 German prisoners-of-war. Most of these patients were medical cases, including 85 cases of malaria and 37 of infective hepatitis. The ship left Taranto on October 12 for Philippeville where the patients were disembarked.

On October 16, the ship left for Tripoli and embarked 400 patients, including 36 cases of malaria and 11 cases of diphtheria. These patients were transferred to the 64th General Hospital at Alexandria on the 22nd.

The ship remained at Alexandria until October 30, when she sailed with 366 patients who were disembarked at Glasgow on November 12, after calling at Gibraltar and Belfast.

After refitting, in the course of which the invalid accommodation was increased by 100 beds, she sailed for the Mediterranean, where she was fully engaged between January and March 1944 in carrying patients (British, American, French, Indian, Jugoslav and African, with German and Italian prisoners-of-war in addition) between a number of Mediterranean ports. She then returned to the United Kingdom carrying many serious battle casualties and after a further journey to North Africa, returning with 458 patients, she undertook the duties of a base hospital ship at Scapa Flow.

From July to October 1944, *Amarapoora* was in dockyard hands, being refitted for tropical service, and on recommissioning sailed for the Far East with 128 Indian repatriated prisoners-of-war. A further 351 Indian patients were embarked at Suez. All these patients were landed at Bombay.

Between January and mid-February 1945, *Amarapoora* was in dockyard hands at Bombay undergoing complete reconstruction of the air-conditioning system and drastic alterations in the structure of the operating theatres, X-ray department and one ward.

After two months as base hospital ship at Trincomalee, the ship discharged her patients to shore hospitals at Colombo on May 8, and was then loaned to the Army as a hospital carrier until August 8. During this period of carrier duty in the Bay of Bengal the staff worked under conditions approaching hardship. The monsoon had broken and usually the embarkation and disembarkation of patients had to be carried out in torrential rainfall. The heat and humidity were almost unbearable at times and this was aggravated by a further breakdown in the cooling system. In addition, the ship proved unsuitable for such duties when journeying in the deltas of the great rivers. Her power was too low to make reasonable speeds against the monsoon currents, and her draught was too great to allow her to proceed except on flood tides with which she was rarely able to coincide owing to her lack of headway. This meant constant delay and slow passages. For example, it was quite impossible for the ship to proceed at any speed in the Ganges Delta, and she was never able to get up the Hoogly river in under two tides, and usually took at least forty-eight hours to pass from the mouth of the river to Calcutta. The same difficulties accompanied the journey up the Irrawaddy to Rangoon. Besides these difficulties the ship again proved unsuitable for the accommodation of Asiatic patients, who were always unhappy and subversive while on board. These various factors could not fail to have a depressing effect on the ship as a whole, though the nursing staff continued to perform their duties with admirable fortitude.

The war having ended, *Amarapoora* took in large quantities of medical stores, clothing and comforts for prisoners-of-war, and after embarking 187 nursing and welfare staff, sailed to Singapore. After carrying a large number of prisoners-of-war and civilian internees, suffering from various manifestations of malnutrition, from Singapore to Madras, and a further large number of patients including prisoners-of-war, internees for repatriation and Indian other ranks from Rangoon to Calcutta, she was loaded with nine tons of hospital beds and took in stores and medical personnel of the 84th Indian General Hospital for Sumatra. Having disembarked passengers and stores, she sailed for Singapore, thence to Bowen, Queensland, and then to Rabaul where she embarked 504 patients, including 443 Malayan civilians and a few Indians and Chinese, all from Japanese prisoner-of-war camps. These were disembarked at Singapore on December 23.

The New Year, 1946, found *Amarapoora* at Singapore with her future movements uncertain. It will be realised that by this time not only was her small staff in need of a rest, but the ship itself had seen so many miles under tropical conditions that she was beginning to display serious defects. The X-ray apparatus had ceased to function and her cooling system again showed signs of failing. Also, the ship's annual refit was long overdue. After a long refit at Bombay, completed on April 25, the ship was detailed for the urgent task of carrying sick Japanese personnel

from Java and Sumatra to Japan. At Batavia she filled to capacity with Japanese invalids and took on a staff of Japanese medical officers and orderlies for nursing duties; these were disembarked at Kure on June 5 after an uneventful voyage, during which the conduct of the medical and nursing staff was exemplary and their duties were greatly eased by the obvious appreciation of the Japanese under treatment.

Amarapoora paid off at Toulon on August 13 and was handed over to the Army authorities.

During the whole war period approximately 9,767 patients were admitted to the ship, in addition to which large numbers of out-patients attended for treatment.

The valuable work performed by *Amarapoora* during the war is obvious, but her history shows that such work was only possible when her structural condition permitted it, and her staff carried out their duties, particularly during the ship's service in the Tropics, under conditions which could not fail at times to approach hardship. To the time lost undergoing repairs must be added delays occasioned by coaling ship, and there is no doubt that with her unsuitable draught and low speed she was quite unsuitable for work up and down the great rivers of India and Burma. In general, she was an example of the unfortunate but inevitable exigencies of war which necessitated the use of old coal-burning ships for conversion into hospital ships.

H.M.H.S. Oxfordshire

H.M. Hospital Ship *Oxfordshire* was requisitioned by the Admiralty in September 1939. Her conversion was carried out with marked efficiency with an eye to fundamental requirements. This was to stand her in good stead during the whole of her war service. She carried, in addition to master and Merchant Navy crew, a medical staff consisting of ten medical officers under the command of a surgeon captain, sick berth staff, and nine naval nursing sisters under a matron. Medical accommodation was available for 505 patients, including 20 officers.

From November 1939 until February 1941, *Oxfordshire* carried out the duties of base hospital ship at Freetown, Sierra Leone. After a refit at Port Elizabeth completed in May 1941, she embarked a large number of military invalids at Durban and Capetown and sailed for Freetown where 203 foreign invalids were transferred to H.M.H.S. *Vasna* for passage to the United Kingdom. On the way to Freetown the ship took aboard 56 persons, including one woman, survivors of two merchant ships torpedoed and sunk 14 days previously.

Oxfordshire remained at Freetown as base hospital ship from May, 1941 until the middle of 1942, when she sailed for Capetown and was in dry dock there until August 17. She embarked 234 military invalids at Durban and further invalids at Freetown and arrived at Liverpool on September 22, 1942. After refitting at Liverpool—her first major refit

since commissioning in 1939 and one which undoubtedly improved the ship's medical efficiency as well as the comfort of her medical staff—she was employed in connexion with the invasion of North Africa. At Algiers on December 10 she received 364 Naval, Military and Merchant Navy casualties and later a number of survivors from H.M.S. *Partridge*, sunk by torpedo, of whom 18 were suffering from 'immersion blast', occasioned by the explosion of the ship's depth charges at the time of her sinking. These survivors, while in the water, had been exposed to a blast pressure of between 1,000 and 2,000 lb. per square inch. These cases presented the picture of 'blast syndrome' in varying degrees, including symptoms of intra-thoracic and intra-abdominal catastrophe. Four cases were fatal, but the remainder survived. It was fortunate at this time that the surgical specialist had considerable experience of this type of casualty, having been engaged on research work concerning immersion injuries earlier in the war.*

Oxfordshire continued to serve in the North African theatre of the war until June 23, 1943, carrying casualties between North African ports, particularly between Bone and Algiers. She evacuated 1,490 casualties from Bone, often under heavy fire, and also carried 1,831 casualties to the United Kingdom on five trips.

In July, August, and September 1943, the ship was employed as hospital carrier between Sicilian, North African and Italian ports. Considering that the ship had originally been converted as a static hospital ship, these carrier duties were performed very creditably in spite of the disadvantages of relatively small cot capacity, low speed, lack of power boats, and poor manœuvreability in small harbours. These disadvantages were overcome in part by local improvisation, and particularly by the expert handling and seamanship of the ship's master.

For the rest of the year she continued to perform carrier duties in the Mediterranean, calling at Augusta, Salerno, Castellamare, Phillippeville, Tripoli, Alexandria, Haifa, Taranto and Naples. During this period she steamed 9,222 miles and carried 2,312 patients.

After a refit early in 1944 at Swansea, *Oxfordshire* performed carrier duties between the Mediterranean and the United Kingdom, then ferried casualties between Italy, Sicily and North Africa. Three trips were made to the Anzio beachhead, then the scene of active fighting.

The ship entered dockyard hands at Clydeside in June 1944, for the construction of new storerooms, conversion of existing storerooms into a new ward of 86 beds and general repairs to plumbing and sanitation. After a short period as base hospital ship at Scapa Flow, *Oxfordshire* was refitted for tropical service. Before proceeding to India, where she arrived on November 20, she carried Italian invalids and casualties between Mediterranean ports. On the voyage to India she carried 329

* The late Surgeon Commander E. R. P. Williams, O.B.E., Royal Navy, Hunterian Professor, Royal College of Surgeons of England, 1942.

Indian military invalids. The experience of this particular journey showed that a naval hospital ship, though always suitable to accommodate Europeans, can never be regarded as a suitable carrier of Asiatic invalids at short notice and as a matter of course. On this occasion the ship was under the direction of the Military Medical Authorities, who did not realise that *Oxfordshire* was lacking in Asiatic-type latrines, for example, and that no facilities existed for cooking separately the necessary diets required by Hindus and Moslems on religious grounds. It was necessary therefore to improvise sanitary and cooking facilities as far as possible and to obtain an adequate supply of rice. Nevertheless, a satisfactory solution was never effected in the short time available, and in spite of the attempts made to meet their requirements, a number of Sikh patients went on hunger strike.

From India, *Oxfordshire* sailed to Sydney which she reached on Christmas Day, 1944. After a short period as base hospital ship pending the opening of the Royal Naval Auxiliary Hospital, Sydney, she became an integral part of the British Pacific Fleet Train, and in that capacity carried convalescent patients from Manus in the Admiralty Islands to Leyte and invalids from Leyte and Manus to Brisbane. These duties occupied her until the end of June. There followed a period in July–August 1945, during which she was on loan to the United States Seventh Fleet as base hospital at Subic Bay. During this period relations with the Americans were most cordial and work proceeded very smoothly.

Oxfordshire next served as a hospital carrier for the repatriation of British prisoners-of-war in Japanese hands. She embarked 334 prisoners-of-war at Hong Kong on August 30 and sailed for Sydney where she arrived on September 22. During this voyage seven patients died and one woman was confined. On the whole, with careful nursing, the majority of the ex-prisoners-of-war had made a remarkable recovery within a few days, several gaining as much as 10 to 14 lbs. in weight.

Of the patients carried on this journey, 36 per cent. were suffering from pellagra, 23 per cent. from malaria, 16 per cent. from beriberi, 3 per cent. from ascariasis, and the remainder from various forms of dysentery.

Returning to Hong Kong the ship embarked 399 ex-internees, including 214 women and 57 children; a number of these were landed at Singapore, the remainder at Liverpool on December 5, 1945, after which she ceased to be a hospital ship.

During the whole war period approximately 22,351 patients were admitted to H.M.H.S. *Oxfordshire*, in addition to which 5,715 out-patients attended the ship for various reasons.

From the account given it is obvious that *Oxfordshire*, though an old ship, performed gallant and valuable service for the Navy through the war, great credit being due to her medical and nursing staffs, her master, chief engineer, and Merchant Navy crew. It must also be placed

on record that there is no doubt that the success of this ship was in great part due to the wisdom displayed in her selection, and the fact that her original conversion was carefully studied and well conducted.

H.M.H.S. Vita

H.M. Hospital Ship *Vita* was requisitioned by the Admiralty from the British India Steam Navigation Co. in May 1940. She carried in addition to master and Merchant Navy crew, a medical staff consisting of seven medical officers under the command of a surgeon captain, sick berth staff and naval nursing sisters. The total invalid accommodation was 240, including 28 officers.

Vita commenced her conversion, which was far from satisfactory, in Bombay in May 1940, and owing to shortage of material and repeated delays, was not fully commissioned until August 3, 1940. The ship sailed immediately for Aden, but owing to monsoon conditions, many windows of her upper deck wards were smashed and about half of her distinguishing lights were washed away. Time did not permit of immediate repairs. She embarked 127 Indian and 30 European Army patients at Berbera and after experiencing the usual difficulties of naval hospital ships ill-equipped to carry Asiatic patients, disembarked 116 at Aden and the rest at Bombay, where she entered dockyard hands for repairs.

Vita returned to Aden in September and acted as base hospital ship until February 1941. Further refitting and repairs then commenced at Bombay but were interrupted, as *Vita* was urgently required in the Red Sea. She embarked 200 patients at Port Sudan and landed them at Suez on March 11. She then proceeded to Port Said.

On April 5, 1941, *Vita* commenced a brief period of active service which brought fame to her name. Leaving Port Said, she arrived at Tobruk and embarked 328 Army casualties and 63 Australian Army nursing sisters, all of whom were disembarked at Haifa on April 10.

On April 12 she sailed from Haifa and arrived back at Tobruk early on the morning of April 14. The port was the scene of great enemy air activity during the day, but in spite of this 430 Army casualties were embarked. Of these only 25 were cot cases and the remainder were able to walk, a fact which proved fortunate in the light of subsequent events. The ship sailed in the afternoon, and at 1726 hours, on leaving the swept channel, she was deliberately attacked by a formation of nine German aircraft. Although the ship did not receive a direct hit, one bomb fell particularly close to the starboard quarter; the explosion lifted the stern completely out of the water, and blast did widespread damage throughout the ship. Apart from devastation of much of the super-structure, the main damage occurred in the engine room, where pipes were fractured, causing the whole compartment to flood, and both engines and dynamos were put out of action.

Bulkheads held satisfactorily, but by midnight No. 3 and No. 4 holds appeared to be flooded, and the ship took such a serious list to port that it was decided to evacuate all the patients and most of the medical and nursing staff. H.M.A.S. *Waterhen* came alongside, and with no sign of panic patients and staff were transferred to her, with the exception of the principal medical officer and warrant wardmaster, who remained on board with the Merchant Navy officers and crew.

Shortly afterwards *Vita* seemed about to founder, and was completely abandoned. But a few hours later, although again attacked by enemy aircraft, the ship was still afloat, and it was found possible to tow her into harbour. The Merchant Navy officers and crew were re-embarked and salvage operations were commenced. Within a few days the engine room and holds were pumped dry and minor repairs were effected. The ship was frequently attacked during this period, but on April 21 was towed away from Tobruk and though again twice bombed on passage, reached Port Said safely and was conducted through the Suez Canal to Port Tewfik.

In addition to the damage mentioned, five wards were wrecked, and the laboratory and dispensary were set on fire with a considerable loss of medical stores and equipment.

Throughout this ordeal the conduct of medical officers, sisters, sick berth staff and patients had been of the highest order, and all were disembarked safely in Alexandria. During the next few weeks some hardship was occasioned by loss of personal belongings, particularly clothing, the latter being difficult to replace.

At Port Tewfik, *Vita* underwent minor repairs and eventually was pronounced sea-worthy and fit to proceed under her own steam at slow speed. On May 13 her complement rejoined, and the ship sailed on May 14 to commence an arduous passage on one engine only, and with dynamos out of action, with consequent lack of lights and fans. On May 28 the ship arrived at Bombay, to commence a long period of refitting, repairs and reconstruction which was not completed until August 4, 1941.

On August 4, she left Bombay for Aden where she remained as base hospital ship until October 1941, apart from a short visit to Assab on August 24 to embark 20 cases, of which eight were casualties following an explosion in the vicinity.

On October 6 she left for Suez and embarked 144 patients from that port, all of whom were disembarked at Aden on October 19.

On November 20 *Vita* arrived at Addu Atoll where a minor medical crisis called for investigation among the personnel of the Mobile Naval Base Defence Organisation landed there. Approximately 100 patients were seriously ill in a tented hospital ashore, suffering from malaria and an obscure pyrexial illness which later proved to be scrub typhus. The latter disease was spread in epidemic form and during the next four

weeks *Vita* had approximately 130 patients on board under treatment. A longer stay was impossible, however, owing to shortage of food, ice and coal, thereby proving how unsuitable the ship really was for prolonged, isolated work in the Tropics. Carrying a full complement of sick the ship arrived at Colombo on January 1, 1942.

The same day *Vita* left for Trincomalee arriving on January 3, where the ship attempted to undertake the duties of base hospital ship, but always under the great disability that if required to remain at less than 24 hours' notice for steam it became imperative to visit a coaling port within three or four weeks. In any case, when at twenty-four hours' notice for steam it was only possible for the ship to remain at anchor for two months before having to refuel.

On March 5 she left for Madras, arriving on March 7; sailing again on March 11 after coaling, she arrived back at Trincomalee on March 13.

On the evening of April 8, 1942, she sailed from Trincomalee bound for Addu Atoll, and at 0930 hours on April 9, she passed H.M.Ships *Hermes and Vampire* steaming in the opposite direction. Half an hour later a formation of between 40 and 50 Japanese aircraft appeared and immediately attacked the two men-of-war, both of which sank within twenty minutes.

Vita immediately turned about and quickly arrived at the scene of the disaster. Enemy aircraft were still attacking with cannon fire, but it is recorded that on *Vita's* arrival all hostile activity ceased and due respect was accorded to the Red Cross.

She lowered boats, and before leaving the area at 1900 hours on that day had picked up 595 survivors many of whom were badly burned and wounded. During the whole night the medical and nursing staff worked unsparingly, and all these casualties were landed at Colombo at 2000 hours on April 10.

On the same day she received an urgent summons to Addu Atoll but was unable to answer it owing to the problem of coaling, which was a cause of such delay that the ship did not arrive until noon on April 16. At Addu Atoll 98 wounded survivors were embarked all of whom were members of H.M. Ships *Dorsetshire* and *Cornwall*, recently sunk by Japanese aircraft. These casualties were carried across the Indian Ocean, and after a pause for coaling at Mauritius were landed at Durban on May 31. It can be appreciated that to deal with nearly 700 casualties, over a brief period, had taxed *Vita's* supplies to the limit, and she now found herself seriously depleted of medical stores which could be replenished only with difficulty by dint of local purchase, appeals to the Royal Army Medical Corps, and the good offices of the local Red Cross Organisation.

In June and July 1942, *Vita* acted as base hospital ship at Kilindini and on being relieved by *Vasna* carried a full complement of invalids

to Durban. She then embarked patients at Mauritius, Seychelles and Addu Atoll, landing them at Bombay on September 13. After refitting, *Vita* left Bombay on September 27, and proceeded via Aden and Durban for Diego Suarez. Here and at Mombasa she undertook Fleet duties for two months. A period of carrier duties followed between Durban, Mauritius, Diego Garcia, Addu Atoll and Colombo. The ship returned to Bombay on March 26, 1943, and was in dockyard hands for two months. The refit was adequate and resulted in improved ventilation, additional special departments and improved living conditions.

During the latter part of 1943 *Vita* was employed in carrier duties in the Mediterranean, except for the last few weeks undergoing refitting. She resumed duties with the Eastern Fleet in January 1944, carrying patients (including Indians and East Africans suffering from a variety of tropical diseases) between Bombay, Colombo, Mauritius, Addu Atoll, Seychelles, Durban and Kilindini. Leaving Kilindini on April 3, 1944, she sailed for Colombo via Durban, Mauritius, Diego Garcia and Addu Atoll, performing carrier duties en route. She was in dockyard hands at Bombay for a month until June 7, and employed as base hospital ship at Trincomalee until the end of September 1944. From then until the end of the year she was again engaged in carrier duties between Colombo and Durban and the intermediate places above-mentioned. During the next three months she undertook duties as base hospital ship at Trincomalee, which she left on April 5 to undertake similar duties at Cochin, Southern India, for which she was urgently required.

Vita arrived at Madras on April 28 and after filling to capacity with medical stores for operational requirements sailed for Kyankpyu, the Rangoon River and Rangoon itself, embarking some 100 casualties, who were landed at Calcutta on May 17. She now sailed for Chittagong where 275 Army patients were embarked. Having landed these at Madras, *Vita* returned to Trincomalee for duties as base hospital ship. These duties, apart from a brief journey to Colombo and one to Madras, lasted until October 22 and proved to be the ship's busiest period of the war, 1,813 out-patients alone being treated on board.

On October 27 the ship arrived at Bombay for refitting in dockyard hands, which continued until January 1946, when she was paid off as a naval hospital ship and released to her owners.

During the war years approximately 3,685 patients were treated in H.M. Hospital Ship *Vita*, whose valuable work is evident despite time lost in her periods of coaling and repairs.

H.M.H.S. Tjitjalengka

H.M.H.S. *Tjitjalengka*, built in 1939, owned by the Netherlands Ministry of Shipping and Fisheries, was requisitioned for Admiralty service on July 8, 1942. She carried, in addition to master and Merchant Navy crew, a medical staff consisting of ten medical officers under the

command of a surgeon captain, sick berth staff, and three naval nursing sisters under a matron. Medical accommodation was available for 504 patients including 44 officers.

Tjitjalengka was the only naval hospital ship acquired for the war which was actually selected in consultation with the Medical Department of the Navy. In addition, her conversion, which was carried out at Liverpool, was under the supervision of an Admiralty medical representative, and the ship therefore commenced her career with everything in favour of herself, her medical and nursing complement, and her future patients.

It is therefore somewhat disappointing that, for the purposes of this History, her records for the greater part of her career, although meticulously accurate statistically, give little detail of the domestic developments on board which would have provided interesting reading by comparison with other hospital ships less adequately fitted out.

After carrying a full complement of American and Canadian invalids to Halifax, Nova Scotia, in October 1942, the ship undertook the duties of base hospital ship at Freetown, Sierra Leone until February 1943. During this period a brief epidemic of 103 acute cases of infective hepatitis occurred in the vicinity, no less than 46 being cases among the ship's medical officers and sick berth staff. The epidemic ended as abruptly as it began.

There followed a period of general service in the Indian Ocean, during which the ship visited Kilindini, Diego Suarez, Durban and Bombay. From December 1943 until July 1944, she was employed as base hospital ship at Trincomalee. After a further period of general duties visiting Colombo, Durban, Mauritius and Addu Atoll, she returned to Trincomalee at the end of the year for base hospital ship duties.

In February 1945, *Tjitjalengka* sailed to Sydney and served with the Eastern Fleet in the Pacific until June, when for a few weeks she was lent to the United States to act as base hospital ship at Leyte. In mid-July she rejoined the Eastern Fleet Train at sea in the forward area, and continued cruising until finally anchoring in Sagann Wan Bay on August 28. She then proceeded to Yokohama and embarked a full complement of prisoners-of-war who were disembarked at Auckland, New Zealand. Returning to Sydney where she underwent engine repairs, she proceeded via Hong Kong to Shanghai where 190 ex-internees, including 161 Asiatics, were embarked. Of the latter, two died at sea and a third committed suicide by jumping overboard. A further 68 Asiatic invalids were embarked at Singapore. All the Asiatics were landed at Madras. After embarking 89 naval casualties at Colombo and filling to capacity with Service invalids at Durban, the ship sailed to Liverpool and having landed all patients proceeded to Tilbury Docks to be released to her owners.

During the whole war period approximately 7,270 patients were admitted to the ship, in addition to which a large number of out-patients attended for treatment.

It is impossible to exaggerate the advantages which *Tjitjalengka* possessed over her sister hospital ships during her period of valuable war service, and not the least of her assets was the excellence of her conversion under medical supervision which, with her high endurance, rendered her a desirable adjunct to the Fleet at sea.

H.M.H.S. Ophir

H.M.H.S. *Ophir*, a seventeen-year-old Dutch liner owned by the Netherlands Ministry of Shipping and Fisheries, was requisitioned for Admiralty service on July 8, 1942.

The medical and nursing staff consisted of four medical officers, one dental officer, one warrant wardmaster, matron, and five nursing sisters, all under the command of a surgeon captain, R.N. A Church of England Chaplain was carried in addition. The ship's complement of Dutch Mercantile officers and crew was retained. There was invalid accommodation for 346 patients, including twelve officers.

The conversion of *Ophir* was carried out at Calcutta, where progress was very slow owing to lack of materials. On December 3, 1942, *Ophir* was ordered to sail from Calcutta, work being still unfinished, and conversion was completed in Colombo by January 21, 1943. Emergency stores were now obtained locally, and on January 27 the ship arrived at Addu Atoll where she undertook the duties of base hospital ship, albeit embarrassed by shortage of staff and equipment. The main function to be performed was that of providing convalescent accommodation for cases of scrub typhus in the vicinity, and the shortage of nursing staff was solved by employing the sick berth staff of the Second Naval Tented Hospital from shore.* Short experience at that time soon revealed that shortages of equipment did not permit the ship to undertake with efficiency general hospital work.

On May 8, 1943, she completed her duties at Addu Atoll and returned to Colombo where her stores, equipment and nursing staff were brought up to full strength.

On May 30 she did a carrier trip to Suez via Kilindini and arrived on June 19.

On July 1, 1943, the ship sailed under the Dutch Flag, and until the middle of August performed carrier duties between Port Said, Tripoli and Alexandria. On August 11 she was transferred from the Mediterranean to rejoin the Eastern Fleet, and arrived at Bombay on August 21.

The ship left Bombay on September 1, and until the end of 1943 was engaged on carrier duties between Colombo, Addu Atoll, Diego Garcia, Mauritius, Diego Suarez, Durban and Kilindini, and steamed some

* See Chapter 2 of the Operational Volume of the Naval Medical History.

25,000 miles. 3,035 patients were carried during the period, including 30 cases of leprosy.

In January 1944, carrier duties, mainly of Army invalids, were continued between Durban, Mauritius, Diego Garcia, Addu Atoll and Colombo. On February 18, the ship arrived at Bombay and underwent docking and repairs until March 11.

On March 19 *Ophir* left Bombay and after calling at Colombo, arrived at Calcutta on March 23. From now until the end of October the ship performed carrier duties under Army direction, and transported casualties between Chittagong and Calcutta; 7,418 patients were carried altogether, of whom 2,532 were battle casualties. Of the latter it was noted that wound infection was high and recovery long delayed in casualties from Burma compared with casualties from the Mediterranean theatre, and in the case of the Burma casualties there was a high rate of inter-current infection with malaria and dysentery. Little else of interest has been recorded, apart from the suicide on August 29 of an Indian Sepoy who jumped overboard in mid-ocean. He could not be found despite a prolonged search by boats from *Ophir* and another ship in company.

On November 5 the ship arrived at Bombay and underwent refitting and repairs until December 7.

On December 8 she left Bombay, and until June 1, 1945, was employed on carrier duties between Colombo, Aden, Bombay, Chittagong, Calcutta, Madras and Kilindini. These carrier voyages were few in number, and with the exception of the last, which extended over twenty-one days, were of very short duration. There was little opportunity for continuous professional work on board, and the interim periods involved many weeks of idleness and monotony for the medical and nursing staffs. In all a total of 2,822 patients was carried, of whom 768 were Asiatic and 1,099 East and West African Army casualties; 32 cases of leprosy were carried and 131 cases of pulmonary tuberculosis.

June 1, 1945, found *Ophir* at Bombay, whence she sailed for the Mediterranean theatre on June 5, arriving at Port Said on June 16.

On June 24 the ship arrived at Taranto and embarked 234 Indian Army patients. The ship left Taranto on July 1 for the Far East, and after embarking a further 72 Indian Army patients at Port Tewfik, arrived at Bombay on July 17, where all patients were transferred to hospitals ashore.

Leaving Bombay on July 25 she arrived at Trincomalee on August 3, and relieved *Vita* as base hospital ship for ten days. On September 3 the ship left Trincomalee to undertake the duties of base hospital ship at Port Swettenham, in connexion with the re-occupation of Malaya.

These duties continued until October 14 when the ship sailed via Singapore for Batavia, arriving on October 19. The main object of this journey was to enable the Dutch officers and crew of the ship to

search for their families who had been in the hands of the Japanese. The search was fortunately successful, and seven wives and thirteen children were traced and brought on board where they were accommodated in comfort.

Ophir returned to Singapore, and after a short period of general duties carried invalids from Port Swettenham and Madras to Calcutta, arriving on January 3. On this date, the Netherlands Government pressed strongly for the release of the vessel to her owners, and by the end of January the medical personnel were appointed elsewhere, medical stores were removed, and after a two months refit in dock the ship was handed back to her owners on April 8, 1946.

H.M.H.S. *Ophir* was of valuable assistance to the Naval Medical Transport organisation at times, but, in general, was too small and too old a vessel for what was really needed in Eastern waters, in addition to which the policy of the Netherlands Government resulted in the diversion of the ship from service in the Pacific Ocean where it had been intended that her ultimate duties should be performed.

During the whole war period approximately 12,111 patients were admitted to the ship, in addition to which large numbers of out-patients attended the ship for various reasons.

H.M.H.S. Cap St. Jacques

A French vessel, built in 1922, with invalid accommodation for 299 patients, including 45 officers, carried, in addition to master and Merchant Navy crew, a medical staff consisting of eight medical officers, sick berth staff and seven naval nursing sisters. She was originally converted for service as a military hospital ship in 1944, and was transferred to the Royal Navy in April 1945, in spite of strong protests by the Medical Department of the Admiralty in view of her potential unsuitability for duties in the Pacific. The ship had to be accepted owing to the acute shortage of shipping at the time, but from the beginning of her naval service was an almost impossible proposition.

Her maiden voyage as a naval hospital ship was in May 1945, with a load of 402 patients to be repatriated in the Middle East. During the early stages of this voyage her nursing facilities were found to be quite inadequate for tropical conditions and in the interests of her medical and nursing staff, as well as the patients themselves, 75 invalids had to be disembarked at Suez in order to make living conditions tolerable.

The ship arrived in Ceylon in June 1945, where her remaining patients were disembarked. It was now found that during her voyage she had developed so many defects that repairs could not be undertaken in Colombo or Trincomalee, and her state was such that in August she was sent to Durban to undergo alterations and repairs.

Her refit was now complicated and prolonged by a fire which broke out on board. Nevertheless, the ship returned to Ceylon in October

1945 and performed a number of short carrier trips during November, but she had to have repairs carried out repeatedly at each port of call. Early in 1946 the ship assisted with repatriation of Allied prisoners-of-war in the Singapore area, and in March she transported French invalids from Saigon to Toulon.

She was released from Admiralty service at Toulon on April 18, 1946, and returned to her French owners.

During the whole war period approximately 1,207 patients were admitted to the ship, in addition to which numerous out-patients attended for various reasons.

H.M.H.S. Gerusalemme

This ship was an Italian passenger ship, built in 1920, which could accommodate 388 patients, including 40 officers. She carried, in addition to master and Merchant Navy crew, a medical staff consisting of nine medical officers, sick berth staff and naval nursing sisters.

Gerusalemme was requisitioned for naval service in January 1945, and her conversion, which was carried out at Durban, was completed only with difficulty, mainly due to labour problems at that port. It had originally been expected that she would be ready for service in the Pacific in February 1945, but she did not leave Durban until April 1945, and then had to return immediately as her refrigerating plant broke down. The ship eventually left Durban for Australia in June, but on arriving in Melbourne was found to have developed defects which necessitated repairs over a period of six weeks.

At the end of July she arrived to commence duty at Manus, Admiralty Island, but immediately suffered an outbreak of fire on board which put her out of service for a further period. In September 1945 the ship became reasonably serviceable and was of some local use at the relief of Hong Kong, and early in 1946 as a temporary base hospital ship at Singapore.

During this time approximately 464 patients were admitted to H.M.H.S. *Gerusalemme*.

H.M.H.S. Empire Clyde

This was a Government-owned liner managed by the City Line and built in 1925. *Empire Clyde* was originally named *Leonardo da Vinci*, and was converted into a hospital ship after being captured from the Italians at Massawa in 1943. She served originally as a military hospital ship, and was transferred to Admiralty service in May 1945, as one of the additional naval hospital ships required for service with the British Pacific Fleet at that period of the war. She could accommodate 411 patients, including 25 officers. She carried, in addition to master and Merchant Navy crew, a medical staff consisting of nine medical officers, sick berth staff, and seven nursing sisters under a matron.

Empire Clyde had already performed valuable service under Army control, but though little fault was to be found with her construction, her initial period of naval service was marred by an acute shortage of nursing staff. She left the United Kingdom for the Far East on July 28, 1945, carrying only 25 per cent. of her nursing staff, and was brought up to full complement in Australia in September 1945. During the remainder of 1945 and most of 1946 *Empire Clyde* saw service at Manus, Shanghai, Singapore and Hong Kong, and at the last mentioned port performed a long period of duty as base hospital ship.

She was taken over permanently as a naval hospital ship, and, renamed *Maine*, has replaced the old H.M.H.S. *Maine* for peace-time naval service.

During 1945 approximately 237 patients were admitted to the ship.

SUMMARY

The following table records the numbers of patients admitted to naval hospital ships during the war:

TABLE

	1939	1940	1941	1942	1943	1944	1945	Total
Amarapoora	58	3,063	2,746	2,479	212	615	594	9,767
Cap St. Jacques	—	—	—	—	—	—	1,207	1,207
Empire Clyde	—	—	—	—	—	—	237	237
Gerusalemme	—	—	—	—	—	—	464	464
Isle of Jersey	—	868	1,529	2,511	2,646	1,739	851	10,144
Maine	168	626	1,764	1,405	5,459	2,276	1,816	13,514
Ophir	—	—	—	—	1,035	7,034	4,042	12,111
Oxfordshire	160	1,961	2,111	1,102	7,753	7,304	1,940	22,331
Tjitjalengka	—	—	—	668	1,599	3,456	1,547	7,270
Vasna	—	890	1,877	1,532	1,872	4,591	1,650	12,412
Vita	—	—	—	1,304	401	592	1,388	3,685
								93,142

It will be seen that of 93,142 patients admitted to hospital ships, 58,401 were received in four ships, *Isle of Jersey*, *Maine*, *Oxfordshire* and *Vasna*. *Oxfordshire* received 22,331 patients, and served throughout the whole war period. *Maine* also served throughout the whole war and received 13,514 patients in spite of being a coal burner and the oldest hospital ship afloat. *Isle of Jersey* was an oil burner and served a shorter time but dealt with 10,144 patients in spite of being by far the smallest of all the hospital ships, with an endurance of only 900 miles. *Vasna* was built in 1917 and has been described as badly converted and always 'a make-shift venture', 'a source of expense' and grew to be associated with repeated misfortunes. Nevertheless, she received 12,412 patients, being exceeded only by *Oxfordshire* and *Maine*, each of which saw longer service.

CONCLUSIONS *

It is tempting to accept these figures as an automatic presumption of individual usefulness, ignoring suitability, and to deny that defects and drawbacks could have existed where so much valuable work was performed. But to imply from mere figures that efficient working was everywhere unquestioned or that critical opinion was exaggerated would mean that the facts recorded above in the case of each ship must be largely discredited. Instead, it must be realised that these figures were indeed fortuitous, and they must be read not in relation to an apparent but misleading estimation of sea or shipworthiness, but as illustrating how the combined efforts of the personnel of these ships managed to achieve a high standard of medical and nursing care of their patients in spite of conditions which were in most cases unsuitable.

In the light of experience gained, an attempt was made at the close of the war to assess the value of the services of the various naval hospital ships in commission. Data were compiled in relation to factors considered likely to reveal errors and omissions on the one hand, and to confirm foreseen and display unforeseen advantages on the other. Matters studied were:

Ease of conversion.
Range of action, speed, type of fuel, fuel and fresh water capacity.
Ventilation and climatic adaptability.
Storage space, medical stores and equipment.
Hospital accommodation and special clinical facilities.
Hospital annexes, including galleys, refrigeration, laundry, ablutions and sanitation.
Complement, accommodation and health of medical and nursing staffs, recreation and amenities.

As the evidence was obtained it became obvious that the specifications for fitting ships for hospital services were in need of revision, as well as the *desiderata* which should govern the future selection of such ships.

As regards the pooling of inter-Service requirements, it was shown that, from the naval point of view, a common specification is not a practicable proposition because the replacement of man-power wastage in the Navy differs fundamentally from that in the other Services. A man-of-war can withstand only a minor degree of reduction of complement without serious loss of efficiency as a fighting unit, and cannot be withdrawn and replaced by a reserve unit since the latter does not generally exist in war. Naval medical organisation is accordingly directed to return the naval patient to his own ship in the minimum of time. It was realised as the war progressed that the application of the Army system to naval patients (as when it is arranged for the Army to deal with naval casualties in forward areas), though acceptable in theory,

*Compiled with the assistance of the records of Surg. Rear-Admiral L. F. Strugnell, C.B., K.H.P., R.N., late Deputy Medical Director-General of the Navy.

militates very seriously against fighting efficiency. For example, the experience of this factor during the assault on Burma was such as to prompt the allocation of a separate hospital ship to serve naval needs when planning the subsequent assault on Malaya.

The essential difference is that the Army hospital ship should be a link in the line of communication, while in the Navy it should be equivalent to a field hospital. The Navy thus has a strong claim for ships to be allocated as floating hospitals, as opposed to the land forces' normal requirements of a hospital transport ship. Such a ship for purely naval service should, therefore, fulfil the following basic requirements:

1. It should be capable of serving as a base hospital ship.
2. It should be capable of keeping within such reasonable distance of the Fleet Train or replenishment group as to be capable of serving as a forward Royal Naval Hospital.
3. It should include provision for the expansion of sick accommodation by the conversion of single berths into double tier berths, and thus be capable of meeting necessary commitments when employed as a transport to convey casualties to base or to the United Kingdom.

The pure hospital carrier, as such, has therefore little place in naval service, and hospital ships might well be classified in accordance with their utility for long sea voyages or short sea voyages, though there is still probably a place for a smaller variety of the latter group for rapid ferrying work over very short distances.

As regards the policy of conversion, experience has proved that oil fuel or diesel driven ships are acceptable, and the authorities are unanimous that coal burners should not be converted for use as hospital ships.

In general a minimum speed of 14 knots is necessary, with an endurance of 700 miles for the short sea voyage, and at least 6,000 miles in the case of the long sea voyage type.

The need for modern refrigerating plant has been emphasised, on the basis of a minimum cold storage space of 3,000 cubic feet per 400 patients, in addition to which facilities for the production of an adequate quantity of ice each day have been recorded as desirable.

The supply of fresh water has been a constant anxiety in the past, and in-so-far as naval requirements are concerned there seems no doubt that a hospital ship should have at least the same sea-keeping endurance as the rest of the Fleet. The ship must thus be independent of shore water supply, and must therefore have an adequate distilling plant in addition to good storage capacity. The rationing of water for patients has never been acceptable, and in any ship converted for hospital employment it should be possible to produce 15 gallons of fresh water per head per day, and a storage capacity of not less than 800 tons has been proved necessary.

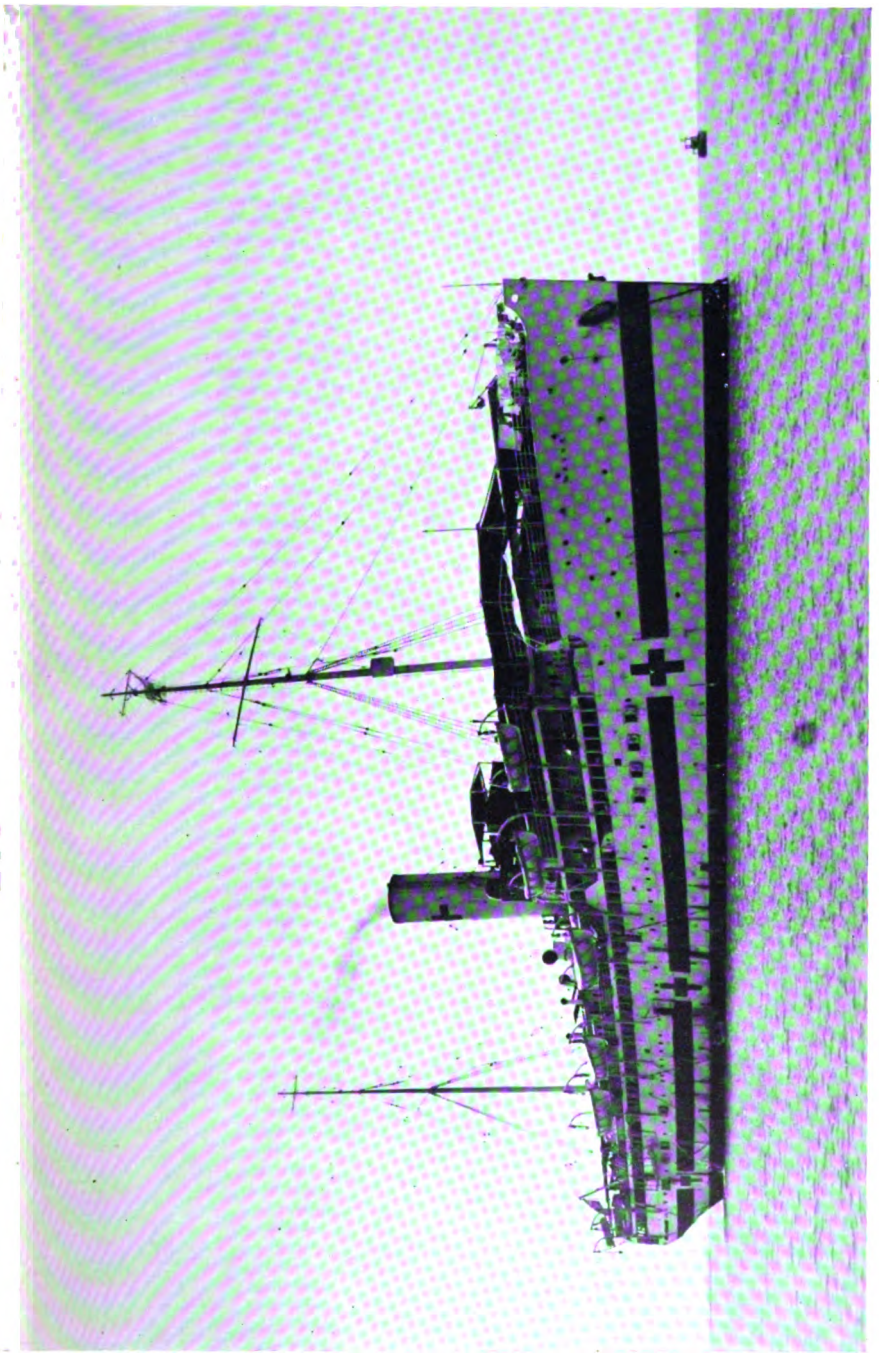

PLATE V. H.M. Hospital ship *Maine*.

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PLATE VI. A ward in a hospital ship.

PLATE VII. Casualty reception.

PLATE VIII. An operation in a hospital ship.

PLATE IX. Dentistry in the tropics in a hospital ship.

As regards electrical plant, it was a constant complaint during the war that the introduction of modern medical electrical equipment frequently led to overloading and consequent breakdown. Additional generators should therefore always be provided in order that an ample margin of power should be available. In relation to this requirement, experience has proved the need to include among a ship's personnel technicians capable of repairing and maintaining special medical electrical equipment.

Observations in relation to invalid accommodation have centred not so much around the adequacy of bed strength in general, as around problems of distribution. In particular, accommodation for tuberculous cases has always been sadly inadequate. Provision is necessary for a small number of female patients both surgical and medical, and accommodation for officers must always be elastic with special provision for those holding senior rank. The beds available should be distributed in such a way that surgical wards are sited adjacent to operating theatres and X-ray departments, and sloping ramps should be fitted in place of lifts and stairs wherever possible.

Experience has shown that the amount of labour and time expended in maintaining cleanliness of hospital ship wards has been out of all proportion. This has been largely due to the passage of a multitude of exposed water, steam and fuel pipes, electric cables, and ventilation trunks through wards themselves. Such structural disadvantages are hard to eliminate in actual construction, as each plays its essential part, but they are notorious collectors of dirt, in addition to which a steam joint has been known to fracture and expose patients to the risk of scalding. For reasons of safety and cleanliness, therefore, all overhead structures should be cased in flush to the deckhead.

Ward annexes, including lavatories and bathrooms, have received special consideration as they have frequently been badly placed.

The complement of medical officers and nursing staff is a matter concerning which available records have not always been of constructive assistance. It is, in fact, difficult to lay down with any degree of accuracy what the ideal medical complement of a naval hospital ship should be. To allow for every contingency has sometimes resulted in redundancy with consequent complaints of inactivity. In other cases where staff has purposely been restricted, it could barely compete with large quantities of work which had not been foreseen. An added difficulty concerns male nursing complement, for frequently the number of sick berth staff carried in individual hospital ships has depended more on what was available than what was desirable. It is, however, obvious that as regards female nursing staff, the presence of naval nursing sisters in naval hospital ships was at all times a valuable asset, and this fact is of some importance as representing a reversal of the policy laid down during pre-war preparation. Also, it has not hitherto been the practice to carry

V.A.Ds. in naval hospital ships, but experience makes it evident that a base hospital ship may be forced to embark them to nurse female patients, and their presence will have to be allowed for in the future.*

The health of medical and nursing staffs in hospital ships was on the whole good, apart from an epidemic of jaundice which occurred in the case of one ship. During the course of the war, acting on the advice of the Matron-in-Chief of the Navy, it was arranged that where possible naval nursing sisters should not be required to serve longer than twelve months in a hospital ship, and with some exceptions such service should be effected on a voluntary basis. But the reasons which prompted this policy were concerned not with problems of health, but with monotony arising from long periods of inactivity.

The question of the accommodation of medical and nursing staffs has been closely scrutinised. Complaints of poor accommodation have usually been justified, though not always reasonable. There were times, for example, during docking periods in tropical ports when temporary accommodation ashore would have been desirable, but could not be effected owing to general or local regulations, and such instances, though few, occasionally approached hardship. Nevertheless, such difficulties arising during a docking period are concerned more with local arrangements than with general policy, and it could be argued that disorganisation of living conditions on board at such a time is recognised as a customary burden to be accepted and suffered among persons who serve afloat. But in general, experience has been that the accommodation allocated to medical and nursing staffs has been that left over after everything else has been dealt with. This is as it should be, for the welfare of patients must naturally take priority. Nevertheless, as medical and nursing complement is usually barely sufficient, sub-normal efficiency cannot be accepted in the case of men and women who work long hours under trying conditions, and need in their off-duty time comfortable and well-ventilated living spaces. This is particularly so in the case of night duty staff, especially in the Tropics, when in order to be able to obtain reasonable rest during the hottest part of the day they require cool and airy accommodation so situated as to ensure a minimum of disturbance by noise.

A hospital ship must naturally be prepared to serve in any part of the world at short notice, in which case her system of ventilation, heating and cooling is of vital importance. It is therefore of the greatest interest to record that in the light of experience general air conditioning has been proved to be impracticable. The reason for this is that should the system fail, a ship is far worse off than if it had not been installed. Air conditioning can therefore be said to have been successful only when confined to selected compartments.

* V.A.Ds. are carried in the present Hospital Ship *Maine*, since that ship operated in Korean waters.

Many deficiencies which have existed in the past and should be necessarily remedied in the future may be mentioned, including plaster room, X-ray viewing room, medical and surgical specialist consulting rooms, ophthalmic room, accommodation for Asiatics, and provision of power boats.

It was repeatedly shown during the war that a hospital ship cannot be regarded as fully operational unless fitted for the carriage and treatment of Asiatic patients. Unacceptable delay has always been experienced where the necessary equipment has not been fitted until the ship is actually detailed to carry such patients. Specifications should therefore always include provision for appropriate galleys and W.Cs. adaptable to Asiatic requirements.

The power boat situation has been notoriously unsatisfactory in hospital ships, and complaints have revolved around lack of provision, mechanical unreliability, poor maintenance, boats' crews, and the reluctance of the master to employ lifeboats for normal administrative duties in harbour, contrary to the general practice of the Merchant Navy. Such defects have frequently been held to be purely domestic, but mature consideration shows that they are so constant as to represent a potent factor in the comfortable and harmonious administration of hospital ships as a whole. The chief requirements are a small power boat for the exclusive use of the Medical Officer-in-Charge and a large power boat for the transport of hospital staff to and from shore and to perform the necessary communication duties which play so large a part in the hospital administration. To provide these boats may be a simple matter, but their manning and maintenance properly belongs to the realm of higher policy when the Royal Navy performs non-combatant functions in a Merchant Navy environment, and is therefore a matter which happily it is the duty of this History only to record, but not to solve.

A final criticism has been that more use might be made of platforms rigged at sea doors when embarking patients. Cot cases could thus be loaded direct to a ward deck with speed and comfort rather than having to undergo the alarming experience of being hoisted inboard, often to a great height, by crane.

In assessing the value of naval hospital ships during the war the defects which existed have been set out, and they must not be minimised or lost sight of when balanced against the admission figures which have been given. History might well condemn the policy of conversion and the poor quality of vessel concerned, but it is perhaps more fitting to do no more than praise not only naval hospital ships and their companies for the valuable work they did, but also those persons whose task it was to dispose these ships to the best advantage throughout all corners of the globe.

Plates VI, VII, VIII and IX illustrate some of the work on hospital ships.

CHAPTER 9

ROYAL NAVAL BLOOD TRANSFUSION SERVICE*

BLOOD TRANSFUSION IN NAVAL HOSPITALS

THE policy adopted by naval hospitals with regard to blood transfusion immediately before the outbreak of war differed little, if at all, from that practised in the large civilian hospitals and other medical communities throughout the country. The use of stored blood and the development of the blood bank for use in an emergency for the treatment of casualties were then only in their infancy and had not been generally adopted. The usual practice, therefore, was to use fresh blood, which was drawn from a donor after the emergency had arisen.

There was no recognised standard technique for blood grouping, for bleeding a donor, or for giving a transfusion. The apparatus and technique employed depended entirely on the whims or fancies of the medical officer responsible for administering the transfusion, and the apparatus used was usually a proprietary article, the product of a commercial firm. Furthermore, not only did every hospital have its own technique, but it was not infrequent to find several methods, all employing different forms of apparatus, being practised in one hospital simultaneously.

There was, therefore, at the outbreak of war, no standard technique of giving a blood transfusion in which large numbers of medical officers, nursing staff or technicians could be trained, and no standard apparatus with which they could become familiar. It was apparent, therefore, that for training purposes alone, a standard technique, using a standard type of apparatus, would have to be adopted and uniformly practised throughout the country; this was also essential if transfusion apparatus was to be provided in the quantities necessary in time of war, for it would have to be produced on a mass production scale.

One of the most important steps taken by the Ministry of Health was to organise, in co-operation with the Medical Research Council and the War Office, a National Transfusion Service. The whole country, with the exception of London, was divided into nine Transfusion Regions each with its own Director. Eight of these were under the administration of the Ministry of Health, and one, Region VII (South Western), under the Army Blood Transfusion Service. Region V (London) was treated as a special entity and divided into four areas with headquarters at Slough, Maidstone, Luton and Sutton. These areas were administered by the

* Compiled from the records of Surgeon Rear-Admiral S. G. Rainsford, M.D., Sc.D., B.Ch., M.R.C.P., D.P.H., Royal Navy.

Medical Research Council, to whom their Directors were responsible. Each Region was responsible for enrolling 'Donor Panels', for collecting blood inside their own area, and for supplying it to the various hospitals in that area. They were also responsible for supplying all the transfusion apparatus required, packed, sterile and ready for use, and for the training of mobile blood transfusion and resuscitation teams to work in any part of that area whenever an emergency should arise. (See E.M.S., Volume I, Part II, Chapter 11.)

The Medical Research Council also set up two advisory committees, 'The Blood Transfusion Research Committee' and 'The Traumatic Shock Committee'. On both of these committees there was a representative from each of the three Fighting Services and from each of the Blood Transfusion Regions, in addition to the Medical Research Council representatives.

Once this organisation had been set up, all matters pertaining to blood transfusion developed rapidly. A standard technique for bleeding donors and standard methods of administering transfusions, were decided upon. The necessary apparatus and equipment was ordered through the Ministry of Supply who put it into mass production. In the design of apparatus, the Army Blood Transfusion Service played a major part. The Army had given much thought to the problem of resuscitation and blood transfusion in the field before the war, and when war broke out, it already had plans and designs prepared. The Army was, therefore, in a position on the outbreak of war, to get off to a flying start in this matter and there is no doubt that it took the lead.

In 1940, as a direct result of the deliberations of the two Medical Research Council Committees, War Memorandum No. 1 'The Treatment of Traumatic Shock' was published. This memorandum gave a complete exposition of all the recommended methods and techniques required for the collection and administration of blood, and for the care, packing and sterilisation of all apparatus. This memorandum greatly helped to standardise methods and techniques throughout the country.

During the period which elapsed between the outbreak of war and the end of 1940, there had been a great increase in the number of sick quarters and naval hospitals established throughout the country. The smaller naval hospitals and sick quarters had insufficient laboratory facilities to operate their own blood banks, and relied upon their local Ministry of Health Transfusion Centre for supplies of blood and transfusion equipment. During 1940 the 'blitz' put a severe strain on the various Blood Transfusion Regions, and it was as much as they could do to supply sufficient blood and equipment to deal with the civilian casualties in their own areas. The Admiralty at this time, therefore, laid it down in principle that each hospital where laboratory facilities were such that it could carry out Kahn and Wassermann tests, should be self-supporting in the matter of blood, and that it should keep and operate

its own blood bank, using volunteer donors drawn from naval personnel in barracks and naval establishments in close proximity to it. This order, however, could not be universally obeyed, because some naval hospitals had been sited intentionally in remote districts of the country, far away from any naval establishment which could be regarded as a legitimate target for the Luftwaffe. These hospitals, therefore, had to continue to call upon the Regional Transfusion Officer for assistance.

BLOOD TRANSFUSION IN SHIPS IMMEDIATELY BEFORE THE WAR

Before the war, much consideration had been given to the advisability of providing facilities for administering blood to the injured on board ship. It was not considered feasible to keep a blood bank on board ship, even in a Capital Ship. It must be remembered at this time that the life of stored blood, under the most ideal conditions of refrigeration, was considered to be not more than seven days, and on board ship where it would be subjected to the effects of vibration, its life would be considerably shortened. The only feasible method of giving a blood transfusion on board ship, therefore, was to use fresh blood obtained from a donor amongst the crew. There were very many good reasons why such a procedure was not advisable, the chief objection being that there was no practical method available by which the blood group of a donor could be accurately determined on board ship. It is true that every ship carrying a medical officer was supplied with a Shucksmith apparatus, but before it could be used for bleeding a donor or for giving a transfusion, the medical officer had to assemble it, sterilise it and in addition prepare and sterilise the citrate solution for use with it, and all this had to be done on board and at sea. Needless to say, this apparatus was scarcely used, if at all, and in any case, in most ships, with the exception of Capital Ships, adequate facilities for the sterilisation of the apparatus and the preparation and sterilisation of the citrate solution did not exist.

The Effect of the 1940 '*Blitz*'. As a result of the 1940 'blitz', a great deal was learnt concerning the treatment of traumatic shock amongst civilian air raid casualties. The value of blood products, such as serum and plasma, in the treatment of oligaemic shock, and especially their value in secondary shock following severe burns, was clearly demonstrated. In 1940, too, Greaves (1941) working for the Medical Research Council, had developed a spin freezing method by which the blood products could be dried and bottled in an atmosphere of dry nitrogen, which would preserve them against ageing and deterioration for very long periods, two or possibly three years. An experimental plant, capable of drying 200 bottles each containing 400 c.c. of serum or plasma per week, had been set up at Cambridge by the Medical Research Council. By the end of 1941 experimental work had shown that serum or plasma, bottled and dried by the 'Greaves' process, was safe to transfuse

after being stored for many months at the ordinary ambient temperatures occurring in this country. It was also shown that blood grouping serum could be dried, and when stored in a dry state, would retain its potency for very long periods. To improve the standard of grouping serum available throughout the country, the Medical Research Council set up in 1940 an Establishment at the Galton Serum Laboratory, Cambridge, for selecting high titred human sera. This laboratory was in 1941 capable of supplying reliable standard high titred anti-A and anti-B serum to all who required it, including the Royal Navy.

In addition to these many developments, there was in 1941 a considerable influx into the Royal Navy of young medical officers who had had practical experience of transfusion methods for the resuscitation of the injured during the 1940 'blitz'. They realised to the full the practical value of these methods. In addition to these new entries, a considerable proportion of naval medical officers had, during these war years, passed through naval hospitals, and had seen the methods used there for the treatment of air raid casualties. The Naval Medical Service was, therefore, by the beginning of 1941 becoming 'transfusion minded'. Medical officers in ships commenced to agitate for better transfusion facilities to be made available to them on board.

As a direct result of these developments, it was considered that H.M. ships carrying medical officers should be supplied with dried serum or dried plasma, sterile saline or water to reconstitute this material, and blood transfusion apparatus for its administration.

THE FORMATION OF NAVAL BLEEDING UNITS

In view of the special difficulties with regard to the resuscitation of casualties pertaining in ships, the Medical Research Council, at the beginning of 1941, offered the Admiralty half the output of their Experimental Drying Plant at Cambridge. As already mentioned, this had a potential output of 10,000 bottles per year. At this time, however, the Blood Transfusion Regions, as a direct result of the 'blitz', were themselves short of blood products, and what was even worse, of donors. The raw material to provide 100 bottles of serum a week to be dried at the Cambridge Plant had, therefore, to come from naval sources. A naval bleeding unit was, accordingly, formed and consisted of one surgeon lieutenant, one naval sister and four naval V.A.Ds. The duty of this unit was to visit naval establishments and call for volunteer donors and bleed them. The blood thus collected into bottles was allowed to clot, and these bottles were forwarded to the North-west London Regional Supply Depot, Slough. Here the serum was separated from the clot and forwarded to Cambridge, where it was filtered and dried by the Medical Research Council Experimental Plant. By agreement between the Admiralty and the Medical Research Council, laboratory assistance was afforded at Slough in the form of six naval V.A.Ds. and three S.B.

ratings (L). This bleeding unit collected approximately 250 to 300 pints of blood per week, working four days per week. This rate of bleeding was sufficient at this time to cover requirements, as it needed not more than two-and-a-half pints of blood to produce one bottle of serum.

The Formation of a Second Naval Bleeding Unit. In September 1941, the Medical Research Council offered the Navy the entire output from their Experimental Plant, i.e. 200 bottles per week. The North-west London Depot, however, indicated that even with naval assistance, they were not prepared to handle more than 300 pints of naval blood per week. In order, therefore, to produce the extra raw material required for another 100 bottles of serum, another source of supply had to be sought. It was arranged between the Admiralty and the Ministry of Health that another naval bleeding unit should be formed, and that this should draw blood from civilian donors in Region No. 2. This unit consisted of eight naval V.A.Ds., two S.B. ratings (L) and two surgeon lieutenants. The serum from the blood collected by this unit was separated at the Region's laboratories at the School of Medicine, Leeds. It will be seen that these two units, which consisted of three medical officers, one nursing sister, 18 V.A.Ds. and eight S.B. ratings (L) were being employed at this time to bleed 600 donors, and to separate 80 litres of unfiltered serum per week. That such an arrangement was extravagant to a degree was shown later after the Royal Naval Blood Transfusion Service was established, for it was found then that this staff would have been adequate to bleed 1,800 donors and collect 300 litres of serum per week. As things turned out, however, this arrangement proved to be of inestimable value to the Navy, for later, when the Royal Naval Blood Transfusion Service was established early in 1942, these two units helped to form the nucleus of a trained staff on which this organisation was eventually built up. By the end of 1941, 5,000 bottles of dried serum had been issued to the Fleet, together with 5,000 bottles of sterile saline. The saline solution which was required for reconstituting the serum, was prepared for the Navy by a commercial firm under contract to the Admiralty. Most of these materials were employed during the latter half of 1941 for the treatment of wounded during the various amphibious operations carried out by Combined Operations Command. The packing and issue of these materials, together with the supply of sterile administration apparatus, was at this time being handled entirely by the Supply Division of the Medical Department of the Admiralty, through one of their Medical Store Depots under the direction of a Superintending Pharmacist.

The practical value of these materials for the treatment of casualties afloat was soon demonstrated, and it became obvious that the available supply of these materials was quite insufficient to cope with the demand. At the end of 1941 complaints were being received concerning the quality of the saline being supplied, for a large percentage of bottles

showed a growth of moulds, etc. The supply of administration sets was also apparently inadequate. Some hospitals, too, complained that they were short of blood products and had insufficient staff and equipment to process their own plasma from their own blood banks.

THE ESTABLISHMENT OF THE ROYAL NAVAL BLOOD TRANSFUSION SERVICE

The Medical Director-General, for these reasons, decided at the end of 1941, to establish a Royal Naval Blood Transfusion Service and appointed a surgeon captain, R.N., as Medical Officer-in-Charge.

At a meeting of the Blood Transfusion Research Committee held early in 1942, the Medical Research Council indicated that its Experimental Drying and Filtration Plant at Cambridge would no longer be available for handling blood products after September 1942. The Wellcome Trust, however, had offered £20,000 towards the cost of erecting a drying plant if it was considered to be a national requirement.

Since May 1941, there had been something of a lull in the air attacks on the country, and during this lull, the various Regions had been endeavouring to build up a stock of blood products. It was now apparent that, although the keeping quality of these was much superior to that of whole blood, they were unstable. The life of liquid plasma or serum varied from one to four months, depending on the method used in processing it. There was, therefore, at this time, a considerable wastage of these products taking place. It was unanimously decided at this meeting that the only practical method available for preventing this wastage, and the only way in which stocks of these products could be built up against a future emergency, such as a recurrence of the 'blitz', would be to dry them by the Greaves process. It was, therefore, agreed that there was a national requirement, and that the offer from the Wellcome Trust should be accepted.

The problems which now remained to be decided at this meeting were:

how large a plant should be erected,
who should manage it, and
how should personnel required for its operation be obtained?

The Medical Director-General's representative indicated that the Royal Navy's requirements would be at least 600 bottles per week, and in view of this, the Medical Director-General had agreed to help in the matter of personnel, by providing a number of naval V.A.Ds. It was eventually decided that the plant should be capable of drying, under ordinary running conditions, 3,500 bottles per week, and that it should be administered by the Ministry of Health, and that any additional staff, other than eight naval V.A.Ds., should be the responsibility of the Ministry of Health. The Navy would, when once their own Transfusion

Service was organised, filter all its own serum and forward it to this Ministry of Health Drying Plant, which it was agreed should be erected in Cambridge. Cambridge University had agreed to allocate the space required for the installation of this plant at Downing College.

When planning the organisation of the Royal Naval Blood Transfusion Service, it was realised that, to begin with, there would be a serious lack of trained personnel. The Service would, therefore, have to be built up gradually and be expanded as more and more trained personnel became available. There would have to be a modest beginning. The primary object of the Transfusion Service would be to improve and provide better facilities for the treatment of traumatic shock on board ship. It was considered that naval hospitals and sick quarters could continue quite well for the time being under the system by which they obtained help when necessary from the local Regional Transfusion Officer. It was, however, felt that although the supply of dried blood products, saline and transfusion apparatus in adequate quantities to ships should have the highest priority, there was still a requirement for whole blood transfusion on board ship. It was also considered that the development of a method by which whole blood transfusions could be rendered safe afloat, should be the concern of the Royal Naval Blood Transfusion Service. To make whole blood transfusion reasonably safe at sea, there were two essential requirements, namely, a medical officer fully trained in all matters pertaining to blood transfusion, and an accurately blood grouped population on board from which he could draw donors. It was considered that if 10 per cent. of the entire personnel of the Navy could be accurately typed and placed in their correct blood group, this would afford a reasonable chance of a number of accurately grouped universal donors being available in every ship at sea. The objects of the Service could, therefore, be stated in the following order of priority:

1. To train medical officers, nursing staff and laboratory technicians in all matters pertaining to blood transfusion, so as to allow the Royal Naval Blood Transfusion Service to expand and to make transfusion safe and easy on board ship.
2. To bleed and group as many naval personnel as possible, and as quickly as possible, so as to obtain serum for drying, and ensure that a reasonable percentage of every crew should be accurately grouped.
3. To provide ships with adequate quantities of dried human serum and sterile physiological saline solution for its reconstitution.
4. To provide ships with adequate quantities of transfusion apparatus, packed, assembled, sterile and ready for use.
5. To provide naval hospitals and sick quarters with liquid serum and transfusion apparatus.
6. To prepare all crystalloid solutions required for transfusion for the entire Navy.

7. Eventually to become a comprehensive Service so as to supply everything pertaining to transfusion for the whole Navy. In addition, to maintain a blood bank on which any hospital or sick quarters in the United Kingdom could make demands for O(IV) blood.

It was realised that, if the most urgent requirement, namely, the supply of dried serum to ships in adequate quantities was to become accomplished within a reasonable period of time, more donors would have to be found and bled. It was not considered practicable, at this stage, to attempt to bleed more than 600 to 800 naval personnel per week. The agreement between the Admiralty and the Ministry of Health, by which a naval unit was given facilities to bleed civilian donors in Region No. 2, was originally subject to certain difficulties. In June 1942, a new agreement was made between the Admiralty and the Ministry of Health, by which Region No. 2 would bleed for the Navy approximately 1,000 donors per week, and supply the naval laboratories with 175 litres of unfiltered serum separated from the blood thus obtained. The nursing staff required to carry out this programme would be provided by the Ministry of Health, and the only assistance that would be afforded Region No. 2 by the Admiralty would be to provide one medical officer and one sick berth rating (L). The Navy would supply Region No. 2 with all the apparatus required for bleeding donors, and assist Region No. 2 in obtaining any other necessary equipment. It would also afford the Region some assistance in transport, by providing one motor vehicle for the transportation of nurses, etc. The main advantages of this scheme were that it assured the Navy of a constant supply of serum, for it was known that this Region had the largest donor panel of any in the country. It also provided the Royal Naval Blood Transfusion Service in London with a nucleus of trained staff, on which to build up its organisation. This agreement was put into operation in August 1942.

In February 1942, part of the Royal Veterinary College, Camden Town, N.W.1., was requisitioned as the headquarters and laboratories of the Royal Naval Blood Transfusion Service. This building had only been completed in 1937, and was magnificently equipped with lecture rooms, laboratories, and refrigerator and incubator rooms. It was the ideal building for what was required, but it had been severely damaged in the 'blitz' of 1940. A great deal of repair work and alterations were necessary. These were undertaken by the Civil Engineer-in-Chief of the Admiralty, after the Medical Officer-in-Charge had indicated his requirements.

In addition to the laboratory rooms, space was obtained in this building for V.A.D. quarters, sufficient to house and sleep fifteen V.A.Ds. The building was not ready for occupation until June 27, 1942, but in the meantime, a great deal was accomplished. Stores for equipping V.A.D. quarters had to be obtained, civil industrial staff in the form of female cleaners and male labourers had to be engaged, and a transport service had to be organised in co-operation with the Naval Stores

Department, Admiralty. Victualling and cooking equipment and laboratory equipment, some of which was specially designed, had to be ordered. An efficient fire fighting service was trained by an arrangement with N.F.S. Incubator rooms and refrigerators had all to be serviced and put in working order by Chatham Dockyard. All this was accomplished at a time when the industrial production of the country was only just getting back on its feet after the tremendous disorganisation produced by the 'blitz'.

Until June 1942, the two naval bleeding units, one bleeding in naval establishments and one operating in Region No. 2, bleeding civilians, continued their activities, the blood received from Team No. 1 being forwarded to Slough, and that from Team No. 2 to Leeds, where the serum was separated and forwarded to Cambridge for filtering and drying. In June, all the naval personnel from Leeds, and from the North-west Blood Supply Depot at Slough, were transferred to the London laboratories, and from then onwards, all the blood obtained from naval sources and all the serum obtained from Region No. 2 was handled at the Navy's own laboratories at Camden Town. About this time also, Burroughs, Wellcome and Company erected a drying plant at Beckenham, and offered the Navy drying space for 50 bottles per week. The additional blood required to produce the serum for these fifty bottles was easily obtained, by increasing the output, from the team bleeding in naval establishments. This team, as already stated, was bleeding approximately 300 donors per week, and it had been found that with efficient training, and working five days a week, one team could easily bleed up to 1,200 donors weekly. By August 1942, the Navy was filtering all its own serum, and was bleeding at a sufficient rate to collect enough serum to produce 600 bottles per week, that is to say, it was bleeding at the rate of 1,800 donors per week. Approximately 800 of these donors were naval personnel, and 1,000 civilians in Yorkshire from Region 2. It was expected that the new plant, capable of drying these 600 bottles per week, would have come into operation in September. It did not, however, commence to operate until December 1942. Because of the delay in getting this new plant into operation, the laboratories had an excess of liquid serum left on their hands which could not be dried. It was, therefore, decided that this should be issued to naval hospitals and sick quarters. There was at this time a serious lack of refrigerator space at all naval hospitals and sick quarters, and it was known that serum could only be kept satisfactorily for long periods if stored frozen. Negotiations were, therefore, opened between the Medical Officer-in-Charge, Royal Naval Blood Transfusion Service, and Messrs. J. Lyons and Company. The sale of ice-cream had been prohibited throughout the country for a long period, and it was known that Messrs. Lyons had a large number of ice-cream freezing cabinets lying idle. It was thought that these might be adapted for either keeping serum frozen, or for

storing blood. Eventually, a contract was arranged between the Admiralty and Messrs. Lyons and Company for the temporary loan of these cabinets. Under this arrangement, all naval hospitals and sick quarters were provided with the additional refrigerator space required. It will be seen, accordingly, that, although the supply of blood products to naval hospitals and sick quarters was one of the objects of the Service when it was originally planned and was an object with a comparatively low priority, yet it was completed before any of the more urgent requirements.

The demands for liquid serum for hospitals and sick quarters were much less than expected, and there was still an excess of filtered serum after these had been met. Fortunately, it was found possible to keep this material stored in the spun frozen state at Cambridge until the plant there came into operation, and it was agreed that in view of the delay in getting this plant into working order, its complete output for the first few weeks should be made available to the Navy. This plant commenced to operate in the middle of December 1942, and by the end of the year, the Service had issued to the Fleet 15,192 bottles of dried serum and 5,818 bottles of physiological saline solution. The disparity between the number of bottles of serum and the number of bottles of saline solution issued is explained by the fact that the Admiralty held at this time approximately 10,000 bottles of saline prepared for the Navy under contract by one of the commercial firms.

ROYAL NAVAL BLOOD TRANSFUSION UNITS

During the years 1942–3, 58,000 naval personnel were bled and accurately blood-grouped by the Royal Naval Blood Transfusion Service. It was, therefore, realised early in 1943 that the requirement to bleed and group approximately ten per cent. of the entire Navy would be accomplished by the end of that year. Furthermore, a comparatively large number of naval medical officers had received a comprehensive course of instruction in blood transfusion matters. It was, therefore, felt that consideration might now be given to developing facilities for the administration of whole blood on board ship.

Much experimental work on this problem had been carried out at the laboratories. Grouping serum was being produced and issued, dried in ampoules, at such a rate that it was considered feasible to supply it to all ships. This was partly made possible by the Royal Naval Blood Transfusion Service having its own laboratory for selection of high-titred sera, and the resources of this laboratory greatly helped to amplify the output from the Medical Research Council Laboratory at Cambridge. It was considered, therefore, that if medical officers on board ship would confine themselves to selecting as donors only those men who belonged to the O(IV) universal donor group, and who had been accurately typed by the Service, blood transfusion on board ship could be a reasonably

safe procedure. In addition, experiments had shown that cross-matching could be easily and accurately performed with oxalated plasma, instead of serum from a patient against the cells of a donor.

Furthermore, this test could be carried out very rapidly provided that there was a centrifuge available. In conjunction with Chatham Dockyard, a piece of apparatus had been designed which could, by being attached to a standard naval table fan, be converted into an electrical centrifuge. This attachment was so designed that it could be mass produced quickly and inexpensively. The Royal Naval Blood Transfusion Unit was, therefore, developed. The contents of this unit were as follows:

CONTENTS

		One book of instructions.
Serum	.	5 M.R.C. bottles of dried human serum (sterile).
Saline	.	5 M.R.C. bottles of physiological saline solution (sterile).
Citrate	.	2 M.R.C. bottles each containing 120 c.c. of 2·5 per cent. di-sodium citrate in 5 per cent. glucose (sterile).
3 tins	.	each containing one sterile transfusion giving set and swabs.
1 tin	.	containing 2 sterile donor taking sets and swabs.

Blood grouping equipment:

2 × 0·25 c.c. ampoules Anti-A dried grouping serum.
2 × 0·25 c.c. ampoules Anti-B dried grouping serum.
One 6 oz. bottle of distilled water (sterile).
One 6 oz. bottle of 2·5 di-sodium citrate (sterile).
One 6 oz. bottle of physiological saline solution (sterile).
2 corked oxalate tubes.
3 × 5 c.c. empty screw capped bottles.
1 tile for grouping.
3 glass pipettes and rubber teat.
1 needle, triangular.
1 sterile syringe.
1 tourniquet (3 ft. of rubber tubing).
1 × 2 c.c. ampoule of 2 per cent. Novotox solution and file.
One 1 oz. screw cap bottle containing Dettol.
One centrifuge attachment with 2 centrifuge cups.

The book of instructions supplied with each unit explained in detail how all this apparatus should be used for checking the blood group of a donor, bleeding a donor and the administration of the transfusion. It was also fully explained how the centrifuge should be set up and how the cells of a donor could be cross-matched against the oxalated plasma of a patient.

It was suggested that every medical officer possessing these units should practise the following routine:

He should ascertain what members of the crew had been previously bled and grouped by the Royal Naval Blood Transfusion Service. He

should confirm at his leisure the blood groups of these men or a proportion of them, using the equipment provided in the unit. In this way, he would become proficient and experienced in the technique. If, for any reason, the medical officer was doubtful about the accuracy of a man's group (for example, should the man have lost the card given to him when he was bled), the medical officer could confirm or otherwise the man's blood group by signalling the R.N.B.T.S., giving the man's name and number in full and approximately the date on which he was bled. (The R.N.B.T.S. maintained a complete card index of every donor bled by them from the date of its inception onwards.)

When a casualty occurred which required resuscitation, it was suggested that the medical officer should start a transfusion using serum, but that when he introduced the needle into the vein to give the transfusion, he should first draw off five cubic centimetres of blood from the patient, collecting it in one of the oxalated tubes provided. If later he considered that this patient required whole blood, he could call upon one or a number, if available, of the universal donors on board and cross-match these donor's cells against the oxalated plasma before bleeding any of them. In the meantime, the patient would be receiving serum.

This scheme was suggested to the Medical Director-General and approved by him in April 1942. It was estimated that in the first instance, 4,000 of these units would be required and in addition, there should be available replenishments for all expendable material in the units sufficient to re-equip completely, 2,000 units. The scale of supply approved was:

5 units to every Capital Ship and Aircraft Carrier and Heavy Cruiser.
3 units to every Light Cruiser.
2 units to every Destroyer.
1 unit to every Small Ship carrying a medical officer.

Ships carrying more than one unit were to stow the units separately in various parts of the ship in order to reduce the chance of all the units being destroyed simultaneously by enemy action.

By the end of 1943, 2,000 of these units had been completed and issued to the Fleet, and the whole commitment was completed by September, 1944. Indeed, if it had not been for the requirements of 'Operation Overlord' this commitment would have been completed by April 1944, that is, one year after it had been approved by M.D.G.

During the year 1943, the Blood Transfusion Research Committee decided that all blood products being prepared for drying at the Ministry of Health plant at Cambridge, should be filtered only by those authorities who maintained a complete bacteriological laboratory capable of exercising a strict bacteriological control over their filtration plant. By arrangement between the Ministry of Health and the Medical Research Council, two filtration plants, one at Cambridge and one at the Lister Institute, were set up to filter the entire supply of plasma from all the Regions

except that operated by the Army. The Naval Blood Transfusion Service agreed to filter all the serum available. This organisation worked extremely well and reduced enormously the wastage of blood products that was occurring in the Regions. It also facilitated the setting-up of a complete blood bank at the R.N.B.T.S. laboratories, Camden Town, because the plasma recovered from the aged blood in the bank that had not been issued could be forwarded to the Lister Institute, where it was filtered and eventually dried at Cambridge. This plasma when dried was issued to the Regions.

Most of the Regions had a preference for dried plasma rather than serum. Some of the London Regions, like the Navy, however, were an exception and preferred to use serum. By this arrangement, therefore, the serum from these Regions was filtered at the R.N.B.T.S. laboratories, and during the years 1942 and 1943, 10,000 bottles of serum were filtered for the Regions by the Navy. Any serum above these requirements was retained by the Navy to compensate for the plasma supplied from its blood bank to the Regions.

By the end of 1943, the first six of the original objectives of the Service had been accomplished. Dried serum was now in ample supply for the whole Navy, including naval hospitals and sick quarters in the United Kingdom. Furthermore, the scale allowed to Service afloat had been increased to permit every ship an allowance equivalent to one bottle for every twenty-five men of its complement, and medical officers were instructed to demand more if they had any reason to think they would require it. There were ample supplies of all forms of transfusion equipment available, and it was open to all ships and establishments to demand anything wanted, including whole blood, for a blood bank of O(IV) universal donor blood had been established at the R.N.B.T. laboratories in December 1943.

A complete list of the products issued by the Royal Naval Blood Transfusion Service is shown below:

1. *Dried human serum*
   Issued in M.R.C. bottles containing the dried material from 400 c.c.
2. *Physiological saline solution*
   Issued in M.R.C. bottles containing one pint.
3. *Glucose saline solution*
   This consisted of a solution of 5 per cent. glucose in physiological saline and was issued in M.R.C. bottles containing one pint.
4. 10 *per cent. Glucose in water solution*
   Issued in M.R.C. bottles containing one pint.
5. *Glucose citrate solution*
   This consisted of 5 per cent. glucose in 2½ per cent. di-sodium citrate solution. It was issued in 120 c.c. amounts contained in M.R.C. blood collecting bottles fitted with special bleeding cap, so as to allow blood to be drawn from a donor into the citrate

solution, without opening the bottle. Usually issued together with a donor bleeding set.

6. *Donor bleeding sets*
   Issued sterile, assembled and ready for use in sealed boxes, containing in addition sterile swabs.
7. *Administration sets*
   Issued sterile, assembled and ready for use in sealed boxes.
8. *Dried grouping serum, anti-A or anti-B*
   Issued in ampoules of various sizes from 0·25 c.c. to 10·0 c.c.

For issue to Service afloat only

9. *R.N. Blood Transfusion Units (complete)*

For issue to Home hospitals and sick quarters and Amphibious Operations only

10. *Whole blood*
    O(IV) universal donor group blood in M.R.C. bottles each containing 500 c.c. of citrated blood. Each bottle labelled with the date of collection. Issued in insulated boxes, ice cooled, containing ten bottles.
    The internal temperature of these boxes is maintained at 2°–6° C. for thirty-six hours even in warm weather.
11. *Liquid human serum*
    Issued in M.R.C. bottles each containing 400 c.c.
12. *Ether extracted serum*
    Issued in M.R.C. bottles containing 400 c.c.

The issue of these products ceased when dried serum became available in such quantities that the issue of it had not to be restricted to Service afloat.

For issue for Special Amphibious Operations only

13. *Landing Ship units*
    Each unit contains eighteen bottles of dried serum, eighteen bottles of physiological saline and eight administration sets.

OPERATION 'OVERLORD'

By the end of 1942, although the Royal Naval Blood Transfusion Service can be said to have reached maturity, it was not fully grown. This Service had been planned so that, should any special emergency arise, a very rapid and very considerable expansion could take place. During the years 1942 and 1943, a large number of personnel had been trained, including medical officers, nursing staff and laboratory technicians. More space had been requisitioned at the Royal Veterinary College and this now, exclusive of the V.A.D. quarters, covered a floor area of fifty thousand square feet. The V.A.D. quarters too had been expanded to accommodate 25 V.A.Ds. Therefore, when an increased output of blood and blood products was called for to cover Operation 'Overlord' in February 1944, it was found possible, within a month, to expand the Service by about 100 per cent. The Tables below show the normal staff of the R.N.B.T.S. at the end of 1943 and its distribution, together with the staff necessary for Operation 'Overlord'.

ROYAL NAVAL BLOOD TRANSFUSION SERVICE

	Normal Staff	*Staff for Operation 'Overlord'*
Medical officers (including M.O.I.C.)	5	8
W.R.N.S. officers	1	1
Q.A.R.N.N.S.	1	1
Warrant wardmaster	1	1
V.A.D. commandant	1	1
V.A.Ds.	52	78
V.A.D. cook	1	1
Sick berth staff	9	12
Royal Marine drivers	2	5
Civil industrial staff		
Male labourers	4	7
Female cleaners and bottle washers	7	10
Cook housekeeper	1	1
Totals	85	126

DISTRIBUTION

London Laboratories

	Normal Staff	*Staff for Operation 'Overlord'*
Surgeon Captain as M.O.I.C.	1	1
Surgeon Lieutenant	1	1
W.R.N.S. officer	1	1
V.A.D. commandant	1	1
Warrant wardmaster	1	1
V.A.D. nurses	34	44
V.A.D. cook	1	1
Sick berth staff	8	11
Royal Marine drivers	2	5
Civil industrial staff		
Male labourers	4	7
Female cleaners and bottle washers	7	10
Cook housekeeper	1	1
Lister Institute Laboratories		
V.A.Ds.	2	2
Cambridge Laboratories		
V.A.Ds.	8	8
Leeds Laboratories		
Sick berth ratings (L)	1	1
Mobile Naval Bleeding Teams		
Surgeon Lieutenants (1 under training)	2	3
Q.A.R.N.N.S.	1	1
V.A.Ds.	8	24
Bleeding Team in Region No. 2		
Surgeon Lieutenants	1	2
V.A.Ds.	0	0
Bleeding Team South-west London Area		
Surgeon Lieutenants	0	1
V.A.Ds.	0	0

Operation 'Overlord' was the largest amphibious operation planned during the war. When it was planned, it was envisaged that the Navy would be responsible for the moving and carrying of all wounded from the Normandy Beaches to England for at least the first twelve days of the fighting, or until 'Landing Grounds' could be prepared for aircraft

and the Army could set up forward hospitals for the treatment of the more urgent cases. When this stage had been reached, it was expected that a great many of the wounded could be transported by air. Until then, however, the transport of wounded was to be carried out in specially fitted Landing Ship Tanks, and it would be a naval commitment to care for them until they were safely landed in England. It was, therefore, necessary for these L.S.Ts. to be supplied with ample resuscitation equipment and blood products. Seventy-five L.S.Ts. were to be equipped to carry wounded, and each would be capable of carrying up to 300 wounded men. It was decided in January 1944, that each L.S.T. should carry on each trip 90 bottles of dried serum, 90 bottles of physiological saline solution, and 24 bottles of glucose saline, and that there should be available at least one administration set for every two and a half bottles of transfusion material. It was considered that each L.S.T. would not make more than three trips carrying wounded. This commitment, therefore, entailed a demand for approximately 20,000 bottles of dried serum, 20,000 bottles of saline solution, 5,000 bottles of glucose saline and 10,000 administration sets. Furthermore, it was required that these supplies be delivered to the 'Hards' not later than May 25. This was a very considerable demand and it could not have been made at a more unfavourable time, for it was made when stocks held by the R.N.B.T.S. were extremely low owing to the fact that practically 4,000 Royal Naval Blood Transfusion Units had just been packed and distributed to the Fleet, and this alone had entailed the issue of 20,000 bottles of dried serum. In addition, there were very considerable demands outstanding, as the Navy was endeavouring at this time to build up a stock of these materials in Australia and the East Indies for the war in the Pacific. A meeting was, therefore, called at the Ministry of Health and this was attended by representatives from the Ministry of Health, the Medical Director-General and the Medical Research Council, and the Medical Officer-in-Charge, Royal Naval Blood Transfusion Service. It was decided at this meeting that:

1. Half the complete output (i.e. 1,500 bottles per week) of dried serum from the Cambridge drying plant should be made available to the Navy for 20 weeks.
2. That all the Regions should make a contribution of dried serum or plasma from their stocks.
3. That the Navy should supply the additional serum required for the drying plant but that it should be afforded facilities for bleeding donors in one of the London Regions.
4. That, as a temporary measure, the Regions should build up stocks of liquid serum or plasma, as there would be a shortage of dried material available to them.
5. That supplies of dried material were expected from Canada, and some of these would be made available to the Navy.

As a direct result of this meeting, the Navy received 10,000 bottles of dried serum from the Regions and eventually 28,000 bottles of Canadian material. The whole of the latter, however, was not received before D-day. It was also arranged that, if one medical officer was allocated to the South-west London Area, the nursing staff would be recruited locally to provide an extra bleeding team to draw blood from civilians entirely for naval use. This team, however, would have to be equipped and maintained from the Service Laboratories in London. In addition to the above, the Medical Officer-in-Charge, R.N.B.T.S., arranged that one naval team should be placed indefinitely in H.M.S. *Royal Arthur*, where it was considered that it could bleed at the rate of approximately 1,000 donors per week, and that another naval mobile team should be formed to visit other naval establishments. It was estimated that this team would bleed approximately 600 donors per week. It was also decided that a third naval team should be trained and held in readiness as a reserve.

This programme, it was estimated, would collect approximately 3,400 pints of blood per week. This calculation was based on the following estimated output from the various teams:

	Pints of blood per week to be bled
No. 1 naval team. Bleeding at H.M.S. *Royal Arthur*	1,000
No. 2 naval mobile team	800
No. 3 team. Bleeding at South-west London Region	600
Region No. 2	1,000
Total	3,400

This amount of blood would, it was calculated, be just sufficient to provide for the preparation of 1,500 bottles of dried serum per week.

The requirements for staff and equipment to put this programme into operation were placed before M.D.G. and duly approved and obtained. This programme was brought into operation during the first week in February.

Distribution and Packing of L.S. Units. The dried serum and saline were issued in Landing Ship units specially designed for the occasion by the Royal Naval Blood Transfusion Service. Each unit contained 18 bottles of serum, 18 bottles of saline and 8 administration sets. The size and weight of the unit was limited so as to allow it to be handled easily by two men. The glucose saline was issued in units containing 12 bottles and 5 administration sets. In all, 1,065 L.S. units and 484 glucose saline units were packed and issued. Each L.S.T. was supplied, in the first instance, with 5 L.S.T. units and 2 glucose saline units, leaving 710 L.S. units and 284 glucose saline units, which were held in reserve at the 'Hards' at Gosport and Southampton. All these materials were packed at the London laboratories and transported from there to the various

'Hards' by road. The whole demand was completed and issued by May 15, that is 10 days earlier than the target date.

THE SUPPLY OF WHOLE BLOOD FOR OPERATION 'OVERLORD'

In March 1944, the Blood Transfusion Service was informed that each L.S.T. should carry, in addition to blood products, 18 pints of fresh O (IV) blood per trip. It was calculated that at the commencement of the operation, in all 1,350 pints would be required, and following D-day, about 1,000 pints would be needed each week. Such a demand presented a number of problems. It was possible by this time, by improvements in technique, to keep blood stored in good condition for about one month, but it was not known how long it could be kept refrigerated when subjected to the vibration of a ship. Experiments carried out at the Service laboratories showed that if special precautions were taken, it could probably be maintained in good condition in these circumstances for about 14 days. It was, therefore, decided that if blood was to be supplied to these ships, it should not be more than 3 days old when received, or used after it had been on board for more than 10 days. To obtain 1,000 pints of O (IV) blood per week would entail bleeding approximately from an ungrouped population, 2,500 pints per week, and it was considered, for technical reasons connected with the difficulties of transport, that Region 2 should not be called upon to produce any of this blood. It was, however, completely outside the bounds of possibility for the London laboratories to collect and have ready at any moment, 1,350 pints of O (IV) blood of not more than three days old in its bank, for this would have meant bleeding from an ungrouped population at a rate of about 1,000 pints per day.

It must be remembered that the actual date of D-day was unknown and, therefore, the day on which the R.N.B.T.S. would receive the demand for the 1,350 pints of blood would not be disclosed until the very last moment.

A meeting was, therefore, called by the Medical Officer-in-Charge, which was attended by the Directors of the various Regions. It was decided at this meeting that each London Region would, from the middle of May onwards, increase its O (IV) blood banks by about 50 per cent. and that the Service would keep a blood bank of 750 pints of O (IV) blood of not more than three days old. When the call came it was hoped that it would be possible to make up the deficiency of 600 pints by collecting contributions from each of the London Regions. It was further agreed that if, after D-day, 1,000 pints per week were found to be insufficient, all Regions would endeavour, by increasing bleeding programmes in their areas after D-day, to assist the R.N.B.T.S. in making up the deficiency. It was, therefore, decided that the Third Naval Bleeding Team which was held in reserve, should be brought into operation on June 6, and a programme for it to do so was accordingly arranged.

When planning the bleeding programme, it was considered that although the commitment for the Navy to transport the Army's wounded would probably last for not more than 10 days, it would be advisable to ensure that blood was available on the scale envisaged for at least three weeks. The other commitments of 'Overlord' had already rendered it necessary to put into operation three naval bleeding teams to collect approximately 2,400 pints of blood per week. Furthermore, the programme arranged for these three teams covered a period extending up to the end of August. When planning the programme for the Fourth Team it was, therefore, arranged for it to cover the period June 6 to August 31, inclusive, and it was hoped that D-day would fall within this period and not later than August 10. D-day, as is now well known, fell on June 6, and although a pure coincidence, this was extremely fortunate for it fell on the very day on which it was arranged that the fourth team should go into operation.

The details of the programme planned and the total amount of blood and of O (IV) blood which it was hoped would be collected are shown below:

	Amount per week	*O (IV) Blood expected*
Team No. 1 operating in H.M.S. *Royal Arthur*	1,000 pints	460 pints
Team No. 2 operating in London, Chatham and South-east Kent .	700 pints	280 pints
Team No. 3 operating in West Country and Plymouth areas . . .	700 pints	280 pints
Team No. 4 operating in South-east London Region	600 pints	240 pints
Totals	3,000 pints	1,260 pints

It should be noted that it was hoped to bleed 2,400 naval personnel per week. In 1944, the commanding officers of naval establishments had become used to the visits of the bleeding teams, for these teams had attended and bled at practically every establishment at least twice a year for periods of one to three weeks at a time since 1942. The Commanding Officers of these establishments had accordingly, by this time, become 'blood transfusion minded' themselves and assisted the bleeding teams in every way in their power. The Medical Officer-in-Charge found, therefore, little difficulty in planning, arranging and putting this programme of bleeding into operation.

The collection and distribution of this blood presented the greatest problem, for the R.N.B.T.S. at this time possessed no refrigerated vans. All blood collected up to this time was transported in specially designed insulated boxes which were cooled by CO_2 snow. There were not enough of these boxes available to distribute all this blood, and furthermore, these boxes were very heavy and bulky and it would have required an enormous amount of transport and labour to distribute all the blood required for this operation if this type of box was employed. The

Medical Officer-in-Charge, therefore, again appealed to Messrs. J. Lyons & Co. to place at his disposal their complete fleet of five-tonner vans which they employed before the war for transporting ice-cream. These vans were not, however, in the strict sense of the term, refrigerated vans. They were each fitted with two insulated bunkers running along each side which were kept cool by means of blocks of dry ice which were placed loose in each bunker. Such an arrangement although eminently suitable for transporting ice-cream could not be used for transporting whole blood, as there was no means of controlling the temperature, and in any case this was far too low, being approximately 10° below zero, Centigrade.

Experiments were, therefore, made with one of these vans at the R.N.B.T.S. laboratories and from these experiments, the following satisfactory method of keeping blood at the correct temperature in these vans was developed.

The Service employed for packing purposes a cardboard carton which held six blood bottles. It was found that if these were packed with three bottles of blood and three bottles of frozen water and stacked three deep in a bunker with a fourth layer of cartons on top containing only bottles of frozen water, the temperature of the three layers containing blood could be maintained indefinitely, even in hot weather, at 2° to 4° Centigrade. This was ideal for blood. Furthermore, it was found by trial that the bottles of ice in the boxes containing the blood needed replacing only about once in every seven days, provided that those of the top layer were replaced daily. This method of stowing allowed 500 bottles of blood to be stowed in one bunker. The other bunker was used to stow bottles of water with dry ice at a temperature of approximately 10 degrees below zero. Each van, therefore, could carry 500 bottles of blood and also hold and freeze any fresh bottles of ice it required. It was only necessary to keep it supplied with fresh amounts of dry ice daily. Sick berth staff and V.A.Ds. were, therefore, instructed in the management and maintenance of a blood bank, using one of these vans, and the Naval Stores Department, Admiralty, was informed that these vans would prove suitable; and it was arranged for two of them to be supplied on permanent loan to the R.N.B.T.S., and three additional vans on temporary loan to cover the four months' period, from May to August inclusive. These vans were, however, heavy and slow. A great deal of the R.N.B.T.S. transport was driven by V.A.Ds., but these vans were far too unwieldy for a woman to handle. The G.O.C., Royal Marines, London, was approached, and he agreed to draft five Royal Marine drivers to the Service temporarily to cover the period of the emergency, and for two Royal Marine drivers to be provided permanently, or for as long as they were required. The Marine drivers on joining, were given a course of instruction on the management of the blood bank. It is worthy of record that they were found to be most receptive, and during the emergency

they carried out these duties with geat skill and efficiency. Furthermore, they were extremely valuable purely as man-power. The R.N.B.T.S. had seven labourers engaged at this period, but these civilians were either too old or, in some way, physically unfit for the Services; they were, therefore, not capable of any prolonged great physical effort. It will be realised that there was a good deal of heavy and bulky material to be handled at this time at the London laboratories, and for this the services of these Marines were invaluable.

On May 30, the Medical Officer-in-Charge was informed that the blood was required to be placed on board the L.S.Ts. by 1600 hours Monday, June 1. A call was sent out to the various Regions and 600 pints of fresh O (IV) blood were collected from the four London Depots and, in addition, the Welsh Region delivered with their own transport, 200 pints at 2400 hours on May 30.

During the night of May 31–June 1, three vans were packed with 1,350 pints of blood and all three vans were on their way to the 'Hards' by 0600 hours on June 1. All was satisfactorily delivered by 1500 hours and distributed to the L.S.Ts. by 1600 hours on June 1.

For the replenishment of supplies to the L.S.Ts. it was arranged that two vans, each holding three hundred pints of blood and a reserve of transfusion apparatus, should be stationed permanently, one at Gosport Hard and one at Southampton, from June 2 onwards. Each of these vans was staffed by a Royal Marine driver and a sick berth rating. It was left to these two men to arrange their own watches. These vans were continuously supplied from London daily with fresh amounts of blood and dry ice. They were in direct telephone communication with the London laboratories and kept the laboratories daily informed as to what stocks of blood and transfusion apparatus they held. A van, holding all replenishments required, set off daily from the R.N.B.T.S. laboratories and visited the vans at Gosport and Southampton, and after replenishing their stocks and collecting the 'empties' and aged blood, returned to London. The staffs operating the vans at the 'Hards' were relieved every four days.

This organisation worked extremely well and no hitch occurred. Any medical officer in an L.S.T. arriving at Gosport or Southampton, was able to have a van alongside within a few moments of arrival and could draw what fresh supplies he required.

The number of casualties suffered during the assault period was far fewer than expected, and the bleeding programme arranged by the R.N.B.T.S. was ample to cover all demands. It was, therefore, unnecessary to call on the Regions for any further assistance. It was, however, found necessary to keep the organisation functioning for the full six weeks, since weather conditions were such as to hamper the movement of wounded until the middle of August.* During

* See R.A.F. Medical History Vol. I, Chapter 10.

the first three weeks, however, although the casualties were fewer than expected, the demands for blood were approximately that calculated when the operation was planned. This was due to a number of unforeseen contingencies. The Army had agreed to keep its own hospital carriers supplied with fresh blood from Bristol, but on D-day + 2, the Royal Naval Blood Transfusion Service received a request from the Army Blood Supply Depot, Bristol, that these carriers might, in future, draw their blood supplies from the Royal Naval Blood Transfusion vans at Southampton, and this was arranged forthwith. On the same day, the Naval Port Officer at the Port of London, on his own initiative, informed the Medical Officer-in-Charge at the Royal Naval Blood Transfusion Headquarters that a U.S. Navy L.S.T. had arrived in the Port of London with casualties, and that it was short of blood, blood products and transfusion apparatus. No previous arrangements had been made to supply any of the U.S. Navy L.S.Ts. with blood transfusion materials. The Medical Officer-in-Charge sent a representative on board this ship to enquire what was required and, at the same time, communicated with the United States Naval Attaché in London and informed him that any supplies of this kind could be obtained from the R.N.B.T.S., London. From then onwards, all United States Navy L.S.Ts. arriving in London drew all their fresh supplies of blood and blood products from the R.N.B.T.S. Headquarters, and it can be stated that no United States Navy L.S.T. left London short of these supplies. In addition to these unexpected demands for blood, some additional demands were received from a number of naval hospitals whose own arrangements were insufficient to cope with the requirements.

During the whole operation, the Royal Naval Blood Transfusion Service supplied 3,640 pints of O (IV) blood, 80 per cent. of which was issued during the first three weeks. During the whole six weeks period, the four teams bled 15,000 donors, 11,000 of whom were naval personnel and bled in naval establishments, and there is no doubt that this number could have been exceeded. After June 27, however, the demands for blood were so modest that the bleeding programme had to be adjusted and reduced to prevent the wastage of blood. The total issues made for Operation 'Overlord' were as follows:

Whole blood: O (IV) group . .	3,640 pints
Dried human serum . . .	19,530 pints
Physiological saline solution . .	19,530 pints
Glucose saline solution . . .	5,208 pints
Administration sets . . .	11,000

When the operation was completed, 17,928 bottles of dried serum and 3,936 bottles of glucose saline were returned to Headquarters. It will be seen, therefore, that only 1,602 bottles of dried serum and 1,272 bottles of glucose saline were actually used during the operation. During this period, Region No. 2 had continued to forward 175 litres of serum

per week. There was now a great excess of serum in the laboratories awaiting filtering, and the stocks of dried serum now held, which included 28,000 bottles of Canadian material, were more than sufficient to cover the Far East commitments.

The staff at the laboratories had not had leave since September 1943, and they had been overworked and had been subjected to frequent aerial bombardment since October 1943. It was, therefore, decided to reduce all bleeding and work at the laboratories to a minimum and give leave.

Gradual Reduction Period following September 1944. After 'Overlord' had been completed, the whole situation had to be reviewed. Stocks of dried serum and liquid serum awaiting filtering held by the R.N.B.T.S., taken together with the stocks held by the Fleet and various Medical Depots, were such that it was calculated by the end of the year there would be sufficient dried serum available to keep the Navy supplied for at least two years. The stocks with regard to apparatus were also satisfactory. There was, however, still a considerable shortage of crystalloid solutions, and many demands for these materials were still outstanding. It was, therefore, decided to reduce bleeding to the minimum, in fact, to the extent only of maintaining a blood bank of approximately 300 pints of O (IV) blood. The agreement with Region No. 2 was brought to an end, and three of the naval bleeding teams were disbanded, only one team being kept in operation. Actually, at this time, it would have been impossible to employ more than one team profitably because during this period a number of naval training establishments closed down. By March 1945, all requirements for crystalloids had been met, and following V.E. Day, the naval requirements for blood transfusion products and accessories were more than complete. Following V.J. Day, it was decided to close down and disband the Service as the Royal Veterinary College authorities were anxious to return to their own building in London.

SUMMARY OF WHAT WAS ACCOMPLISHED BY THE R.N.B.T.S. DURING THE WAR

It would be much too long a story to relate in detail the many vicissitudes and trials that the Royal Naval Blood Transfusion Service passed through during the war, but some idea of what it accomplished can be obtained by studying Tables Nos. I and II.

Table No. I shows the number of donors bled by or on behalf of the R.N.B.T.S., and Table No. II the total amount of material issued by this Service to the Navy for each year. It will be seen from Table I that the Service obtained a great deal of assistance from the Regions but they afforded the Regions much in return. For example, the drying plant at Cambridge, which dried the blood products for the whole country with the exception of those collected in the Region operated by the Army, was almost entirely operated by naval V.A.Ds. who were under the

TABLE I

Showing the number of Donors bled by or on behalf of the R.N.B.T.S.

	1941 (Before the R.N.B.T.S. was established)	1942	1943	1944	1945	Totals
Naval personnel including W.R.N.S. and Royal Marines bled by mobile naval bleeding teams . . .	5,534	24,523	33,283	26,928	10,230	100,498
Civilians bled by R.N. teams	—	—	—	16,763	1,338	18,101
Civilians bled in Region No. 2 with assistance from the Royal Navy	6,000	28,800	47,118	32,000	—	113,918
Miscellaneous contributions from various regions .	—	—	1,470	2,400	2,538	6,408
Totals	11,534	53,323	81,871	78,091	14,106	238,925

Blood collected from 238,925 donors. Total number of bottles of dried serum produced = 105,000. Total amount of whole blood issued = 8,126 pints.

administration of the Royal Naval Blood Transfusion Service. Furthermore, the naval laboratories filtered any serum collected by the Regions. The filtration plant at the Lister Institute was also afforded some naval assistance in the form of two naval V.A.Ds. from the R.N.B.T.S. Region No. 2 whose contribution of serum to the Royal Navy was by far the largest of any Region, had the services of one surgeon lieutenant and sometimes of two for most of the war, and also that of a sick berth rating (L) to assist in the laboratory work.

It will be seen from Table I that during the war, 100,498 naval personnel were grouped and bled by the Royal Naval Blood Transfusion Service. Moreover, eighty thousand of these were bled during the years 1942–4 inclusive. Therefore, even when the wastage of men had been allowed for, there must have been more than 10 per cent. of the entire naval personnel accurately grouped at the end of 1944.

The falling off of the figures for the numbers bled for the year 1944 in spite of the large 'Overlord' programme can be explained by the fact that after August 1944, only a minimum of bleeding was carried out, in fact, only sufficient to maintain a small blood bank of approximately 300 pints. The figures for 1944, therefore, really only cover an eight months' bleeding programme, as compared with a full year's programme in 1943. It is worthy of note that 113,918 civilians from Yorkshire contributed their blood to the Navy during the war.

Table No. II requires little elaboration, but it shows that the Blood Transfusion Service issued as whole blood, 8,126 bottles. From the rest of the blood collected, it prepared 105,000 bottles of dried serum. It can, therefore, be calculated that it took approximately 2·2 donors to obtain enough blood for each bottle of dried serum produced. This speaks very highly for the technique of bleeding, filtering and processing, for it shows a theoretical loss from the bleeding to drying of only 13 per cent. This calculation is made on the assumption that every donor contributed a full pint of blood and that all the serum available was separated from the clot, neither of which assumptions is true in practice, for at least 8 per cent. of serum cannot be separated from the blood clot, and at least 2 per cent. of donors fail to supply a full pint of blood. It might be of value here to record that the incidence of fainting amongst all Naval donors, including W.R.N.S., was approximately 1·5 per cent.

It will be observed that in all, 137,778 bottles of dried serum were issued, yet only 105,000 bottles of this material were prepared by the Blood Transfusion Service. The failure of these figures to balance is explained by the fact that a contribution from the Regions of ten thousand bottles was received for 'Overlord', and in addition, the Blood Transfusion Service received a contribution of 28,000 bottles of Canadian material.

Following V.J. Day, all naval establishments reduced the stocks of blood transfusion material that they were holding against any emergency,

and returned the excess to the Royal Naval Blood Transfusion Service Headquarters. As a direct result of this the Service held the following stocks of materials when it finally closed down:

Dried human serum in M.R.C. bottles	15,120
Dried human serum in Canadian bottles	20,314
Physiological saline	18,360
10 per cent. Glucose in distilled water	2,832
5 per cent. Glucose in saline	8,256
Giving sets in tins	11,420
Taking sets in tins	3,200

TABLE II

Showing Total Issues of the R.N.B.T.S. during the War

	1941	1942	1943	1944	1945	*Totals*
Administration sets	Nil	Nil	11,286	35,137	4,952	51,375
*'Taking' sets	Nil	Nil	4,026	12,070	278	16,374
Dried serum (M.R.C. bottles) (400 c.c.)	5,243	16,192	35,855	70,694	9,794	137,778
Liquid serum (M.R.C. bottles) (400 c.c.)	Nil	346	Nil	Nil	Nil	346
Ether extracted serum (400 c.c.)	Nil	174	Nil	Nil	Nil	174
Physiological saline solution (pints)	Nil	5,818	35,518	70,479	22,432	134,247
*Glucose citrate solution in collecting bottles	Nil	Nil	4,026	12,639	515	17,180
5 per cent. Glucose saline (pints)	Nil	Nil	Nil	16,025	16,339	32,364
10 per cent. Glucose in water (pints)	Nil	Nil	Nil	3,711	9,456	13,167
R.N.B.T.S. units (complete)	Nil	Nil	2,000	4,001	277	6,278
Whole O (IV) blood (pints)	Nil	Nil	Nil	5,291	2,835	8,126

* Does not include 118,599 sets issued to R.N.B.T.S. bleeding teams during the war, or 118,599 bottles of glucose citrate solution likewise issued.

CHAPTER 10

NEURO-PSYCHIATRY IN NAVAL MEDICAL ADMINISTRATION

In the period between the two World Wars neuro-psychiatry, as a separate branch of clinical medicine, had acquired a strong foothold in the scientific world. Before the outbreak of the Second World War the Royal Navy had wisely recognised the importance of this subject, and its utility in dealing with not only mental casualties of modern warfare, but also in the conscription into a Fighting Service of large numbers of individuals from all walks of civil life.

In peace-time the Navy possessed no permanent specialists in this subject, though regular naval medical officers with experience of mental diseases were employed at the Royal Naval Hospital, Great Yarmouth. Unfortunately, while on general service afloat, the junior of these two medical officers lost his life by enemy action.

Early in the war, under the direction of an eminent consultant in neuro-psychiatry, who was granted the rank of surgeon captain, R.N.V.R., an organisation was built up in which a large number of experienced specialists in the subject were employed as medical officers in the Royal Naval Medical Service. With the active co-operation of the Naval Executive numerous powers were introduced and regulations framed for dealing with problems of mental health among naval personnel. The many specialists in neuro-psychiatry were employed, not only in medical establishments and certain hospital ships, but were carefully distributed in key points ashore such as depots and training establishments, where the problems of newly entered ratings could be studied. The result was that, in due course, large numbers of men were eliminated from the Service whose use to it was negligible, while others who were unsuitable for the type of work for which they had been conscripted, were diverted into branches of the Navy where such talents as they did possess could be usefully employed.

It was the opinion of the neuro-psychiatrists that it should be possible to detect, at the time of recruitment, a considerable proportion of recruits later destined to prove unsuitable for Service life owing to certain mental disabilities and inadequacies. Owing to the fact that full examination by a specialist in the subject was a lengthy procedure, it was impossible for a specialist to examine fully more than a certain proportion of entrants. It became obvious as the war progressed that there was need for a preliminary screening procedure to indicate those persons for whom a full psychiatric interview was desirable. The method adopted aimed at direct questioning as the main weapon in order to

elucidate points of psychiatric significance. It was considered that intelligent women with a little specialised training could be employed as questioners. The verbal procedure was not confined to any of the standard intelligence tests, but was flexible in nature, thus compensating for the loss of objectivity as compared with a purely questionnaire method. The basis of the method was to present each essential topic to the individual candidate in the most suitable way.

In the late summer of 1941 it was decided to appoint selected members of the W.R.N.S. as assistants to the naval recruiters whose duty it was to interview all men who had either volunteered for the Navy or had expressed a preference for the Navy when called up for National Service. These selected W.R.N.S. were only given a very brief course of training, though they were subsequently supervised by experienced psychiatric social workers, whose arduous task it was to travel round so that the practical tuition of the W.R.N.S. should continue. These supervisors were originally three in number for the whole country, but were later reduced to two, and finally to one. Instructions were provided to guide the W.R.N.S. assistants in making enquiries into each man's past record, and in asking certain additional questions when checking up the simple forms which all naval candidates had to fill up. The duration of the interview was usually about eight minutes.

The whole aim was that, in the case of markedly unsuitable candidates, information would be elucidated which would make it clear to the naval recruiter that the man was unsuitable and should therefore be rejected for naval service. In a higher proportion of cases, while the information elucidated did not actually justify rejection, it nevertheless indicated the desirability of a complete psychiatric examination by a specialist when the man reached his training establishment.

H.M.S. STANDARD

In the summer of 1941 consideration was given to the formation of a labour unit in which men whose conduct had been unreliable, but who had no medical complaints justifying invaliding, could be employed on work of naval importance whilst still remaining under naval discipline. From this developed H.M.S. *Standard*, a rehabilitation centre established in Northumberland. The selection of trainees was an executive decision arrived at with the assistance of the Medical Authorities. When a man's conduct was such that he was considered unreliable and useless in general service, but physically fit and amenable to training, he was placed in category C/Q and sent to H.M.S. *Standard* for training to become fit for either full or restricted service in the Navy. This system allowed both the Executive and Medical Authorities the opportunity to remove from general service, without actual discharge from the Navy, those troublesome individuals who were constitutionally unfitted for life at sea in time of war.

H.M.S. *Standard* was in fact a special unit where men who possessed such a low morale, or such a degree of temperamental instability as to make them unemployable as combatants, were received and wherever possible, treated. The particular group of men whose needs were served were to some extent both culpable and abnormal, but they were neither pure psychiatrics nor pure delinquents who could be dealt with either in hospital or in detention quarters. These were men who were not wanted in ships or on foreign service, who were physically fit, and who were not mentally afflicted to a degree which necessitated invaliding on mental grounds. Before the founding of H.M.S. *Standard* there was no provision for this particular group of men, and the problem with which the Service was faced was that if such men were permitted to escape their responsibilities to the nation and the Service in time of war, they might well infect others, whose morale might equally become impaired.

As many of the men to come under training in category C/Q might have a history of repeated desertion, it was necessary to choose a site for H.M.S. *Standard* which would render such an offence difficult. It was also necessary to provide an environment free from the distractions of cinemas and public houses, as well as air raids, and where the individual might become healthier in body and more settled in mind. Certain sites, including the Orkneys, were considered and rejected, and eventually a derelict camp was discovered in the heart of the Cheviots, which had once been a Ministry of Labour Training Centre for unemployed, but had been abandoned and had gradually fallen into decay. This camp was requisitioned by the Admiralty, and was reconstructed and extended. By January 1942 it was fit for use, and the first trainees arrived in the following month.

The view of the Admiralty was that the establishment should be a place in which hard manual work might be substituted for the hazards and hardships of active service afloat, the primary object being to instil self-discipline, and to show the individual that privileges are the reward for correct conduct and steady industry, and not his prerogative. This having been achieved, the intended procedure was to place the individual, in due course, in a situation where the environmental circumstances would not prevent his giving reliable service.

On the whole the officers responsible for the internal organisation of H.M.S. *Standard* were given a remarkably free hand within the normal framework of naval disciplinary requirements. Some preliminary general regulations were laid down at the outset regarding the treatment of the ratings sent to the establishment, but it was never regarded either as a hospital or as a penal settlement. The camp was under Executive control, and represented a combined operation between the Executive and Medical Authorities.

The camp itself was situated in a valley with hills on three sides and a river on the fourth. The isolation was extreme, which served the

double purpose of discouraging deserters and avoiding the visits of camp followers. The district was remarkably healthy and physical illness was rare. There were no structural boundaries to the establishment. Leave was restricted and was not granted at all until after a probationary period of one month's good conduct. After four Saturday afternoons ashore without untoward incident, each man became entitled to week-end leave at home, and a further week-end each month subsequently. Men who had responded well were granted seven days leave before drafting to a ship or to shore service abroad. Daily routine in H.M.S. *Standard* was:

6.45 a.m.	Hands turn out
7.15 a.m.	Fall in for 20 minutes' P.T.
8.0 a.m.	Breakfast
8.10 a.m.	Sick list
8.45 a.m.	Divisions and prayers
9.0 a.m.	Work commences
10.45 a.m.	Stand-easy for 10 minutes
12.00	'Secure' (i.e. pack up work)
12.10 p.m.	Dinner
1.20 p.m.	Fall in: work recommences
2.45 p.m.	Stand easy for 10 minutes
4.0 p.m.	'Secure'
4.10 p.m.	Tea
5.0 p.m.	Fall in for Evening Quarters, P.T. or instruction
6.0 p.m.	'Secure'
7.0 p.m.	Supper
10.0 p.m.	Pipe-down

When the camp was opened it was hoped that the surrounding forest would provide an inexhaustible supply of hard outdoor work for the trainees, but unfortunately the available work in the vicinity of the camp was completed, thereby bringing to an end a most healthful and popular form of employment which was also of direct value to the community. Other useful work included land drainage, the building of an Admiralty-owned reservoir, and farm labouring. In the latter case a number of men was employed as far away as ten miles from the camp. Some of the trainees worked very well at these occupations, and benefited both physically and mentally.

In addition to general measures, special treatment by way of personal influence formed a most important element in the system of rehabilitation at H.M.S. *Standard*. There was here probably more personal and individual attention than anywhere else in the Navy, and this was made possible by the comparatively large number of officers staffing the establishment in relation to the usual strength of the trainees, normally limited to 100. Each trainee was interviewed frequently by the commanding officer, schoolmaster, chaplain, medical officer and psychiatrist, and these various officers each exerted an influence from their own particular aspects, and were ready to pool their knowledge for the benefit of others. In this way a common policy could be reached. The final phase of treatment aimed at an assessment of the individual by the

commanding officer from the executive aspect, after obtaining a clear impression of him from the psychiatrist.

In the course of time the methods were gradually altered. The aggressive type of trainee required an outlet for his impulses, which was provided by physical training, games, and manual work in the open air. The timid and heavy-hearted were encouraged to exert themselves both physically and mentally in an effort to improve their morale. Behind the daily work and exercise there was a constant round of naval routine in which hoisting colours, divisions, church, rounds and the rum issue all played a part in keeping the trainee in touch with the Service to which it was hoped he would eventually return as a useful member.

After three months in H.M.S. *Standard* the suitability of a trainee for draft came up for discussion. Between 3½ and 4 months proved to be the average length of stay. Four months after taking up an appointment, a report was made to H.M.S. *Standard* by the medical officer of the ex-trainee's ship or establishment.

This drafting of the trainee was the most important function of H.M.S. *Standard*. Training based upon occupational diagnosis enabled a definite decision to be reached in many problem cases. Certain trainees were recommended for discharge as useless, while others merited purely medical disposal. But in the bulk of cases, after observing a C/Q trainee for a number of weeks, it was usually possible to suggest the best type of future employment in the Service. Some men require restricted duties, such as service in depot ships, boom defence vessels, small coastal craft or shore bases at home or abroad, but over one-third were considered fit for general service, and in any case a rating trained to any form of useful service of a restricted nature released a more suitable man for general service, an important consideration in time of war.

H.M.S. *Standard* was closed on July 13, 1945, and during its existence 842 trainees were received, of which 680 were transferred to useful service employment, including 271 to general service. In addition to the valuable function of raising and maintaining the morale of inadequate individuals for service in the Navy, H.M.S. *Standard* also played a part in producing a number of good citizens.

POSTINGS OF NEURO-PSYCHIATRISTS

During the war years specialists in neuro-psychiatry were employed in the following Naval Hospitals and Auxiliary Hospitals:

Chatham	2	Alexandria	1
Knowle	5	Colombo	1
Barrow Gurney	3	Trincomalee	1
Wraxhall Court	2	Sydney	2
Cholmondeley Castle	5	Haslar	2
Kingseat	2	Plymouth	2

Two such specialists were employed afloat in hospital ships, and specialists were appointed to the following shore establishments:

R.N. Barracks,	Chatham	2		Clyde Area	2
	Portsmouth	2		H.M.S. *Standard*	2
	Devonport	2		H.M.S. *Royal Arthur*	1
				Scapa Flow Area	1

and one for duty with the Naval Air Arm.

The disadvantage attached to the early employment of specialists in this subject was lack of experience of service afloat. Such service was frequently recommended but was impossible to implement until 1944, when the paramount qualification required in medical officers wishing to specialise in neuro-psychiatry was that they should have spent a period of at least six months in one of His Majesty's Ships afloat.

CHAPTER 11

MEDICAL STORES AND EQUIPMENT*

In dealing with the question of the supply of medical and dental stores to H.M. Ships and Establishments, it would appear desirable to indicate the general arrangements in peace-time, as on those arrangements mainly depended the expansion necessary to war-time conditions.

The Medical Director-General of the Navy is responsible for stores of all kinds in naval hospitals and marine infirmaries, for sick bays of H.M. Ships, and for hospital ships, and sick quarters generally. He is also responsible for medical stores in H.M. Dockyards, and for all dental stores and appliances supplied for the use of naval and marine personnel.

In peace-time there was only one hospital ship, the *Maine*, but for war, provision was made for taking up eight hospital ships or carriers. This was done on the charter basis, and the provision of other than medical technical stores became the province of the owners, whilst ward equipment, stores, etc., were provided by the appropriate Admiralty departments.

The general procedure in peace-time was that a stock of general medical and dental stores was kept at the Medical Depot, Deptford, but bedding and clothing were drawn as and when required from the naval store depots and victualling yards. Issues were made on requisitions approved by the M.D.G.'s Department.

ORGANISATION DURING THE WAR

At the beginning of the war, therefore, the principal depot for the storing of reserve stocks of medical and dental stores was at Deptford, and early in the war subsidiary depots were established at Coventry and Liverpool. Unfortunately, all these depots were destroyed at various times by enemy action, but they were replaced and added to as requisite.

At the naval depots were maintained stocks of the more important classes of stores in common use in the Medical Branch of the Royal Navy, e.g. dressings, instruments, medical glassware and earthenware, X-ray machines and stores, microscopes, and dental stores of all kinds.

All stores for shipment abroad passed through a transit store, also situated at Deptford, for examination before freightage. This transit store was later transferred elsewhere.

Issuing depots for service afloat stores were maintained at the three main naval hospitals, Chatham, Haslar and Plymouth, and at an early

* Compiled from the records of Mr. P. A. Cackett, Civil Assistant to the Medical Director-General of the Navy.

stage of the war one was established at Dunfermline for ships in northern waters. At these various depots were kept stocks of medical stores for issue to the Fleet. Stores for H.M. Ships, comprising medicines, dressings, surgical instruments, dispensary necessaries, etc., were issued on commissioning a ship, packed in chests of various sizes and contents, according to the class and complement of the particular ship.

Demands for replenishments of stores of H.M. Ships were also fulfilled by the depots at the R.N. Hospitals. The stores at these hospitals were in charge of a Superintending Pharmacist, who in addition was responsible for the storekeeping duties connected with all supplies for actual consumption and use of the patients in the hospital itself.

The packing of all stores was in accordance with approved scales, and a number of chests was maintained in readiness for immediate use. As a war measure a special packing depot was instituted at Chatham Hospital in order to ease the congestion of work at the other depots, but that also was moved elsewhere. Eight different units were normally held for various classes of fighting ship.

At naval hospitals abroad, viz. Malta, Hong Kong, Simonstown and Bermuda, service afloat depots were maintained for the issue of stores to ships on their respective stations. The work, however, mainly consisted of replenishments. A small depot existed at Gibraltar, and early in the war a medical store depot was instituted at Alexandria to serve as an alternative depot to Malta. A medical store depot was instituted at Trincomalee before the war, principally for the custody and maintenance of the reserves of stores and equipment for hospital ships which it had been expected would commission at Bombay or Calcutta. The turn-over of perishable stores of the hospital ship units was effected by issues to H.M. Ships on the East Indies Station, replacements being sent out from England.

In addition to day to day issue of stores, the medical depots at home assembled, as directed, special outfits which might be required for a particular service, e.g. tented hospital units for mobile naval base defence organisations. Units for hospital ships and carriers were assembled and kept in reserve at Haslar, Plymouth and Chatham.

Medical stores were returned to service afloat depots from H.M. Ships on 'paying off', and they were there surveyed by technical staffs before being disposed of, i.e. serviceable stores taken into stock, unserviceable stores sold or destroyed. At R.N. Hospitals where service afloat depots were carried, one common stock only of medical stores was maintained, i.e. separate stocks were not kept apart for the service afloat. Issues were made from the common stock to ships, sub-establishments, and for use within the hospital itself as requisite. In peace-time the stock was maintained at a figure sufficient to provide a working margin of six months' issues and expenditure. Demands for

replenishments were rendered to the Medical Department twice yearly, but provision was also made for supplementary demands if considered urgent.

The general procedure for the purchase, supply and maintenance of medical and dental stores and equipment for H.M. Naval Service was carried out at the Medical Department, Admiralty, and purchases were made direct by the Department under contracts made by the Director of Contracts in consultation with the Medical Director-General.

Arrangements for the economical and expeditious acquisition of technical stores were made by means of:

(*a*) Competitive tender,
(*b*) Standing contract,
(*c*) Discount agreements.

(*a*) *Competitive Tenders*

Any requirements involving expenditure of a sum of over £50 were normally put out to competitive tender. In cases of urgency this might be done by wire or telephonic communication in close liaison with the Medical Department. Dressings in bulk, X-ray apparatus, etc., are examples of requirements filled by competitive tender.

(*b*) *Standing Contracts*

These were made on a competitive basis with manufacturers for many classes of stores in common use. Supplies were made at a net price approved by the Director of Contracts, and requirements were ordered as they arose direct by the Medical Department.

(*c*) *Discount Agreements*

These existed with a number of firms and covered a wide range of miscellaneous items which were supplied by the firms concerned at the published catalogue price less an agreed percentage of discount. Orders were placed direct by the Medical Department.

Sundry articles not covered by the arrangements at (*a*), (*b*) and (*c*) were purchased direct, by the most convenient and economical method, by the Medical Department up to a total net value of £50. Stores over £50 in value were dealt with as at (*a*).

Specifications. For dressings, surgical instruments, sterilisers, clothing and most articles in general use specifications had been evolved through years of trial and error in collaboration with the technical advisors to the Medical Director-General, the Directors of Contracts, Electrical Engineering, and Victualling, with special regard to service afloat and tropical requirements.

Inspection. All goods, either before or immediately after delivery, were inspected by technical officers of the appropriate depot or hospital, or by the Technical Assistant to the M.D.G. in conjunction with the technical officers of other Admiralty Departments.

Local Purchase. Establishments were empowered to make local purchase in cases of urgency to the value of £20 at large hospitals, and £5 at smaller hospitals.

Interdependence between Admiralty Departments. The closest liaison with many Admiralty Departments was essential and was maintained on supply questions, as even some of the technical stores were supplied by them, while equipment stores such as bedding, linen, cutlery, etc. were largely supplied by the Directors of Stores and Victualling. For instance, in medical establishments, the Director of Electrical Engineering would undertake the purchase and the fitting of bowl, instrument, water and dressing sterilisers, shadowless operating theatre lights, etc.

In the service afloat the Director of Stores would supply operating tables, lotion bowl stands, instrument tables, electric kettles, etc., whilst the Director of Naval Construction would fit out a dispensary. The Medical Department was also in constant touch with the Civil Engineer-in-Chief, Surveyor of Lands and the Keeper of Stationery and Printing.

Annual Store Estimates. Annual estimates of certain classes of stores in common use, e.g. dressings, dispensary necessaries, glassware and earthenware, which were likely to be required were furnished to the Medical Department by establishments and co-ordinated there, and purchase in bulk was based on the total figures provided. Similarly, requirements of naval and victualling stores were recorded and tabulated, and establishments were authorised to draw such stores as were necessary as and when actually required from the respective depots. In addition, as knowledge of future policy was essential to the procuring of annual demands for the maintenance of supplies, the Medical Department was kept informed of forthcoming commissionings of ships, new stations, and movements generally. Extraordinary commitments at short notice, and involving an entirely new scale for special service, were frequent, and therefore the most intimate liaison with the Director of Plans and Operations was essential in order that these might be met.

No special scale of stores was laid down for a naval hospital, and the requirements were governed by the exigencies of the situation and the number of patients under treatment. The smaller of sub-establishments, dockyard surgeries, sick quarters and marine infirmaries, would demand the stores required from the nearest naval hospital. Surgical instruments, X-ray and laboratory apparatus, however, were demanded through the Medical Department, and dealt with there in a similar manner to the demands of the larger establishments.

H.M. Ships were supplied with medical stores in accordance with authorised scales. On commissioning, the ship would draw the stores allowed to her particular class from the naval hospital of her manning port, and replenishments were drawn similarly by the medical officer without reference to the M.D.G., provided the scale allowed was not

exceeded. When for any special reason it was necessary to exceed the authorised scale, the prior approval of the M.D.G. was required.

Provision was made, however, for a considerable increase during war-time over and above the peace-time scales.

All stores were accounted for to the Medical Department by means of stores accounts. At the hospitals, the loose-leaf ledger system was in operation and was continually extended to other establishments, but H.M. Ships rendered an annual account to the Medical Department.

PROGRESSIVE EXPANSION AT HOME AND ABROAD

During 1939, in accordance with the approved policy, the assembling of reserves of medical stores and equipment proceeded in order to meet the war requirements of shore establishments and the Fleet. The immediate requirements anticipated on the outbreak of war were:

(*a*) The equipping and storing of 19 large hospitals and sick quarters, as well as a number of smaller establishments.
(*b*) The storing of all new men-of-war under construction, and all His Majesty's Ships brought forward out of reserve.
(*c*) The storing of three hospital ships and three hospital carriers.
(*d*) Additional commitments were the requirements of a number of armed merchant cruisers, and several hundreds of small craft.

Some months before the outbreak of war, emergency contracts were made for the supply of certain essential medical materials at stated periods should hostilities begin. On September 3, 1939, these contracts were successfully operated, thereby ensuring a continuous delivery of stores to meet naval requirements, and such important items as surgical dressings, ligatures, anaesthetics, sera, and X-ray films were adequately covered.

During the first three months of the war a number of extra commitments had to be undertaken. These included the supply of medical equipment concerned with the passive defence of naval shore establishments, including dockyards. Equipment for blood transfusion was also supplied to all ships and establishments carrying a medical officer. A commitment which was not wholly foreseen, but which was adequately met, was occasioned by the appointment of a medical officer to each of H.M. Destroyers afloat. In peace-time a medical officer was carried in the Flotilla Leader only, and this increase meant that approximately 100 destroyers had to be equipped urgently with such extra stores and equipment as were demanded for the use of a medical officer on board.

In the year 1940 there was a progressive increase in the demands made for medical stores by H.M. Ships and establishments, and this increase was met in spite of the many difficulties arising from enemy air activity during the year, and which seriously affected communications, deliveries and transport.

By the end of the year demands from shore establishments had reached a rate of 4,500 per annum, as compared with 1,500 in peacetime, and the service afloat commitments had increased in similar proportion.

During 1940 medical stores and equipment were dispersed between Deptford, Coventry, Liverpool and Grangemouth, as the main storing depots. Further dispersal was effected amongst the issuing hospitals, and new supply depots were opened at Dunfermline, Scapa Flow, and overseas at Alexandria. Nevertheless, the Liverpool depot was severely damaged by air attack, and medical stores to the value of £66,000 were lost.

At this period of the war it was obvious that pressure of work in the issuing hospitals had led to a serious reduction in the holdings of packed units. A packing depot was therefore opened in R.N. Hospital, Chatham, which was able to meet the majority of service afloat commitments, and could supply a fixed reserve of packed units to each naval hospital. Experience also prompted various alterations in the scales of medical stores supplied to ships, and two new units were added to meet the special requirements and complements of new vessels, while a unit was instituted for land operations.

Mobile surgical units were also constructed and attached to the various hospitals, where they were available at short notice to give help to the Service and civil populations in remote areas.

In 1940 one additional hospital establishment was fitted out by the medical stores depot at Trincomalee.

Subsidiary to these main commitments were other supplies of some importance which added to the burden of naval medical depots. Among these were the distribution of mixed TABC and tetanus toxoid vaccine prepared in the Naval Medical School at Clevedon, the distribution of anti-influenza vaccine obtained from the U.S.A., and the provision and installation of ultra-violet lamps in submarine depot ships.

In addition to these early commitments of the war, constant attention was paid to the memorandum of the Medical Research Council in relation to the restricted use of, and substitutes for, imported drugs.

During the year 1941 the progressive increase in the demands for medical stores continued.

The system of supply was seriously embarrassed by enemy action early in the year, when large stocks and units assembled and ready for despatch were destroyed at Deptford. Grave losses were also experienced at Haslar, Coventry and Plymouth. This necessitated complete reorganisation and replacement, and depots were established at Huthwaite, Leicester and Wellingborough. A further measure of safety aimed at increasing dispersal of stores at the issuing hospitals. Plans were also drawn up to provide new depots at Liverpool, and in Northern Ireland at Londonderry.

Additions, revisions and deletions continued to be made in the service afloat scale, following on the experience of medical officers on introduction of new therapeutic measures. Among other items dried serum was supplied to all ships carrying medical officers. All medical and dental officers were provided with a personal issue of tubonic ampoules of omnopon and scopolamine, the supply of quinine was increased to H.M. Ships, and benzedrine was issued as the subject of a special confidential memorandum.

Three tented hospital units were assembled during the year.

During 1941 pulmographs for mass radiography were installed at Portsmouth and Plymouth in addition to Chatham, and on account of the greatly increased work it was found necessary to replace many of the existing X-ray units throughout the Service with a type of apparatus capable of carrying a heavier load.

Oversea, a new supply depot was organised at Freetown. In the case of Alexandria, complete replenishments for the service afloat depot there were destroyed and lost on passage on three successive occasions. The consequent difficulties were solved to some extent by the supply of medical stores, both at Alexandria and other places abroad, from the U.S.A. H.M. Ships refitting in the U.S.A. also drew replenishments from U.S. naval sources. These arrangements proved of great service. In addition to varieties of medical stores, including several X-ray units which were presented by the American Red Cross, a valuable X-ray unit was also presented by the General Electric Corporation of Chicago.

In 1942 the new supply depots at Liverpool and Londonderry were opened, and also a depot at Bournemouth. At the same time the question of the institution of supply depots in Glasgow and the Orkneys came under consideration, and consignments of medical stores for the emergency replenishment of H.M. Ships were despatched to various sites on the south and east coasts of England, in order to ensure a minimum of delay should communication with the larger distributing depots be inconvenient or interrupted.

A large number of new auxiliary hospitals and sick quarters was equipped in the United Kingdom, and various new depots and medical store units were devised from time to time to meet special needs and circumstances.

Additions, revisions and deletions continued to be made in the service afloat scale, and the need for economy was observed, not only by various modifications in drug supplies, but also by measures aimed to conserve tin, rubber, and other materials which had become scarce.

There was a continued need for the provision of more powerful X-ray units in various establishments, and four new mass radiography units were ordered for use at Lowestoft, H.M.S. *Raleigh*, Glasgow and Liverpool.

Oversea commitments continued to expand during 1942, and following the re-distribution of the Eastern Fleet after the fall of Hong Kong and the Japanese invasion of Malaya, new supply depots were opened at Durban and Kilindini. Stores were also despatched to equip such a depot at Haifa should the need arise. A considerable amount of stores was assembled to equip a 600-bedded hospital at Durban, and further valuable aid from the United States of America included the equipment of the Royal Naval Auxiliary Hospital, Colombo.

In 1943, the number of demands for medical stores showed still a further increase of 10 per cent. above the demands received in 1942.

New supply depots were opened at North Shields and in the Orkneys.

The particular needs of past and impending operations led to the necessity for devising many new types of medical store units, and the experience of medical officers who had used these units was employed with advantage as regards the modification of contents, methods of assembling, and mode of despatch. The first-aid outfit for flying personnel was revised, and additions were made and the form of pack altered. A new comprehensive type of blood transfusion unit was also in full production, and was issued to depots for supply to H.M. Ships.

In conformity with the advance of medical knowledge and the introduction of new forms of therapy, continued revision and modification of the service afloat scale was effected, and outmoded drugs and stores were deleted and replaced by others of proved therapeutic value. In 1943 tablets for the relief of sea-sickness were introduced into the scale for the first time.

Oversea, a large number of new naval medical establishments were formed and supply depots were opened at Algiers, Bombay and Taranto. Equipment for the proposed new naval auxiliary hospitals at Bombay and Nilavoli, Ceylon, was assembled and shipped.

Medical stores for certain stations abroad continued to be obtained from the United States under lend-lease, and in the United Kingdom, as a result of negotiations between the Admiralty and the Ministry of Supply, a considerably greater use was made of the facilities of the Ministry for procuring medical stores and equipment, and a close degree of liaison was established between the departments for facilitating production.

The vast commitments of 1944 and 1945 concerned the supply of stores and equipment to cover the many incidents occasioned by the offensive trend of this stage of the war both in Europe, the Mediterranean and the Far East.

The invasion of Normandy called for special stores for Landing Craft fitted to receive casualties, and for the use of the medical and nursing staffs of port parties.

A stores depot was established in Sydney, and the requirements of naval auxiliary hospitals there and at Brisbane received attention.

Naval auxiliary hospitals in Trincomalee and Colombo (St. Peter's) were equipped, and preliminary steps were taken to establish in Bombay a Royal Naval Tropical Research Unit.

In the United Kingdom a new supply depot was opened at Bishopston, Renfrewshire, for the replenishment of establishments in the Glasgow area, and a sub-depot was opened at Belfast.

In the Mediterranean area a sub-depot was established at Naples.

A major commitment was the supply of equipment and stores to the new organisations of mobile naval air bases and mobile landing craft advanced bases, as well as supplies for malaria control units in Ceylon and elsewhere in the Eastern Theatre.

The supply of mass radiography units continued to be made, and the modifications to the service afloat scale received constant attention.

REDISTRIBUTION AND DEMOBILISATION

In the closing stages of the war attention had to be paid, not only to the maintenance of the various individual medical organisations of the Navy in conformity with the final phases of hostilities, but also to the rehabilitation policy of the immediate aftermath of the war, as well as the reconstruction measures of the future.

A new medical supply depot was made available at the Royal Ordnance filling factory at Risley, near Warrington, to replace requisitioned property in the Midlands. Transfer of stocks from Huthwaite and Leicester proceeded in order to permit the early release of these properties, and the sub-depots in Orkney, Belfast, Bournemouth and North Shields were closed down and the properties de-requisitioned.

Oversea, the medical depot at Freetown was closed, and its stores transferred to Colombo. The depots at Alexandria, Durban and Bombay ceased issuing, and the stores there were dispersed and disposed of, those from Bombay being transferred to Singapore when the latter place was relieved. Likewise medical stores for Hong Kong, on its re-occupation, were supplied from the depot in Australia. The sub-depots at Naples and Taranto were closed and the contents transferred to Malta.

As part of the process of reconstruction, new major diagnostic X-ray units were installed in the naval hospitals at Plymouth, Chatham and Haslar. Mass radiography units were supplied for the Royal Naval Air Station, Lee-on-Solent, and as a replacement at the Royal Naval Barracks, Chatham.

A major commitment was the distribution of penicillin produced at the Royal Naval Medical School, Clevedon, which became a most welcome source of supply, particularly on the cessation of the lend-lease agreement with the U.S.A.

The closing of many auxiliary hospitals and sick quarters, and the paying off of many of H.M. Ships, greatly increased the congestion in

the naval medical store depots. As a result the storage of large masses of medical material awaiting disposal by the Ministry of Supply became a problem, and the surveying of returned stores was materially delayed.

In addition to this broad outline which has been given, the following details concerning medical stores and supplies during the war in the Royal Navy are of interest:

During hostilities the following additional store depots were established:

England

Liverpool (Melias Building) destroyed by enemy action December 22, 1940.
Coventry . . . established May 1939, transferred to—
Leicester . . . „ May 1941.
Huthwaite . . „ July 1941.
Wellingborough . . „ July 1941.
Huddersfield . . „ March 1941.
Barnoldswick (Transit Depot) established May 1942, transferred to—
Salford (Transit Depot) established June 1942.
Liverpool (Great Crosby) established June 1942.
Bournemouth (subsidiary of R.N. Hospital, Haslar) established August 1942.
North Shields . . established August 1943.
Risley . . . „ November 1945.

Scotland

Grangemouth . . „ October 1940.
Dunfermline . . „ October 1940.
Rinnigill . . . „ June 1943.
Bishopston . . „ October 1944.

Northern Ireland

Londonderry . . „ March 1942.
Belfast . . . „ December 1944.

Mediterranean

Alexandria . . „ January 1941.
Algiers . . . „ March 1943.
Taranto . . . „ March 1944.
Naples . . . „ July 1944.

India and the Pacific

Colombo . . „ April 1945
Bombay . . . „ February 1944.

Australia

Sydney . . . „ December 1944.

Africa

Durban . . . „ September 1942.
Freetown, Sierra Leone „ December 1941.
Mombasa . . „ May 1942.

LOSS OF STORES—BY FIRE OR BY ENEMY ACTION

During hostilities five medical establishments were seriously damaged by enemy action. They were the medical stores at the victualling depot at Deptford, a section of the hospitals at Haslar and Plymouth, the medical depot at Coventry, and the medical depot at Liverpool.

The Royal Victoria Yard at Deptford, in which the medical depot was situated, was seriously damaged by air attack on March 19, 1941. During this raid the medical depot was completely destroyed, and it was estimated that the value of the stores lost at Deptford was approximately half a million pounds. Previous to the raid a quantity of stores, dressings, etc. had been diverted to Grangemouth, and the half-yearly demand for the principal medical establishments had been despatched. Therefore the total destruction of stores at this depot did not seriously affect the issues to ships and depot establishments.

In March 1941, on the 10th and 27th of the month, the medical store at R.N. Hospital, Haslar, was severely damaged. The equipment store and packed unit store were hit, and the stores destroyed were valued at approximately £86,000.

The R.N. Medical Depot, Coventry, was damaged in an air raid on the night of April 8–9, 1941, and 20 per cent. of the stores were lost.

R.N. Medical Depot, Liverpool, situated in the Melias Building, was severely damaged in an air raid on December 22, 1940, and medical stores housed there were completely destroyed.

ALTERNATIVE ARRANGEMENTS

As a result of the destruction of R.N. Medical Depot, Deptford, it was decided to disperse the stores into various depots in the Midland area. For this purpose storage space was acquired at Huthwaite, near Mansfield, Notts., Wellingborough, Huddersfield, Leicester, Liverpool and North Shields.

At Huthwaite a section of the Co-operative Wholesale Society Hosiery Factory was acquired, occupying a space of approximately 60,000 sq. ft. This was a modern building, well lighted and heated, and proved to be an ideal storage depot for bulk dressings, instruments, X-ray apparatus, glassware, enamelware, and certain drugs and chemicals, including tablets and ampoules issued in the service afloat scale. The majority of dental store requirements for the Navy were undertaken at this establishment.

At Wellingborough, a boot and shoe factory occupying approximately 40,000 sq. ft. of floor space was obtained. This was used as a unit packing depot.

It was realised early in the war that the service afloat depots at the three main hospitals, owing to lack of accommodation, and the steady increase in requirements for replenishment of medical stores for the

Fleet, could not undertake the packing of service afloat units in sufficient quantities to meet the ever-increasing demands. It was decided therefore to establish a special unit packing depot and the site at Wellingborough was chosen for this purpose.

During the course of the war all types of units were packed at this depot from small No. 7 chests to hospital ship units. The tropicalised *Molcab* and *Monab* units were also prepared here, and to ease the strain at the Blood Transfusion Depot, thousands of sets of transfusion accessories were assembled during the peak period prior to D-day landings in France.

At Huddersfield, a woollen mill, and at Leicester, part of a hosiery factory, were acquired. These were used as supplementary depots for Huthwaite.

These three depots undertook the function of the principal medical supply depot, formerly carried out at Deptford. The head pharmacist established at Huthwaite the central laboratory for the examination of medical supplies.

Leicester and Huddersfield had a combined floor space of approximately 50,000 sq. ft.

At Liverpool, after the destruction of the Melias building, a billiard hall was obtained. This was used as a medical depot to meet the demands of the ships operating in the Western Approaches.

The medical depot at Coventry was acquired in 1938 and was originally intended for use as a medical store for Fleet Air Arm requirements. After sustaining damage during air raids in April 1941, this depot was transferred to Leicester.

Towards the end of 1940 a subsidiary depot was also opened at Grangemouth. This was found to be a very useful dump for the storage of dressings, which proved of great value when the majority of the stocks of dressings were destroyed at Deptford. Grangemouth was closed down in 1941.

On the destruction of the medical depot at Deptford it was necessary to acquire a building to meet the ever-increasing demand for transit stores for ships and establishments abroad. In the first place a transit depot at Barnoldswick, in Lancashire, was acquired; later a more suitable building at Salford, near Manchester, was obtained. This was part of the factory of Messrs. Cussons, soap manufacturers. The floor space available at Salford was approximately 30,000 sq. ft.

The realisation that Malta, in the event of Italy entering the war, would become untenable for the Mediterranean Fleet, necessitated arrangements being made for storage facilities to be established at Alexandria. Before hostilities, therefore, a special unit of medical stores for service afloat requirements, was dispatched to Alexandria, and this formed the nucleus of the stock at the depot when it was established in 1941.

In Malta, considerable supplies of medical stores for Naval purposes were obtained before the outbreak of hostilities, and were distributed at various points in the island as a precaution against destruction by air attack. During the siege no shortage in this direction was reported.

To facilitate Fleet medical store requirements during the campaign in Italy, subsidiary medical store depots were established at Taranto and Naples. The depot at Algiers was opened during the course of the North African campaign to meet requirements of the ships operating in the western Mediterranean.

INCREASES IN STAFF

Before hostilities the pharmaceutical staff employed on naval medical store duties was 25 in number. This staff was composed of:

1 head pharmacist
3 superintending pharmacists
6 senior pharmacists
15 pharmacists.

This nucleus was responsible for the training in medical store procedure of well over a hundred pharmacists entered during the period of hostilities to staff hospitals and depots which it was found necessary to open.

By the end of the war the complement of pharmaceutical officers borne was:

1 head pharmacist
12 superintending pharmacists
24 senior pharmacists
63 pharmacists

Apart from the duties in the medical supply service normally undertaken by pharmacists at home and abroad, some special appointments were made to meet the abnormal requirements brought about by the course of the war. These were:

(*a*) The appointment in 1941 of a superintending pharmacist to the Admiralty section of British Purchasing Commission in the U.S.A.
(*b*) The appointment in 1944 of a superintending pharmacist to the staff of the Commander-in-Chief, British Pacific Fleet.
(*c*) The appointment in 1945 of a superintending and senior pharmacist for a special commission in connexion with medical services in Germany.

TRANSIT OF MEDICAL STORES

Before the war, medical stores for ships and establishments abroad were shipped from the victualling transit stores at the Royal Victoria Yard, Deptford. When the medical depot at Deptford was destroyed

in 1941 it was found necessary to establish a medical transit depot, and premises for this purpose were obtained at Barnoldswick, in Lancashire, in May 1942.

In June 1943, more commodious and convenient premises were acquired at Salford. In the period between the destruction of the depot at Deptford and the acquisition of the premises at Barnoldswick, a pharmacist was appointed to the Royal Victoria Yard, Deptford, to superintend the transit of medical stores.

The transit of medical stores naturally presented many problems, particularly in view of the very limited shipping accommodation available. Urgent stores were given the necessary priority and taking all the factors into consideration transit facilities afforded to medical stores covered the requirements of the period.

To save time and to preserve storage space at Barnoldswick and Salford, medical units were shipped direct from H.M. medical depot, Wellingborough. A liaison was established at this depot, with the Rail Transport Officer at Northampton and Kettering, and this proved of inestimable value in the transit of first priority units from the railhead to the port of shipment.

Huthwaite, Wellingborough and Salford also acquired motor transport, and secret and very urgent operational requirements were transported to the port of embarkation by this method.

Air freight was also freely used for very urgent requirements abroad. The transit of yellow fever vaccine to Malta and the Middle East by air was one interesting problem which presented itself.

As is well known, yellow fever vaccine loses potency at a very rapid rate unless it is stored at 0° C. or below. The transport of this item abroad by air freight was therefore a very serious difficulty. Large vacuum flasks were obtained and packed with cardice (CO_2 snow). The vaccine was placed in the flask and this was packed in a specially constructed box lined with asbestos material and packed with more cardice. By this method it was possible to keep the vaccine at the required temperature for approximately two to three days. The vaccine was taken to the airport by road transport and the pilot of the plane was given information regarding the storage conditions of the vaccine. Arrangements were made by signal for the aircraft to be met at the first landing point, and there the vaccine was repacked, usually with ice, which kept the container at a sufficiently low temperature to ensure that it reached its destination with its potency undestroyed.

An unusual mode of transit which was adopted at one period during the war, was the forwarding of urgent small bulk stores by submarine. The stores forwarded by this method were required by the British Naval Mission in Russia. The packages so forwarded had to be limited in weight and size, and very special attention had to be paid to the packaging and the type of container used.

TROPICAL PACKING

Packing of medical stores during hostilities presented a great many difficulties, particularly in respect of those destined for tropical regions. At the latter end of 1944, the war in the Pacific had reached a stage necessitating the forwarding of vast quantities of stores, particularly mobile packed units. The special preparation of packages for the Tropics was necessary in order to protect the contents from excessive humidity and from the ravages of white ants and other pests. In the absence of suitable storage accommodation, stores were often exposed to abnormal climatic conditions for indefinite periods. Normal port facilities did not always exist, ships and installations might be damaged by air bombardment, and the time limits laid down for the turn round of convoys made careful handling of packages an impossibility. It has always been the practice to pay particular attention to the quality of packing cases used in the Navy. This was found to be a very necessary precaution when porterage was dependent upon unskilled and sometimes careless and inefficient labour.

It is of interest to note that the method of 'Fleet Baling' for surgical dressings normally adopted at medical depots needed very little modification when such bales were required for use in tropical regions. Experiments carried out at Huthwaite proved that the waterproofing wrappers were adequate to withstand exposure to excessive humidity, and even after complete immersion in water for several hours the contents were found to be free from moisture. Specially treated crêpe waterproofed paper liners were used and a double wrapper of hessian processed with copper naphthenate solution.

The medical depots at Huthwaite and Wellingborough were chiefly concerned in the conversion for tropical service of mobile medical units required for use in the Far East. The first complete medical unit to be so converted was packed at Wellingborough in 1944. Packing cases were treated with copper naphthenate solution, and this preservative protected the wood from white ants. Bag liners were constructed from a good quality waterproof paper and the contents of the packing cases were wax dipped in accordance with the recommendations laid down in the British Standard Specification. At this time it was not possible to obtain a protection for labels, and as an emergency method, containers of drugs which it was considered would be liable to lose the label through humidity were all wax dipped as a precautionary measure. Microscopes and other delicate apparatus were packed with a dehydrating agent in accordance with B.S.I. standards.

At Huthwaite the instrument chests and X-ray units were prepared for tropical use. It was found that the surfaces of surgical instruments were liable to rust quickly if handled without gloves, therefore, operatives were issued with gloves when packing instruments for use abroad.

The instruments were cleaned for possible finger prints, and then moistened with prepared liquid paraffin and wrapped in chemical free paper. They were then packed into convenient packages and wax dipped before packing in the instrument chests.

X-ray units presented a very difficult problem as some of the American units which were then in use had elaborate cases of Rexine, lined with a coloured silk material. These cases in tropical regions would absorb moisture at an alarming rate, and the contents would have deteriorated very rapidly. Special cases suitable for the Tropics were obtained for these machines, and the machines themselves were treated with special metal preservative in accordance with the B.S.I. standards.

In 1945, the preparation of stores destined for the Pacific was the subject of a great deal of research. Many papers were issued by the Anglo-American Packaging Commission and by the Australian Scientific Liaison Bureau. Courses in tropical packing were also arranged, and by the end of 1945, the majority of pharmaceutical officers and store-housemen dealing with the packing of stores for the Tropics had attended a course at the School of Tropical Packaging. The medical depots at Huthwaite and Wellingborough had by this time installed apparatus for wax dipping and the preparation of packing cases for despatch to the Tropics, and had also secured standardised bag liners and sealing apparatus.

It is to the credit of Naval Medical Administration and to the small and overworked Pharmaceutical Branch of the Royal Navy that at no time during the war was there anything approaching a major break-down in the supply of medical stores and equipment, either to the Fleet or to establishments on shore.

CHAPTER 12

PREVENTIVE MEDICINE

THE ADMINISTRATION OF THE PRINCIPLES OF HYGIENE IN THE NAVY

THE original layout of the Naval Medical History of the War made provision for a detailed account of Preventive Medicine in all its phases, ashore and afloat. Naturally, many of the problems dealt with were matters of pure Naval Hygiene, unique to the Senior Service and, with the growth of the necessary administrative machinery, problems arose which formed the basis for research on the part of the Medical Research Council. Over a period of some eighteen months an account of these matters was compiled by the Royal Naval Personnel Research Committee, which reported its war-time activities in detail. Unfortunately, this report is not available for general publication, so that much of the material originally chosen for inclusion in this chapter has had to be eliminated, and the chapter itself considerably curtailed.

During four years of the war the Royal Navy was fortunate in having as its Medical Director-General, Surgeon Vice Admiral Sir Sheldon Dudley, F.R.S., whose foresight and ability were already well recognised in the world of Preventive Medicine and Epidemiology. An indication of his intended administration of Naval Hygiene during the war years was given in his address to the Officers of the Royal Naval Staff College, which later formed the subject of a Royal Naval Medical Bulletin.

In this address it was first pointed out that, broadly speaking, naval personnel need not worry about hygiene as long as they remained in their ships, H.M. Ships being self-contained units in which health measures have been so carefully organised over the course of years that naval officers and ratings have come to accept them as a matter of course. Provided that the instructions concerning health and sanitation were observed it should be impossible to obtain bad food or water, and a sailor in his ship is accustomed to draw water from a tap and drink it without any thought or realisation of the work, supervision and research that has made it possible for him to do so without danger to his health. Continuing the same theme it was recalled that the seaman for generations has unwittingly observed the fundamental sanitary law of keeping his ingests apart from his egests by passing his excrement straight over the side of the ship into the sea, where it cannot possibly pollute food or flies. His ship has always been a sailor's home, accompanying him wherever he goes, granting him facilities for cleansing himself and his

clothes which are never enjoyed by a soldier in the field, and allowing him changes of clothing which are an automatic safeguard against lice and typhus. The sailor has realised that, as long as he remains in his ship, he can avoid contact with the natives of primitive countries who are the chief reservoirs of many infectious diseases, as well as avoiding infection from insects which rarely travel far from shore across water. Such a ship, anchored off a pestilential coast, could be likened to a fortress, beleagured by hosts of deadly microbes and aggressive insects, whose attacks are frustrated by the strip of sea which divides the ship from the shore, and which most of these enemies of health are unable to bridge.

Sir Sheldon then warned his audience that such potential protection afforded by life at sea had itself insidiously become a dangerous doctrine in course of time, for the reason that it was prone to be accepted as a matter of course. Hence in successive generations of naval officers an attitude of indifference had been fostered by their way of life afloat, and obviously complacency of this order had its dangers, should the circumstances of service suddenly transfer them from the comparative safety of the sea to the unhygienic hazards of a shore environment.

From this point it was explained that the discipline of hygiene ashore was in general a matter which held but a small place, if any, in the mind of the sailor. The custom of the Navy had always dictated that such measures of hygiene as might be necessary afloat could be safely left to the doctors. But it must be realised that in the field, the doctor is helpless in his efforts to organise and supervise health measures unless sympathetic co-operation is afforded him by his executive seniors.

These remarks of the Medical Director-General reveal how fully he realised that, not only was the traditional hygienic security of the Navy afloat a dangerous myth, should its natural environment be suddenly changed, but also that in a war of world dimensions, in which circumstances might change almost hourly, the traditional customs associated with Naval Hygiene must be broken down completely.

To understand the dangers of accepting 'custom' as a sound administrative basis in connexion with hygienic measures it is necessary to explain the relationship between the Medical Branch of the Navy and its Executive. In essence, the naval doctor acts in a purely advisory capacity, and whether his advice is accepted or implemented is a discretionary matter for his higher executive authority. Usually, on a basis of mutual understanding and co-operation, the system works satisfactorily, and this is particularly so in the case of surgical and medical incidents in the clinical field. But in the realm of Naval Hygiene and Preventive Medicine the system is attended by two grave dangers.

The first of these dangers is that, having received the advice of the doctor, the executive authority is permitted to exercise discretion in relation to it. The fact that advice is usually sought and soundly

implemented by the executive authority, nine times out of ten, is neither here nor there in the presence of a discretionary power in place of what should be a binding obligation. It might be argued that the executive authority, having received the advice of the doctor, is personally responsible from then on for what he does, or omits to do. But this association of liability with discretion as regards the executive authority is of little satisfaction to a naval officer or rating dying of a disease which might well have been avoided had reasonable hygienic measures been adopted.

The second danger is even more potent, for it relies upon custom and tradition and, though founded on nothing more substantial than these, has yet at times proved almost impossible to uproot. This custom is evidenced in the minds of a generation of the Executive which, while recognising its own discretionary powers in relation to hygienic precautions outlined above, fails to admit, or in some cases even to comprehend, its own personal liabilities in the matter. A state of affairs had thus gradually come into being in some Commands in the Navy, where such hygienic measures as were adopted were regarded as a purely medical responsibility and, worse still, it was implied that not only the responsibility but also the attendant liability was carried by the Medical Branch.

With all this at heart and in mind, it was the constant struggle and aim of the Medical Director-General of the Navy to correct this outlook, and in an address he gave to an Inter-Allied Conference on War Medicine convened by the Royal Society of Medicine, he stated that in his opinion the most important medical lesson learnt in the war to date was 'that Executive and Combatant Officers must be taught that the enforcing of hygienic measures to preserve the health, morale and fighting efficiency of their troops is as important as any other military duty'.

The result was that gradually, as the war progressed, the naval officer realised more and more the implications of psychology, hygiene and medical logistics in his duties as a leader, instructor, and preserver of the health of fighting seamen. In particular he came to understand the fact that a doctor is powerless without executive support in maintaining the health of his medical charge.

A doctrine was therefore prepared which aimed at propagating the principles of Preventive Medicine in the Navy beyond the limited boundaries of the Medical Branch itself. It was determined that every branch of the Navy should become hygiene conscious, that each individual should play some part in maintaining his own good health, and above all that the burdens, hitherto shouldered by the Medical Branch alone, should at least be shared. How seriously this doctrine was supported by the Board of Admiralty is shown by the following Admiralty Fleet Order:

ANTI-MALARIAL MEASURES—EXECUTIVE RESPONSIBILITY

1. Their Lordships have already indicated by A.F.O. the importance they attach to the strict observance of anti-malarial measures in the areas where the presence of the Anopheline mosquito renders these necessary.

2. Experience in the South West Pacific has established that malaria can be effectively controlled by the application, under strict discipline, of the protective measures set out in that Admiralty Fleet Order and that wastage from malaria is, therefore, a reflection on the standard of discipline of the ship or establishment concerned.

3. It is for medical officers, in consultation with medical officers of other units and Services in the same area, to advise on what anti-malarial measures are appropriate, but their Lordships wish it clearly to be understood that they hold Flag and Commanding Officers responsible for ensuring that protective and preventive measures are undertaken and rigorously enforced. They desire that the provision of men for such duties as canalisation, oiling, digging trench latrines, where such measures are necessary, shall be regarded as of operational importance and shall have priority accordingly.

4. Large scale research and experience in the field have shown conclusively that wastage from malaria can be practically eliminated by the continued use of suppressive atebrin.

If this is taken regularly:

(*a*) Malignant tertian malaria will not develop;

(*b*) Symptoms of benign tertian malaria will be suppressed as long as the taking of suppressive atebrin is continued;

(*c*) Men will not become carriers of malaria while taking it and, therefore, will not transmit malaria to others.

N.B. Atebrin (U.S.AL) is exactly the same as mepacrine (English).

5. Continued consumption of suppressive atebrin in prescribed dosages has no harmful effects. Its beneficial effects are in no way diminished by exertion, diet or extremes of temperature.

6. Their Lordships attach particular importance to suppressive drug treatment, where this is advised by M.Os., and rely upon commanding officers personally, to ensure that the prescribed dosage (one tablet (0·1 g.) daily) is taken by every member of the ship's company regularly and without fail. Suppressive atebrin treatment should always be organised as a special 'drill' under the supervision of a commissioned or warrant officer.

7. Failure on the part of any individual to organise or to take adequate protective and suppressive measures imperils the health and efficiency of the remainder of the ship's company and their Lordships accordingly expect commanding officers to take a serious view of any lapse in this direction and to take appropriate disciplinary action.

8. While malaria, owing to its supreme importance, has been specifically selected in framing this Order, the same principles of discipline

and responsibility apply equally to such preventable tropical diseases as dysentery, scrub-typhus and dengue. In fact, these principles should be implicit in all the measures taken to preserve the health of the Royal Navy. The medical officer can only advise as he has no executive authority over officers and ratings except when they are on the sick list.

NAVAL ADMINISTRATION AND MEDICAL RESEARCH

The influence of this doctrine and its advantages became obvious as the war progressed, and many unforeseen problems arose which it was necessary to keep under constant examination in order to find the best solution in the interests of the war effort. Various research teams, councils and committees consisting of Service and civilian medical men were formed for dealing with such subjects as vaccination, malaria, yellow fever and typhus. Each of these apparently purely medical subjects required the interested co-operation of the combatant officer and the lay administration if the best results were to be forthcoming. In the Navy, preventive medicine is a wide subject which embraces a number of activities concerned with a sea-going environment and dangers arising therein.

Friendly relations between the Admiralty and civilian physiologists have enabled advances in knowledge to be applied to the Navy's needs for many years. This is well illustrated in the present century by the close association achieved through various Admiralty diving and ventilation committees with the classical respiratory and environmental studies of Professor J. B. S. Haldane and Sir Leonard Hill. The decompression tables compiled by the former and the Admiralty diving specialists are still in use, and the methods suggested by Hill for evaluating the effects of the thermal environment on man were used by the Navy for investigating compartmental warmth in ships until 1945. Before the commencement of hostilities in 1939 this valuable liaison was continued by the Medical Research Council's Colour Vision Committee (1933), by Sir Leonard Hill who advised the Admiralty Ventilation Committee (1937–1938) and by Professor J. B. S. Haldane, who explored the problems inherent in escaping from sunken submarines. It was not however, until 1942 that a formal organisation was established for putting the services of civilian physiologists and psychologists at the disposal of the Navy.

In August 1939, the Secretary of the Medical Research Council wrote to the Board of Admiralty and offered to the Navy in the event of war the assistance of the Council's scientific staff and research organisation. The Medical Department of the Admiralty was thus represented throughout the war on the numerous committees of the Council which considered the management of war wounds, the intricate problems of brain injuries, nerve injuries and traumatic shock, and such practical issues as large scale blood transfusion, malaria and typhus

control and treatment, the clinical use of penicillin, and the care of shipwrecked personnel. These activities are described in the Council's Report for the War Years (1947). The main effort at that time was devoted naturally to preparations for receiving, treating and disposing of large numbers of casualties from enemy action.

There were no sensational physiological problems afloat to parallel the need for investigating the effects on aviators of the high speeds, altitudes and accelerations which were being attained by aircraft of new design. The Admiralty was, however, associated with the Military Personnel Research Committee of the Medical Research Council, established in 1941 at the invitation of the Army Council, of which the Medical Director-General of the Navy was a member, and particularly with its sub-committees which dealt with clothing problems, motion sickness and analeptics. The Flying Personnel Research Committee of the Air Ministry was responsible for the physiological welfare of the naval airman in the air, and one of its sub-committees considered problems of visual physiology for all the Services for a considerable time.

The tendency was to economise in scientific man-power by taking advantage of the interest of the other Services in problems of common concern to all three. An excellent early illustration of combined service personnel research was afforded by trials conducted to discover the most suitable seasickness remedy for assault troops who were to be carried in landing craft. These were undertaken by Surgeon Lieutenant Commander H. E. Holling, R.N.V.R., Major W. R. Trotter, R.A.M.C. and Dr. Brian McArdle of the Medical Research Council (1943), who recommended hyoscine as the most suitable drug for this purpose. Before benzedrine and instructions for its use were made available to the Fleet in 1941, experiments with benzedrine and methedrine were carried out for the Medical Research Council at the Physiological Laboratory, Cambridge, in a mine sweeping flotilla in the North Sea, and on parachute troops and infantry.

The Naval Staff also requested advice from time to time on the probable human limitations imposed on the enemy by novel operational conditions, in order that the best defence could be developed against his attack. The use by the Italians of 'human torpedoes' called for information as to the most suitable types or weights of deterrent explosives for employment in the defence of ships or harbours. Information was also required by clinicians on the causative mechanism, the treatment and prevention of injuries of the lungs and alimentary tract caused by explosions underwater when men abandoned sinking ships and were swimming in the water, or when troops were wading to and from boats or ships lying off shore, and bombs, depth charges or torpedoes exploded near to them. This double need for information led in September 1941, to a series of hastily conducted experiments on animals in the sea off Spithead by Professor G. R. Cameron, Major R. H. D. Short and

Surgeon Rear Admiral C. P. G. (now Sir Cecil) Wakeley; and observations on human volunteers were made in a lake near to Portsmouth by a team directed by the late Surgeon Commander E. R. P. Williams, Royal Navy, in association with the same workers.

Early in the war, as a result of U-boat action, the necessity of authoritative rulings on the best methods of preserving the lives of shipwrecked seamen made itself felt. The Medical Research Council therefore formed a committee under the chairmanship of the Medical Director-General of the Navy to examine the problem of survival at sea. This problem was a joint one which was concerned as much with seamanship and navigation as with medicine and physiology. The members of the committee were therefore a mixture of Royal and Merchant Navy professional seamen, doctors and scientists whose object was to provide an expert knowledge of the effects of exposure, survival and lifesaving equipment among the shipwrecked. Many non-medical factors were involved. Life belts were inadequate to support men in the water or were supplied in insufficient numbers. Individuals did not know how to use them properly and were untrained in the tactics of abandoning ship. Life-rafts or floats were also defective in numbers and design and were inadequately or incorrectly equipped or maintained. The more serious problems were thus of an executive nature calling for improvements in organisation, training, supplies and equipment development, rather than for advice on the human factors involved; but there was a pressing requirement for the medical and physiological principles relating to human survival under these conditions to be stated clearly.

The report of this committee was published in 1943 and received a world wide distribution, for it was written with the intention that it should be read and understood by everyone who was likely to require the advice within its pages. It has yet to be improved upon as a concise statement of the problems arising in temperate and northerly waters and what to do about them.

The work of this committee was highly successful and displayed the co-operation which was possible between a team of individual experts who, in the past, had been members of independent departments, and it was obvious that further success could be anticipated with confidence should this system of co-operation be exploited on a wider scale.

One important result of the work of this particular committee was to reveal that a large amount of scientific work had already been done in the past on the subject in question, but it had never been made accessible to or used by the persons to whom it might have been of practicable value in life-saving at sea. It was later found that this discovery was commonplace, only to be regarded almost as a general rule, and that whenever a preventive medicine problem arose, more often than not the answer had been discovered years before, but had been buried in the archives of some learned society or in the files of some scientific

laboratory. It was soon realised that what was most needed was some machinery to disinter these buried treasures and to develop their practical application in the field of naval medicine. To meet this need became one of the chief functions of the research committees.

Another feature of these committees' work was to show how desirable it was to correct or remove the many false and harmful superstitions regarding survival at sea which had existed among seamen from time immemorial.

The expansion of shallow water diving activities gave prominence to a number of physiological problems. Oxygen intoxication was suspected to be the cause of a number of incidents where men working hard under water and wearing oxygen respirators lost consciousness at depths formerly considered to be safe. The Admiralty formed an Experimental Diving Unit for investigating this and similar problems, which was established at the premises of Messrs. Siebe Gorman and Company, Limited, at Tolworth, Surrey. A team of naval divers acted as subjects for a long series of experiments in the firm's diving tank and compression chamber, which were carried out from April 1942 onwards by Professor J. B. S. Haldane, and Surgeon Lieutenant K. W. Donald, Royal Navy, in association with Surgeon Lieutenant Commander C. L. G. Pratt, R.N.V.R., Physiologist to the Submarine Service, and the Admiralty Diving Committee.

In the meantime, within the Admiralty, the discussion of the need for applying a scientific approach to other problems affecting the efficiency and comfort of naval personnel had been stimulated by letters received in 1940 and 1941 from Lord Hankey, Chancellor of the Duchy of Lancaster and Sir Edward Mellanby, Secretary of the Medical Research Council. It was suggested by the Naval Staff that investigations might be undertaken to improve flash-proof clothing and weather-proof clothing—the latter had hardly changed during the previous century; to find ways of improving fresh air supplies to certain ships' compartments; to improve standards of mess deck lighting and the design of furniture; to consider dietary requirements in the Tropics and the Arctic; to improve the comfort of lookouts and the procedures for selecting them; to consider anatomical features in the design of binocular mountings; and to reduce fatigue at hand-worked mountings. Although some of these subjects overlapped problems which were being investigated by the other Services, there were appearing naval requirements which could not be solved adequately and expeditiously by the existing organisation.

THE NAVAL PERSONNEL RESEARCH COMMITTEE

As the war progressed it became customary to refer to the Medical Director-General many problems in which mechanics, seamanship, physiology and preventive medicine were all inter-dependent. While doing its best, the Medical Branch of the Navy soon realised that the

limits of its capacity and facilities for arriving at correct solutions were being exhausted. The Admiralty decided therefore to form a Naval Personnel Research Committee to study such problems. When forming this body it was decided, to its later advantage, that it should in fact be a Medical Research Council Committee whose duty would be the study of purely naval personnel problems. This device provided the committee with the assistance of the best medical and physiological experts in the country, as well as permitting Naval Personnel Research to share the high prestige of the Medical Research Council in the medico-scientific world. It was considered essential that executive and other non-medical naval officers should serve on the committee in equal force with medical officers, civilian experts and representatives of other interested Admiralty Departments. It was also considered advisable that the Medical Director-General of the Navy should not be chairman of this committee but that this office should be filled by an eminent civilian scientist in the person of Sir Edward Mellanby, F.R.S. This committee assembled for the first time on November 17, 1942. Sir Edward Mellanby was the first chairman and Dr. G. L. Brown of the Council's Scientific Staff became the secretary. Two members of the Naval Staff, the Medical Director-General of the Navy and one of his assistants, the Deputy Director of Scientific Research and Experiment, Admiralty, and Dr. B. S. Platt of the Council's Scientific Staff were the other members. At a later date the committee was joined by representatives from the staffs of Flag Officer Submarines, the Senior Psychologist and the Deputy Controller, Admiralty. A naval medical secretary was appointed in December 1943.

The terms of reference of the committee were revised at the sixth meeting on March 30, 1943 to read as follows:

> 'To advise the Medical Research Council on such investigations as the Council may be asked to undertake on biological, medical and psychological problems affecting the health and fighting efficiency of naval personnel; and to suggest investigations with a view to increasing or improving the health, fighting fitness and environment of naval personnel; and to aid and supervise such investigations as expedient.'

The task of the R.N.P.R.C. was thus to co-ordinate and direct physiological and psychological research in relation to the needs of the Navy. Contrary to the terms of reference, in practice the committee did not advise on medical research in the commonly accepted meaning of the term nor was it concerned with the problems of aviation medicine.

Although the main purpose was to advise and undertake research on the human factors associated with the successful prosecution of the naval war, it was appreciated from the outset that practical success would nearly always depend on the direct participation of naval officers of all branches and the Admiralty departments responsible for equipment design and production, not only in defining the subjects for research,

providing conditions for field experiments and ensuring that the recommendations of the committee were applied in practice without delay, but in many cases by taking part in the research work.

There was no dearth of problems, and the priority for their consideration was decided by the Naval Staff and the Board of Admiralty according to the more pressing operational needs. Topics discussed at an early time included methods of improving the performance of 'asdic' operators on whose ears depended the ability of a ship to detect a submerged submarine in the vicinity; ways of improving the protection of men immersed in the water against underwater explosions; means for combating the excessive noise which interfered with the efficiency of men manning high speed coastal craft; the improvement of atmospheric conditions in submarines submerged for many hours; and physiological problems associated with diving operations.

Subjects for investigation were proposed by the sponsoring division of the Naval Staff. Sometimes information was available to effect an early solution. On other occasions there was a need for further investigation, and recommendations as to what was required were considered by the committee after the problem had been examined by the scientists and others concerned. The responsibility for providing facilities for research work lay with the R.N.P.R.C.

It was necessary first to define the ways in which the committee was most likely to be able to assist the Navy. A party of observers consisting of Dr. G. L. Brown, Dr. B. S. Platt and Surgeon Commander (now Surgeon Captain) R. A. Graff, Royal Navy, visited H.M. Ships *Osprey* and *Nimrod*, the establishments where anti-submarine detection ratings were trained, and also H.M. Ships *Bee*, *Midge* and *Mantis* and H.M.S. *Forth*, the bases from which were operated the Home Fleet coastal motor craft and submarine flotillas. Surgeon Captain MacDonald Critchley, R.N.V.R., took passage in a cruiser and a destroyer to investigate the problems of men in warships operating in the waters of the Arctic and the North Atlantic and studied American methods in ships of the United States Navy. Professor W. E. Le Gros Clark of Oxford and Dr. T. Bedford, of the London School of Hygiene and Tropical Medicine, visited ships, gunnery training establishments, and the factories and research departments where weapons were designed and produced, in order to identify human factors which might have been overlooked in the design of sighting apparatus and other gunnery equipment; and the latter also advised on the heating and ventilating of small ships.

With one main exception the problems identified by these observers as suitable for investigation, and the work on submarine and diving problems which was already well advanced, occupied the main resources of the R.N.P.R.C. during the war years. This exception concerned the difficulties encountered in tropical naval warfare, which were subordinated in 1942 to the more pressing needs of the Battle of the Atlantic.

The working organisation evolved naturally from these deliberations. The visit of the observers to H.M.S. *Forth* revealed that much could be done by the application of established physiological principles to improve the atmospheric conditions in submerged submarines, and particularly by ensuring that the officers in command of the submarines were informed of the basic physiological factors which influenced the efficiency of their crews during long dives. In addition the work on submarine escape was far from complete, but the Admiral Commanding the Submarine Service asked that the research workers should first direct their investigations on the more urgent problems which were being encountered in the development of underwater methods of attack involving shallow-water divers, and so a sub-committee on underwater physiology was formed, with Dr. G. L. Brown as chairman. This sub-committee was assisted by Professor J. B. S. Haldane and Dr. B. H. C. Matthews, Director of the Physiology Laboratory of the Royal Air Force. Surgeon Lieutenant Commander C. L. G. Pratt, R.N.V.R., and later Lieutenant Commander W. O. Shelford, Royal Navy, provided the the liaison between the sub-committee and the Admiralty Diving Committee.

Other sub-committees were set up to deal with the human factors involved in submarine detection by use of the 'asdic' apparatus, in the design of gun directors and other weapons, and in the development of clothing and protective equipment. These were known as the Asdic, Gunnery and Clothing Sub-committees respectively. Surgeon Lieutenant Commander H. E. Holling, R.N.V.R., was appointed as Physiologist to Coastal Forces as a direct link between the R.N.P.R.C. and the operational problems of the men in 'small ships'. In 1944 a Habitability Sub-committee and a Visual Problems Sub-committee were established to deal with warship 'habitability' or 'climatic efficiency', and naval visual problems.

The nature of the problems determined the composition of the sub-committees. Thus the Director of Anti-submarine Warfare, Captain N. A. Pritchard, Royal Navy, was the chairman of the 'Asdic' Sub-committee and Professor F. C. Bartlett, Sir Lawrence Bragg, and Dr. C. S. Hallpike provided psychological, physical and physiological advice. Lieutenant Commander (E) J. E. Golby, Royal Navy, of the Admiralty Research Laboratory was chairman of the Gunnery Sub-committee, and Professor W. E. Le Gros Clark, Dr. G. L. Brown, Dr. T. Bedford and Mr. M. G. Bennett, of the Research Staff of the London, Midland and Scottish Railways, advised on anatomical, physiological, and ventilating and heating matters. The Director of Victualling, Admiralty, Mr. O. S. N. Rickards, was chairman of the Clothing Sub-committee and Dr. B. S. Platt, Dr. T. Bedford, Mr. J. S. Weiner and Mr. J. C. D. Hutchinson of the Council's scientific staff advised on physiological matters relating to the design of clothing for

wear under hot or cold conditions, immersion suits, flotation equipment and body armour; whilst Dr. R. B. Bourdillon and Dr. O. M. Lidwell devised suitable clothing for protecting against burns from flash and flame. Later, Surgeon Captain MacDonald Critchley, R.N.V.R., became the chairman of the Habitability Sub-committee and Dr. T. Bedford, Dr. Ezer Griffiths of the National Physical Laboratory, and Dr. B. McArdle, Dr. K. J. W. Craik and Dr. N. H. Mackworth of the Council's scientific staff, carried out research to determine the best ways of measuring environmental warmth and the physiological and psychological effects of excessive warmth. Lastly, Surgeon Commander (now Surgeon Captain) D. M. Beaton, Royal Navy, became chairman of the Visual Problems Sub-committee which was advised by Dr. W. S. Styles of the National Physical Laboratory, Dr. E. E. Pochin of University College and Dr. W. D. Wright of the Imperial College of Science and Technology, and the Admiralty scientists who were already working on these problems.

The membership of the sub-committees determined where the work was done. The main research on underwater physiology was carried out by the Admiralty Experimental Diving Unit at Tolworth, at the National Institute for Medical Research and at the Royal Naval Physiological Laboratory after it was established in 1943. Numerous field trials were carried out at the bases and in the ships where operational personnel were under training. The anatomical factors in weapon design were investigated at Oxford, the Naval Gunnery School at H.M.S. *Excellent* and the Admiralty Research Laboratory. Protective measures were devised against flash and flame at the National Institute for Medical Research, and against gun blast at the Road Research Laboratory and the Council's Otological Research Unit, London. The Clothing Sub-committee largely relied on the climatic physiology laboratory at the National Hospital, London. The Council's Applied Psychological Research Unit, Cambridge, and Otological Research Unit advised the Asdic Sub-committee on instrument control and display and auditory physiology. The effects of hot climates on man were investigated in 1944 and 1945 in psychometric chambers at the National Hospital and in similar hot rooms at the Applied Psychological Research Unit. Methods for measuring environmental warmth in ships were evolved at the London School of Hygiene and Tropical Medicine and the National Physical Laboratory. Work on visual problems was carried out at the National Physical Laboratory, the Imperial College, the Admiralty Research Laboratory and the Royal Naval Physiological Laboratory.

Close liaison was maintained with the United States Navy by the reciprocal exchange of observers in London and Washington, where Surgeon Commander R. W. Mussen, (now Surgeon Rear-Admiral R. W. Mussen, C.B.E., Q.H.P.) Royal Navy, represented the Admiralty;

and also with the Royal Canadian Navy. Committee meetings were limited only to those who had positive contributions to make.

There is no doubt that most of the advances in Naval Hygiene and Preventive Medicine in recent years have been due largely to the stimulus of war. As has been described, the protection hitherto afforded by life afloat received a rude shock with the onset of amphibious warfare and the growth of naval bases and air stations ashore in disease ridden territories. Broadly speaking, unlike their contemporaries in the Army, Royal Naval Executive Officers and Medical Officers had small experience of preventive medicine outside their natural sea-going environment, and many lessons had to be learned, often after long and bitter experience.

It is the usual sequence of events in the realm of Preventive Medicine that its value is rarely appreciated until some disaster occurs as a result of its neglect. It cannot be over-emphasised that, in spite of the hygienic measures actually adopted by the Fighting Services during the war, the casualties caused by preventable diseases far exceeded the casualties due to weapons. In the Far Eastern Theatre the ratio was often staggering, but fortunately, as was revealed after the war, was never as formidable as the corresponding wastage in the ranks of the enemy.

Unfortunately, exact figures for the Navy are not available, but reports indicate that whenever proper hygiene and strict control were exercised there was an immediate and dramatic fall in the incidence of sickness.

HABITABILITY

The most fundamental advance in naval hygiene during the war years was the study of 'habitability' in H.M. Ships. 'Habitability' is a comprehensive term which embraces all the factors, domestic and otherwise, which together constitute the living conditions under which a sailor lives his life afloat in a man-of-war. Thus 'habitability' includes such matters as general environment, temperature, humidity, over-crowding, diet, general welfare, and also the provision of amenities necessary to render life tolerable under every extreme of climate. It will be appreciated that such a subject includes problems which are by no means purely medical, but which must also be viewed as affecting the social aspect.

In his admirable preface to the Medical Research Council's War Memorandum No. 17, *Environmental Warmth and its Measurement*, published by H.M. Stationery Office in 1946, Surgeon Vice Admiral Sir Sheldon Dudley points out that often, in the past, ships' surgeons drew attention to the gross neglect of health and comfort of the sailor, in contrast to the zeal and effort expended in improving and maintaining the fighting strength and seaworthiness of the ship herself. The time

came when a more enlightened Admiralty implemented in the Navy the recommendations of Lind, Trotter and Blane, the famous pioneers of social medicine in the Service.

Consequently from the middle of the nineteenth century, great progress was made in the care of the animate as well as of the inanimate part of that fighting machine which consists of a man-of-war and her ship's company.

For at least 200 years the need for fresh air below decks in men-of-war has been recognised, and even so long ago various abortive attempts were made to improve what little ventilation existed. In 1734 the Royal Society investigated a ventilating machine invented by Desaguliers, which had the property of extracting air from a room and impelling fresh air into it. This machine was used later to ventilate the House of Commons, and soon afterwards the possibility was considered of modifying it for use in ships, the need being dictated by the ill-health of men embarked at Spithead for an expedition against Spain. Trials were carried out in a man-of-war and are alleged to have been successful. The legend is that prejudice was displayed by the Admiralty surveyors, whose ideas were conservative. In any case an adverse report was made.

Other ideas were better received in due course, and a steam plant was used to ventilate a man-of-war by drawing the air for the galley fires through the various compartments of the ship. Nevertheless, it is of interest that the centrifugal fans at present used in the Navy are direct descendants of the rejected Desaguliers machine.

In 1844, Reid described in *Illustrations of the Theory and Practice of Ventilation* that, although the ventilation of men-of-war fell far short of what was necessary, recent improvements had been introduced with good effect on the health of the sailor.

In the Royal Navy the peace-time effects of living in extremes of climate have frequently been overlooked and regarded as acceptable in view of their temporary duration. This does not mean, however, that the mere fact that a ship is not likely to be called upon to fight is a guarantee that conditions on board are perfect; what is implied is that in peace-time, although conditions have been far from ideal, they have been made more tolerable by the absence of irksome restrictions, by greater amenities, and by long periods of shore leave. On the other hand, the effects of contrasts of heat and cold on the health and efficiency of men afloat under conditions of war have usually been dramatically and painfully obvious. The interval between the two wars brought about many improvements in living conditions, particularly as regards ventilation, but while the effect of these improvements had become noticeable towards the close of the period of peace, it was soon realised that under the impact of war the introduction into H.M. Ships of modern requirements rendered it imperative to carry such improvements even further.

When considering the question of living conditions afloat, certain elementary factors must be borne in mind which are vital to the survival of the ship itself, and which must always take precedence at the risk of resulting deficiencies in what would constitute the perfect environment. For instance, a ship afloat must of necessity be divided into a number of water-tight compartments, and this alone increases enormously the difficulty of providing satisfactory ventilation. This elementary fact is true in the case of all ships of any size. But in the case of men-of-war other factors have to be taken into account. A warship must be mobile and capable of service in extremes of climate at short notice. The fuel capacity, engines and armament must also receive priority, so that any additional weight or space to be occupied by a ventilation system must replace, to a greater or lesser degree, that required for more warlike equipment.

In short, therefore, when reviewing the question of living conditions in a man-of-war, the paramount consideration must always be the purpose for which the ship has been constructed, and such efforts as are contemplated to improve habitability must be compatible with the ship retaining the highest degree of efficiency as a fighting unit.

In the War of 1939–45 the rapid development and complexity of modern armament and technical equipment meant not only that space had to be found for extra material, but also for the accommodation of large numbers of naval personnel whose duties were concerned with maintaining and working the new machinery and instruments involved. The result was that, as the war progressed, the living space in H.M. Ships was being encroached upon continually. In some ships additional equipment caused an increase of as much as 60 per cent. of the ship's normal complement of personnel. When new ships were constructed on modern lines *ab initio*, it was possible to make some allowance for these increases. But in most cases, all these additional men and machines had to be fitted into an inelastic hull often laid down a great many years previously with totally different circumstances in view. Moreover, such ships had to be operated under conditions of modern warfare, which involved long cruising periods at sea, prolonged hours at 'action stations', blackout conditions, and rigid requirements of damage-control organisation. These circumstances were also aggravated by the greater amount of 'wild heat' produced by the constant running of ships' engines, as well as the maintenance of reserve energy in order that steam for full speed should be available at short notice in order to compete with any emergency of war. Such heat production is a constant accompaniment of a state of preparedness of a man-of-war operating in war-time, and is a factor quite apart from extra heat necessary to maintain and work modern equipment.

The War of 1939–45 was fought in the hottest and the most humid of the seven seas, as well as the coldest. Operational requirements gave

very little chance of periodic cruises, recreation, or recuperative leave as was customary in peace-time. The influence of these hazards of environment afloat was probably more deleterious to the mental and physical make-up of the National Service man, for no matter how great his willingness to play his part and to fit into the Service framework at short notice, his lack of experience in caring for himself under extreme conditions afloat was bound to have an adverse effect when compared with his Continuous Service colleague.

It is now generally agreed that symptoms such as headache, lassitude and inability to concentrate, which are so noticeable after a patient has been in a hot and crowded compartment of a man-of-war, result from physical rather than chemical changes in the atmosphere. On the principle that seamen are a Spartan breed who expect to endure hardships, it was once believed that heat, 'fug' and poor ventilation in H.M. Ships, particularly in the Tropics, were only normal, and as such should be made light of and endured without complaint. Much in the same way as the lack of efficiency due to anoxaemia in air crews operating at high altitudes was insidious and not fully appreciated for a considerable time, so the lowered standard of mental and physical performance of seamen under conditions of excessive heat and poor ventilation was also insidious and unappreciated.

There was a time when attention was paid almost exclusively to the chemical constitution of the air in badly ventilated compartments, the criterion being the degree to which the carbon dioxide content was increased and the oxygen diminished. Later, it was shown that the percentage of carbon dioxide in the atmosphere could be raised very considerably from the normal without harmful effects, and that the quantity of oxygen could be much reduced without necessarily precipitating symptoms of ill-health. From this time onwards attention was transferred from the chemical to the physical qualities of vitiated air.

The maintenance of a constant temperature in man depends upon his ability to balance excessive heat production by a corresponding increase in heat loss. In normal circumstances the body loses heat by radiation, convection and evaporation, and its physiological heat regulating mechanism is capable of maintaining a constant temperature in widely varying thermal environments. Thus, in warm weather, there is a dilatation of surface blood vessels and an increased supply of blood to the skin. In this way the surface temperature is raised and heat is lost by radiation and convection. Heat may also be lost by way of the lungs and through the evaporation of sweat from the skin.

The application of these elementary and widely recognised physiological principles to habitability in men-of-war has brought about a new approach to ship construction in many ways. In overcrowded and badly ventilated compartments, especially in warm climates, the temperature of the air rises gradually and its content of moisture is

increased. As conditions become worse the body is less able to maintain its normal temperature by means of radiation, convection and evaporation. As the atmosphere becomes more laden with moisture so does the evaporation of sweat become increasingly difficult. The occupants now become gradually more lethargic and disinclined for work, and this state of affairs will continue until the temperature of the surroundings and the degree of humidity are adjusted.

The temperature and humidity of the atmosphere are not the only factors of importance to be considered when dealing with the conditions in living and working spaces afloat. The degree of air movement also exerts an effect by its cooling power, as by removing the layer of moist air immediately in contact with the body it aids the evaporation of sweat. It is thus a combination of temperature, humidity and air movement which will produce a good or bad atmosphere and correspondingly good or adverse effect on a man's health and efficiency. Each of these separate factors may have its own individual effect upon health, but as they always coincide they must be considered together when appraising the total effect which any particular atmosphere may have upon men living and working in it. For example, two compartments may possess the same temperature, but yet may exert an entirely different effect upon their occupants if the degree of air movement, or the humidity is not the same in each case. It has therefore become necessary to adopt a method for measuring the combined effect exerted by the factors involved. This combined effect is assessed by estimating what is known as 'effective temperature', calculated from standard tables based upon the temperature of the air, its humidity, and the degree of air movement. An index is thus obtained of the total effect exerted by these three factors, and this provides naval constructors with a means of comparing the adequacy of ventilation under varying conditions which can be taken into account when considering the future construction of men-of-war.

The delicate balance between these environmental factors was apt to be seriously disturbed by the introduction of extra men and machinery into H.M. Ships during the war, and, as has been described, the situation was further embarrassed by the many rigid restrictions necessitated by life afloat in a constant state of preparedness. The problem at issue was perfectly summed up in the words of the Medical Director-General of the Navy:

> 'What is the ration of the space allocated to the mechanical element of the total fighting machine (ship + ship's company) which will make it the most efficient engine of war?'

As the war progressed, the conflict between the human element on the one side and the mechanical element on the other became acute, and it became obvious that a ship's striking power would be seriously

reduced if the ship's company had to live and work continually in the effective temperatures commonly found between decks under war conditions. This was particularly so in the Tropics, and even in more temperate climates when certain compartments of a ship were closed down at action stations.

To attempt to solve the problem at the request of the Board of Admiralty, the Royal Naval Personnel Research Committee of the Medical Research Council formed a Habitability Sub-committee in 1943, whose purpose was to see what immediate improvements could be made, and to initiate a long term scheme of research into the immense problems involved.

Until that time the only standards for ventilation in ships had been those set up by the Ventilation Committee of 1937, which had recommended a figure of 2,000 cu.ft. per man per hour and never less than 1,500 cu. ft. per man per hour, i.e. a change of air every five minutes. No temperature standards were recommended except that a mess deck temperature of between 60° and 65° F. should be maintained in cold climates. Reliance had been placed hitherto on the dry and wet-bulb thermometer and the low temperature Kata thermometer, which were obviously insufficient for the assessment of all the factors involved including radiant heat and air velocity.

Unfortunately, for various reasons, the full account of the activities of the Royal Naval Personnel Research Committee cannot be released for general publication, even for the purposes of this History. Nevertheless, some indication of the work of the Habitability Sub-committee is given in a number of publications already produced in recent years by certain of the sub-committee members.

Surgeon Captain M. Critchley, M.D., F.R.C.P., R.N.V.R., was chairman of the Habitability Sub-committee, and personally studied conditions afloat in the Arctic and the Tropics. His views are described in his Croonian Lectures, published in the *British Medical Journal* in 1945 (*B.M.J.* 1945 (ii) No. 145).

Mr. T. Bedford, D.Sc., Ph.D., M.I.Min.E., prepared the Medical Research Council's War Memorandum No. 17 on *Environmental Warmth and its Measurement* (B.R.1472) published in 1946 as a book of reference by H.M. Stationery Office.

Mr. A. J. Sims, O.B.E., of the Royal Corps of Naval Constructors, published an account of the habitability of naval establishments under war-time conditions at a meeting of the Institute of Naval Architects on April 17, 1945.

Surgeon Commander G. H. G. Southwell-Sander, M.B., B.Ch., M.R.C.S., L.R.C.P., D.P.H., D.I.H., has published some details of habitability under his 'Recent Advances in Naval Hygiene and Preventive Medicine' for the *Journal of the Royal Naval Medical Service*, October 1947.

Information has also been published by Surgeon Commander F. P. Ellis, O.B.E., M.D., Ch.B., M.R.C.S., M.R.C.P., who was secretary of the Habitability Sub-committee, and Surgeon Commander J. Mansel Reese, M.R.C.S., L.R.C.P., D.P.H., 'The Measurement of Thermal Environment Afloat' (*Journal of the Royal Naval Medical Service*, July 1947).

The first step taken by the Habitability Sub-committee was to arrange for a preliminary examination of the living conditions in men-of-war. This was conducted by naval constructors, ventilation engineers, physiologists, psychologists and selected Executive and Medical Naval Officers who visited ships on both Home and Foreign Stations. It was at once agreed that efforts to increase to the maximum the mechanical fighting strength and firing power of these ships had led to a deterioration in the living conditions of the men. But it was also found that much could be done to improve matters by simple means, such as using to better advantage equipment already in existence, or by issuing simple instructions on environmental hygiene which could be easily carried out. It was also found that great improvement could be effected by correcting minor structural defects, many of which could easily be dealt with by the ship's company itself, or by local dockyards without re-arrangement of the general construction programme.

It will be seen, therefore, that even this preliminary action by the committee was able to do much towards solving some of the minor problems connected with habitability afloat. It must also be mentioned that this initial bout of investigation was attended by a result of practical value, if somewhat intangible in character, in that there was a general all round improvement in the morale of the complement of the ships in which the committee's early investigations were conducted. Both officers and ratings felt and realised that more than casual interest was being taken in their living and working conditions, and in the knowledge that their present well-being was the object of close and sympathetic study, their spirits reacted accordingly.

These preliminary investigations, however, showed that few accurate or useful records existed of the atmospheric conditions in ships. Moreover, it was found that the conclusions obtained from research on effective temperatures and working conditions in factories and industries ashore could not be applied to conditions in men-of-war. This was because of the unique character of a man-of-war as a living and working environment, in which the most concentrated production of wild and radiant heat was combined with a high density of population. It soon became evident that one of the chief functions of the Habitability Sub-committee would need to be the collection of data, in order to prove that the fighting strength of a ship depends as much on the fitness of her crew as on the firing power of her guns; it was in fact necessary to establish, by definite data, that nothing could be gained by cramming a

ship with extra weapons and modern technical machinery, if the living conditions were made so bad thereby that the morale and physical welfare of the ship's company suffered in consequence. It was necessary, therefore, to plan investigations which would define the limits under which a man could remain 100 per cent. fighting fit. This meant a long period of observation under various extremes of climate, and a close study of temperature, humidity, air movement, and the bacterial content of the atmosphere in every type of man-of-war under all conditions of naval service.

In order that a common and acceptable standard of conclusions could be reached from the strictly scientific and statistical viewpoint, indices of physical and mental fitness had to be devised. Examples of such indices were the speed at which men could perform gun-loading drill or transmit signals, and the number of errors which were made in such transmissions under different environmental conditions. It was necessary to discover whether general efficiency would be improved by air conditioning, lagging and insulation to such an extent as to justify a compensatory reduction in machinery, armament and complement. The main task was to prove, by figures incapable of contradiction, that a smaller and fitter crew would find and hit the target more rapidly, more often, and for longer periods, than a larger ship's company who, though manning a heavier armament, would be exhausted by living under bad conditions, and would rapidly become fatigued by having to live and perform their duties in an atmosphere in which mental alertness and reaction time might be liable to be seriously impaired.

Perhaps the Habitability Sub-committee's first great achievement was to establish, as part of its own initial researches, standard methods of measuring environmental warmth in H.M. Ships under all conditions of service. The M.R.C. War Memorandum No. 17, referred to above, describes in detail the standard technique of measuring environmental warmth which was adopted by the Royal Navy. The memorandum itself was published in order that it might prove useful to those responsible for preserving the health of the Merchant Navy, and to industrial and other workers ashore. To collect the necessary information on environmental conditions it was recommended that a box of instruments should be issued to ships consisting of:

A whirling hygrometer
A silvered Kata Thermometer 130° F.–125° F.
A silvered Kata Thermometer 150° F.–145° F.
A globe and globe thermometer.

Also contained were surface contact thermometers, a stop watch, a vacuum flask, and means for supporting the globe and globe thermometer. The aim was that from a mass of valuable data naval constructors might be able to make fundamental improvements in the ventilation

system of ships or, if need be, in the design of ships, in order to improve their habitability and to achieve conditions in which the health and efficiency of crews might be less affected by extremes of climate.

It is desirable to draw attention, at this point, to one of the most important lessons for all workers in social health which issued from naval experience in this connexion. It became obvious that it was a waste of time to supply expensive equipment and instruments, unless means were also taken to make certain that the intended users fully understood the exact purpose of such apparatus, how it should be operated, and the benefits which they themselves might hope to reap from its intelligent use. Therefore it was essential that, as far as possible, an expert should be always available to give advice and instruction wherever indicated, and to be personally responsible for ensuring that such health equipment was utilised for the purpose for which it was supplied, and was maintained in good order. It was wisely realised that in applied social medicine, perhaps more than any other subject, success will depend on never neglecting the inherent psychology and instinctive resistance of the herd and its leaders to any change in their customary environment or work, be it for better or worse. It was also remembered that kata thermometers had been a service afloat issue to medical officers for over twenty years, but owing to ignorance of the method of use of the instrument and its function, few had ever been removed from their boxes.

As a result of much research and experiment, and as a compromise between what is desired and what is practicable, the committee provisionally recommended a standard of effective temperature of 80° F. as an upper desirable limit, and of 86° F. as the upper limit above which a man's full efficiency was likely to be impaired.

The next important work of the committee was to recommend the adoption of air conditioning, which it was realised was the only possible method of meeting the standard of effective temperature in the Tropics.

This subject had already been discussed by the Ventilation Committee of 1937, but any improvements considered had been rejected because of the size, weight and cost of the air conditioning plant involved. The war-time investigators well realised that in a ship afloat the problems of weight and space must always be regarded as the limiting factors, should the adoption of wide scale air conditioning ever be considered. As a compromise a priority list was drawn up, giving precedence to the most important compartments from the fighting point of view. It was necessary to decide whether to cool working compartments in order to display a practical result or whether to give priority to the mess deck so as to ensure more satisfactory living and sleeping conditions.

As a guide it was directed that air conditioning should maintain an effective temperature not below 78° F., or not more than a 10° difference between the treated and untreated air.

The project was obviously one of the greatest moment to all men-of-war, particularly to submarines. In such ships as were allocated a degree of air conditioning, the resulting improvement in habitability was dramatic, and complaints of prickly heat, toe rot, diarrhoea and the general mental and physical deterioration of ships' companies disappeared almost overnight. Air conditioning was not confined to the Tropics, but applied equally to Arctic conditions, as the incoming air could be automatically cleaned, dried, moistened, and warmed or cooled as required.

Reference to Chapter 8 of this History on Naval Hospital Ships will remind the reader, however, that air conditioning of a whole ship, as opposed to selected compartments, was adversely regarded, as should the plant break down, the subsequent state of affairs might be generally worse than in circumstances where only isolated compartments would be affected.

Other improvements in habitability which were recommended and many of which were implemented before the end of the war were:

1. The supply of laundries in ships. This was considered likely to effect an economy in man-power, and also likely to decrease the humidity caused by laundering clothes between decks. In any case it was considered that a constant supply of clean dry clothing would be an important factor in maintaining health and morale. At the same time the sailor is a creature of habit, and when he has been accustomed to wash his clothes in a convenient bucket of soapy water for some generations it is difficult to get him to change his routine. Such laundries as were provided were often used for any purpose other than that for which they had been intended, though their inclusion was always a useful addition to the medical organisation of the ship by providing an extra dressing station in action. Also, there is no doubt that certain laundries were badly placed and badly constructed, and in anything approaching rough weather were likely to be flooded and unusable.
2. Provision of water cooling machines, which it was anticipated would be of assistance in combating the evil effects of heat exhaustion.
3. The adoption of centralised messing, and the use of different colour schemes for painting out messes with the object of effecting warmth and cheerfulness.
4. The adoption of fluorescent lighting was an improvement which, as well as being more efficient, reduced the radiant heat effects of filament lamps.
5. The importance of lagging to combat solar radiation and internal radiant heat as well as to maintain heat in Arctic climates.
6. Clothing improvements varied from Arctic clothing to uniform for the Tropics. As regards Arctic clothing the requirements of the Naval Air Arm had to be considered as well as the general and special requirements for service afloat.

CLOTHING

It became increasingly apparent during the war years that there were essential differences between what was suitable for the Navy afloat in cold climates and what was needed by the Army on land under similar conditions. The extreme dry cold conditions experienced on land were never encountered at sea, but on the other hand the clothing of the seaman had to allow for wet as well as cold, and for prolonged periods of immobility out of doors exposed to the elements as opposed to the more mobile functions of his military contemporary ashore. In addition, consideration had to be given to the cold weather requirements in different types of craft, for conditions on board a capital ship or cruiser had obviously to be distinguished from conditions in destroyers, corvettes, minesweepers, and in particular the submarine service.

Before, and during, much of the war, the history of cold weather clothing for naval use is essentially one of improvisation. Considerable stocks of warm clothing had been left over from the First World War, and in the absence of any evidence pointing to the likelihood of prolonged active service by naval units inside the Arctic Circle, little developmental work was carried out in this field in the period between the wars; 1939, therefore, found the Navy with items of cold weather clothing very much the same as those issued in 1918. The watch coat, duffle coat, goat-skin coat, oil skins and thick woollen underwear were the main garments available.

The outbreak of war stimulated investigation in the field of cold weather clothing, and by the end of 1941 small modifications and additions had been made with a view to affording better protection against wind and spray. In all fairness, it should be stated that within limits, the clothing in use up to this time had proved reasonably efficient in providing protection against cold, moderately wet conditions. Furthermore, by combining several of the available garments, it was possible for most sailors to improvise an outfit capable of protecting the wearer against all but the worst extremes of weather and climate. This was so, however ill-fitting the different garments might appear to have been in relation to each other. Unfortunately, the custom of achieving protection by several layers of different garments meant an inevitable increase in the bulk of the wearer, and this had the disadvantage of restricting his mobility, and in some cases, even access or egress to or from important compartments in the ship via restricted apertures.

Following the hardships suffered on the early convoys to North Russia, a serious attempt was made in 1942 to design special clothing for Arctic wear, as a result of which the naval 'Anarak' suit was developed in conjunction with the British Cotton Industries Research Association. This garment took time to develop, but eventually was the chief form of naval Arctic clothing for the rest of the war.

When war broke out in 1939, little had been done for twenty years to provide suitable clothing for Service airmen. Naval pilots, more than the R.A.F., were ill-dressed basically. The naval officer's uniform was not a comfortable or practical flying suit, the double-breasted jacket being too bulky, its pockets too easily torn, and the superfine serge material too easily soiled. Over the uniform suit could be worn an overall provided at the officer's own expense, a Sidcot suit, or an Irving suit. The latter was a heavy, fur-lined, two-piece garment.

The initial impulse to improve on this state of affairs as regards cold weather flying was taken in conjunction with the R.A.F., when suitable clothing had to be devised towards solving the problem of survival of the pilots of C.A.M. ships.* These ships were fitted with a launching catapult by which a fighter aircraft could be made airborne to deal with enemy air attack. Unless within reach of friendly territory the pilot had no base to which he could return, and was inevitably faced by descent into the sea either by parachute or by deliberately crashing his aircraft. A marine suit was therefore designed in which a pilot might fly in comfort, but which would keep him warm and dry when he entered the sea.

To provide such clothing was not easy. Naval interest centred around relatively small aircraft with only one occupant who had to be kept warm while flying. Under tropical conditions it was possible to rely upon electrical heating of clothing or upon the general heating of the cockpit, but such systems were unsuitable for Arctic conditions, since the source of heating would be lost in the event of a forced landing. Warmth, therefore, had to be derived from clothing alone. It was essential too that such clothing should be comfortable, and not too bulky in relation to the cockpit, because pilots were insistent that they would not wear protective clothing which was likely to hamper their operational efficiency. This outlook was reasonable, and pilots were also apt to argue that the less encumbered they were the better they would be able to fight, and the less the likelihood of protective clothing being necessary after survival.

With the arrival of escort carriers C.A.M. ships disappeared, and the above requirements received close consideration in view of the increasing numbers of naval pilots operating under conditions of extreme cold. The result, a naval Immersion Suit, was designed and introduced into service in 1943. It was immediately popular among air crews engaged on Arctic convoys, and in spite of certain drawbacks its value was well demonstrated in actual service by the fact that the expectation of life after crashing in the sea was extended from a matter of ten minutes to over one hour. It is on record that no naval airman wearing the suit was lost when it was known where he might be picked up.

The evolution of suitable clothing for war under tropical and subtropical conditions ashore and afloat was on the whole much slower in

* Catapult Aircraft Merchant Ships.

the Royal Navy than in the other Services. On Tropical Stations His Majesty's Ships in peace-time were largely engaged on 'Flag Showing' cruises to foreign countries and outposts of the Empire. This function quite rightly carried with it social, political and diplomatic duties such as have always been among the major tasks of the Navy oversea. In this respect the appearance, not only of the ships themselves, but of their personnel, has always been of importance. For many years, the question of whether the clothing considered to be consistent with a smart appearance was also consistent with health and comfort was regarded as of secondary importance. The matter was, however, constantly in the minds of more enlightened observers who foresaw that the habitability requirements in hot climates must eventually include some relaxation in the rigid clothing discipline which existed, no matter how revolutionary or distasteful such changes might appear to be in a Service which, despite its ability to improvise when necessary, at heart preferred strictly to adhere to tradition. Such few measures as were suggested received deferred consideration, and though a slight impetus was initiated by the formation of a Naval Air Arm, it was not until the War of 1939–45 that the sailor could be regarded as suitably clothed for service in hot weather, and even then some difficulties existed which were never fully resolved.

Between the wars changes in tropical clothing were very few, and there is no doubt that on the whole both officers and ratings came to regard their uniform requirements as one of the necessary burdens which must be cheerfully borne during a tropical commission.

The officers perhaps suffered most, due to the large variety of uniforms which custom and regulations dictated should be worn both for normal routine and ceremonial occasions. The normal everyday tropical uniform for officers consisted of the following:

A white sun helmet which had to be worn constantly on deck between the hours of 8 a.m. and 4 p.m. Outside these hours a uniform cap with white cap cover could be worn instead.

A starched white duck uniform tunic with high neck. This tunic was originally designed in order to eliminate the cutaway tunic previously worn which necessitated the wearing of a shirt, collar and tie. In point of fact the latter was far cooler, for although the shirt and collar were no longer necessary, the new tunic with its high and tightly fastened neck, removed all possibility of ventilation, and was on the whole much less comfortable than the previous garments.

Long starched white duck trousers.

White socks.

White buckskin or canvas shoes.

During working hours in H.M. Ships in the Tropics this uniform, though smart in appearance, was a torture to the wearer, being usually heavily laden with sweat, and a great hardship to the sufferer from the

'prickly heat' which inevitably developed. On Sundays, and on ceremonial occasions, things were even worse, and the burden was aggravated by a sword, belt, medals and decorations, and white kid gloves. The latter uniform included, for occasions such as Governor's levées, black patent half-Wellington boots. It is recorded that, on one such occasion in Colombo, blue full dress uniform with epaulettes and cocked hat was ordered to be worn!

Apart from the discomfort and unsuitability of this type of uniform for everyday wear afloat, laundering was an additional difficulty, and officers were involved in some expense in maintaining the number of suits necessary to keep up appearances.

During the 1930s this uniform was relaxed in certain of H.M. Ships on tropical service, but very much at the discretion of Commanding Officers whose views as to what was fitting and proper naturally varied. In smaller ships such relaxations gradually became the subject of fresh uniform regulations, but in larger ships the discretionary powers of Commanding Officers on the high seas, and of Commanders-in-Chief in harbour and ashore, still prevailed.

The result was that in sloops serving in the Red Sea and Persian Gulf, for example, on week days and non-ceremonial occasions the uniform suit was replaced by a tropical shirt with open neck and short sleeves, white shorts, and white stockings.

On the other hand, though this sensible type of outfit was permitted in some larger ships, many Commanding Officers felt that such relaxation was bad for discipline and the outfit was prohibited. Other Commanding Officers compromised, and once the ship was out of sight of land, and thus out of the public eye, the white duck trousers were permitted to be replaced by white shorts, but the tunic was retained, and as though to compensate for the display of flesh, blue stockings and black uniform shoes had to be worn at the same time. However, this type of relative comfort was only permissible at sea, and once the ship sighted its destination, be it even a desert island, the regulation uniform suit prevailed once more.

Officers' evening wear ashore and afloat was another item of doubtful suitability in the Tropics. As a routine 'Mess Undress' was worn, consisting of:

Black patent shoes and black socks.
Blue uniform serge trousers.
Stiff fronted and stiff cuffed evening shirt.
Wing collar and bow tie.
Cummerbund, or blue uniform evening waistcoat.
White mess jacket.

During the 1930s, as a general routine, the wearing of a soft shirt and collar instead of the stiff fronted variety became optional. Also, according to the depth of the individual pocket, officers were able to obtain at

their own expense trousers of tropical serge which was finer and lighter than the regulation type. The latter soon became heavy and sweat laden, requiring frequent cleaning.

For more formal evening occasions 'Mess Dress' replaced 'Mess Undress', and this necessitated the wearing of a stiff fronted shirt with a wing collar, uniform white waistcoat, 'gold lace' trousers, and patent half-Wellington boots.

Marine officer's uniform approximated to that of the naval officer for evening wear, but in the daytime the marine officer's khaki drill uniform suit was on the whole more comfortable than the naval officer's white suit, and the marine tunic was 'cut away', with no high neck, and was worn with a shirt, collar and tie.

The requirements of war brought about revolutionary changes in the uniforms of naval officers ashore and afloat in hot climates. The changes were at first gradual, largely unofficial, and were dictated by the requirements of active service, long periods without laundering facilities, scarcity of material, and the additional burden of 'anti-flash' protective garments which made the normal uniform impossible to wear. Also ceremonial occasions were few and the Navy was now performing a combatant function rather than a diplomatic one.

The tropical helmet disappeared, and white uniform tunic and trousers were reserved for formal occasions and for shore-going after dark. Tropical shirt with white shorts, stockings and shoes became routine wear. Under the influence of the Naval Air Arm, which tended to devise clothing more practical for its purpose, khaki shirt, shorts and stockings began to appear in some of H.M. Ships, and became a general article of apparel in establishments ashore. In some ships the khaki shirt was replaced by a khaki tunic or bush jacket, an example here being set by the Supreme Commander, South East Asia.

Such evening wear as was worn under war-time conditions in the Tropics was again dictated by comfort and utility. Blue trousers were largely replaced by white, and a tropical open-neck shirt was worn with a cummerbund. The collar, bow tie and mess jacket disappeared, save on formal occasions.

The clothing of the naval rating in the Tropics largely followed that of his officers, certainly should his duties require his appearance on deck. In general, a regulation sun helmet was worn with white duck jumper and 'bell bottoms' and black socks and boots. Although this uniform was retained for shore-going, Sunday Divisions, and formal occasions, numerous relaxations were permitted afloat during the 1930s, and white jumpers or 'flannels', or white shirts, with white shorts, blue stockings and black shoes became generally recognised.

Here again the Royal Marine was better placed than the naval rating, as his uniform shorts and shirt had always visualised the possibility of suitable clothing for active service on shore.

In company with the naval officer, the naval rating's tropical uniform underwent revolutionary changes dictated by the requirements of war. His sun helmet too, disappeared, white shirt, shorts, stockings and shoes became usual, and in some areas khaki made its appearance.

By the end of the war certain of these changes and relaxations in tropical clothing had become officially recognised, and were the subject of fresh Admiralty Fleet Orders. For example, the sun helmet disappeared from the Service for good, while white tropical shirts, shorts and stockings became a permanent type of wear during working hours. 'Action working dress' also saw the introduction of a blue shirt with long sleeves for use in hot climates. On the other hand khaki dress was never regarded favourably in the Royal Navy, except in the case of Royal Marines, and though tolerated during the war years, was soon afterwards prohibited save in aircraft carriers and on Royal Naval Air Stations.

Many of these clothing changes in hot climates had been advocated by the Medical Branch of the Navy, which considered quite rightly that much of the debility and minor sickness on Tropical Stations could be alleviated by greater personal comfort and freedom of movement. But tradition dies hard, and much in the same way as the abolition of the 'spinal pad' was resisted in the Army at one time, so the suggested changes in naval tropical wear were also deemed to contradict precautionary requirements which, if only legendary, had nevertheless become established as vital necessities. It was with some surprise that the alleged dangers of the direct rays of tropical sunshine were proved to have been grossly exaggerated, but this was indeed the case. Furthermore, experience soon showed that once a man was adequately suntanned he could work more efficiently without a sun-helmet, and bare to the waist. In other words, it was proved that the sun's rays, far from being a danger, were directly beneficial. In the same way sandals worn on the bare feet were shown to be an advantage. It was thus proved beyond all doubt that tropical skin and foot infections could be controlled beneficially, and largely prevented by such sensible relaxations. A ship's company came in fact to possess a sun-bronzed and healthy appearance as compared with the pallor and exhaustion which had come to be associated with tropical service in the past. It was with perhaps even greater surprise that it was realised that these changes in tropical clothing could be consistent with naval discipline and efficiency.

Although the beneficial changes in clothing recorded above came into being during the war years, certain deficiencies did exist which were never adequately remedied, and which always hampered antimalarial precautions, as will be seen later in this chapter.

SUMMARY

The broad account of investigation into 'habitability' in the Navy which has so far been given, also included questions of amenities,

recreation, mail, and domestic worries, which it was realised must play an important part in well-being, though difficult to assess.

By the end of the war it could be stated that air conditioning, the use of refrigerators, and the added discoveries of new insecticides had gone far towards combating the deterioration in efficiency and the development of the tropical neurosis so commonly met on service in hot climates. Similarly steps had been taken in the right direction to alleviate some of the hardships of service in very cold climates. Nevertheless much of the work in this field which was carried out during the war was little more than a preliminary survey of conditions, and it may perhaps be stated more accurately that by the end of the war research experts had before them a number of habitability problems temporarily alleviated only, which would form the subject of many years' additional work before achieving their final solution.

It is now possible to consider particular problems and incidents which merit recording, as opposed to the more general considerations which have so far been set down in this section of the Naval Medical History of the War.

MEDICAL ASPECTS OF A WAR-TIME ANTARCTIC EXPEDITION

It is commonly supposed that the Navy's experience of service under climatic conditions of extreme cold is confined chiefly to those ships which were employed in the North Atlantic, around Iceland and Greenland, and which took part in Arctic convoys to North Russia. This is true to a great extent, and a detailed account of the latter will be given in the Operational Volume of this History.

Nevertheless, a naval expedition left the United Kingdom in December 1943, in the troopship *Highland Monarch*, for a period of service in the Antarctic. This expedition reached Port Stanley, Falkland Islands, at the end of January 1944. Two bases were established, one at Port Lockroy off the west coast of Grahamland, and one at Deception Island in the South Shetlands. Later the main base was left at Hope Bay on the Grahamland Peninsula. The party consisted mainly of scientists, both Service men and civilians. The ages of individuals varied from 20 to 57 years, the average age being 34. The expedition continued its work until the end of 1945, and was finally relieved in January 1946.

The base at Deception Island was established in the buildings of a derelict whaling station. The other bases were built of wood by the members of the expedition. The walls and roof were double with a four-inch air space in which were layers of aluminium foil and sisalkraft paper. The buildings were snowed up in winter, and heated by slow-combustion coal stoves. The bases were in regular wireless telegraph communication with each other and with Port Stanley. The medical officer carried by the expedition was stationed at the main base.

The system adopted was to keep at the small bases typewritten instructions on the questioning and examination of patients. The answers and findings were then sent to the medical officer by radio, who then gave his advice and instructions by the same method.

The expedition was organised in great haste and secrecy in London in the autumn of 1943, and as a result of this haste, and of the indefinite future of the project, far too many medical stores were taken. These stores were despatched from Chatham Dockyard in October 1943, and were so well packed, that they eventually arrived in the Antarctic without damage to a single article. At the base itself the stores were distributed in separate huts as an insurance against fire and damage.

The diet of the expedition was almost entirely canned or dried food, which though plentiful, tended to become monotonous. Fortunately, the cook had previously served on former expeditions as steward of the *Discovery II*, and his experience went far towards maintaining the morale of the party. Fresh food was scarce, and consisted of an occasional deer or seal, fish, which was plentiful in the summer months, and an occasional supply of fresh mutton and vegetables brought by sea. At certain times large numbers of penguin's eggs could be obtained; 50 mg. of ascorbic acid were issued to each man per day, and there was never any sign of scurvy due to the absence of fresh food. Nevertheless, after some months a real craving for fresh food developed. In this respect such fresh food as was sent to the party periodically had frequently been badly packed and handled, and by the time of its arrival was almost unfit to eat. For example, sides of bacon were placed in soldered tins without salt, and having gone bad during transit through the Tropics, were uneatable on arrival. The general shipping programme of this period of the war also exerted an adverse effect, and necessitated the shipping of tinned meat from the River Plate to the United Kingdom and then back to Monte Video before being sent to the Falklands. Consequently the meat was from one to two years old by the time it arrived.

The sanitary arrangements are of some interest. For example, at Hope Bay the lavatory was at the end of an extension built out from the lee side of the house. A urinal made out of flattened corrugated iron occupied one corner, with a pipe running through the floor. This pipe froze in mid-winter, and required excavation from outside and the use of a red hot poker. Owing to the prevalent low temperatures, the lavatory never became offensive, and it was found that ashes placed in the bottom of the receiving bucket enabled the mass of frozen faeces to be easily separated for disposal.

The general health of the party remained good with two exceptions, and no sign of serious disease was ever detected. It is of interest that after the first month there were no respiratory infections, although there were many on board the relief ships which visited the expedition.

Some members suffered from frostbitten feet, but only one case showed more than superficial blistering. This latter man had gone out in wet boots in a temperature below zero. He developed an extensive necrosis of the right hallux, which took five months to heal.

Only one case of snow blindness occurred, snow goggles being worn when necessary as a safeguard.

Only one case suggestive of a deficiency disease was observed.

Dental health was remarkably good and there seemed to be a significant absence of caries.

The main calls on the medical officer were necessitated by minor injuries and psychological factors. The latter increased as time went on. In general there was so much work to be done that there was little time for worry. For relaxation there was a good library, a gramophone with records to suit all tastes, and various indoor games. Many men had hobbies. News from the B.B.C. was heard once or twice daily, and there was a local broadcast from Port Stanley once a week. The main cause for anxiety was the complete lack of information about future plans, and towards the end of the second year when no news of relief had been received, severe depression was felt by many men. This, in fact, is the main factor which has been considered in the Medical Report of this expedition which emphasises that two years is the maximum period which any man should spend in the Antarctic at one time.

DISINFESTATION AND INSECTICIDES

In company with the other Fighting Services, the Royal Navy greatly benefited from the discovery and introduction of modern insecticides during the war years, and the laborious procedure for disinfecting and disinfesting H.M. Ships and Naval Establishments ashore were greatly modified.

It was found that disinfection of quarters after a case of infectious disease no longer required stripping and fumigation. All that was needed in most cases was thorough ventilation and scrubbing with soap and water. In the case of insect borne disease spraying with liquid D.D.T. was carried out as well. For the disinfection of bedding and clothing measures were restricted to simple laundering in most infectious cases, after a preliminary soaking in disinfection fluid in the case of virulent organisms such as typhoid or cholera. Steam disinfection was limited to the more resistant infections such as smallpox. It was also proved during the war that the spread of scabies was by intimate personal contact, and that steam disinfection of clothing or bedding was no longer necessary.

The story of D.D.T. is too well known to need separate detailed description in this History. Its application to naval service brought about phenomenal modifications which had far-reaching results to the advantage of personnel and shipping. Its use eliminated the need of

fumigating large men-of-war by hydrocyanic acid gas except for the destruction of rats, and carboxide fumigation of submarines was no longer necessary. The immense advance in the control of insect borne diseases by the use of D.D.T. was demonstrated abundantly in the control of malaria, sandfly fever and dengue fever in Naval Air Stations and shore establishments in the Tropics. When used to control the breeding and spread of flies, the resultant decrease in intestinal diseases was remarkable. D.D.T. also reduced the ever-present scourge of cockroaches in H.M. Ships, and the occasional menace of the bed bug was almost completely eliminated. In the Pacific and in South East Asia the Navy played a part in the pioneer work concerned with D.D.T. spraying from aircraft, an account of which has been given by the Naval Medical Adviser to the Supreme Commander South East Asia (Journal of the R. N. Medical Service, July 1947).

SPECIFIC DISEASES IN RELATION TO HYGIENE

MALARIA

As has already been pointed out, by virtue of the protection afforded by life afloat, it is only on rare occasions that severe outbreaks of malaria have occurred in the Navy. During the war, however, it became necessary to set up a large number of shore establishments and Naval Air Stations in the Tropics. The latter frequently had to be carved out of virgin jungle, often in highly malarious districts, and the menace of this disease became one of vital concern. The previous happy immunity of the sailor required a painful and laborious propaganda indoctrinisation in anti-malarial discipline ashore, in addition to which engineering projects, housing improvements, clothing modifications, and arrangements for medicinal prophylactic measures had to be undertaken and organised on a vast scale.

Before the high degree of preventive medical measures could be achieved, many casualties were suffered from malaria, both by the Royal Navy and the Merchant Navy working in conjunction at certain large tropical ports. It was soon realised that the immunity which ship life afforded was not completely foolproof, and that when tropical harbours became congested with shipping under the necessities of war, a certain degree of malarial infection could occur amongst personnel on board who had not set foot ashore. This was particularly so in the case of 'base craft', being ships which were more or less permanently based in a particular harbour for indefinitely long periods, but it was also found that the personnel of ships visiting for only short periods could be infected with malaria while remaining on board. Insight into this possibility and the grave hazards involved was shown by the investigation carried out by Professor D. B. Blacklock, of the Liverpool School of Tropical Medicine, in and around Freetown Harbour in 1940 and 1941. (See The Civilian Health and Medical Services, Volume II, Part I, Chap. I.)

As is well-known, the port of Freetown, Sierra Leone, West Africa, became of great importance in the administration of convoys early in the war. The port performed the function of a storing and victualling centre and assembling point for such convoys. The harbour was thus occupied by large numbers of merchant ships and escorting men-of-war. It soon became apparent that ships were arriving in British ports from Freetown with increasing numbers of their personnel incapacitated as a result of malaria. In some cases such a large proportion of the crew was on the sick list that difficulty had been experienced in working the vessel. Transports proceeding south from Freetown had also been affected in some cases, and the troops on board had evidently contracted malaria in the port. Some fatal cases had occurred in the ships, and deaths had occurred either on board or after the case had been landed at a port later in the journey. In July 1940, 223 cases of malaria were reported in ships which arrived at British ports after calling at Freetown. In August of the same year 227 such cases were notified. The notifications came from London, Liverpool, Manchester, Hull, Barrow-in-Furness and Glasgow. The time lost by men engaged in the essential work of sea transport was obviously becoming formidable, and the state of affairs was a repetition of that which existed between 1914–18, when large numbers of seamen suffered from malaria believed to have been contracted in the West African ports of Dakar and Freetown.

In consequence of the increasing gravity of the situation, the Colonial Office requested Professor Blacklock to investigate health conditions in Freetown Harbour, especially with regard to the means by which malaria was being contracted by the personnel of ships afloat. With a view to aiding Professor Blacklock and his assistants in their task it was arranged by the Board of Admiralty that they should be granted the temporary rank of surgeon captain and surgeon commander R.N.V.R. respectively. This arrangement proved to be of very great value to them in the performance of their duties.

Professor Blacklock's work was greatly facilitated by his previous knowledge of the area, as he had spent the years 1921–9 in Freetown as Director of the Sir Lewis Jones Laboratory.

The investigators arrived in Freetown on September 6, 1940, and were immediately impressed by the large number of ships present in the harbour. Whereas in peace-time there were only two or three ships, there were now usually well over 100, and these were spread out over a very large area. The anchorage was obviously overcrowded, and it could be seen at once that the number of ships, as well as their proximity to each other and to the adjacent shore-side, had introduced possibilities of insect borne disease hitherto neglected. This widespread distribution of shipping rendered necessary by their numbers, in fact dictated the direction and scope of the investigations to be carried out. Broadly speaking, the task which presented itself was to safeguard the ships from

their shore-side contacts, to establish the maximum control by preventive measures on board, and to mitigate the risk of infection from Freetown itself and the neighbouring villages around the harbour's edge. The immediate steps taken on arrival aimed at minimising the risk of disease vectors being carried from shore to ships by the large number of small craft operating in the harbour. With the assistance of the Harbour Master, an Executive Naval Officer, it was arranged to spray with insecticide all launches and lighters on every occasion when they left the shore, either to go alongside a ship or to anchor away from a jetty. The agents of the owners of the vessels co-operated willingly and a number of the crew of each vessel was allocated for the spraying duty. The following procedure was adopted:

One man on each vessel to spray it after it had left the shore for any ship or anchorage.

Any vessel moving out before 9 a.m. or after 4 p.m. to be sprayed.

Lighters alongside or anchored to be sprayed before being battened down.

Spraying instructions and drill to be given by a sanitary superintendent qualified for the work.

Periodic examinations of the craft to be made by sanitary assistants for the presence of mosquitoes.

These measures were apparently effective, since on only two occasions after they were put into operation were mosquitoes discovered on board any of these vessels, and in both instances only culicines were found.

As regards sea-going ships, in the course of the investigation 398 ships were examined. Attention was paid first on each day to any ship which had just arrived from other West African ports. This was in order to ascertain whether such ships were bringing mosquitoes with them from earlier ports of call. Evidence was obtained which strongly suggested this possibility.

Attention was then turned to any ships which had been in harbour for a considerable time, special note being taken of those which were anchored near to shore-side or which had been alongside the oil tank jetty, or which had been in contact with the shore through the medium of oil tankers, water boats, tugs and lighters.

In all cases the parts of the ship most carefully examined were the crew's quarters, the officers' quarters, passenger accommodation and public rooms. The possibility of actual mosquito breeding on board was constantly borne in mind.

Anophelines were discovered in each of forty-five ships investigated. The majority of the ships concerned were those which were more or less permanently stationed in the harbour and which frequently went alongside the oil jetty. Culicines were found in sixty-seven ships altogether. On the other hand evidence that mosquitoes were actually breeding on board was found in the case of one ship only, a water distiller.

This systematic examination of a selection of the ships present on any day in the harbour provided convincing evidence that the risk of malaria being contracted on board a ship was considerable. Not only were large numbers of mosquitoes found in ships, but a fair proportion of these were anophelines. Furthermore, quite early in the investigation infection in the salivary glands was discovered, and such mosquitoes were undoubtedly capable of spreading disease. It must be remembered too that the investigation was of necessity limited to relatively a small proportion of the ships entering and leaving the harbour, and also that in such ships as were examined attention could be paid to only a relatively small area of the ship itself. The inference was, therefore, that the total number of mosquitoes on all the ships was probably very large indeed.

There seemed to be no doubt, judging from the results of these examinations, that malaria could quite well be contracted on the ships in Freetown Harbour even by persons who never went ashore.

However, it was also evident that a considerable proportion of the malaria ascribed to Freetown had been rather too hastily so attributed for no other reason than that this was the last West African port of call on the homeward voyage. The investigation proved that a large amount of the ship malaria must have been due to conditions existing at other ports at which the ship had called, and not only in West Africa, but East Africa and places even more remote. It was therefore obvious that if such anti-malarial measures in the Freetown area were to be successful they must also be adopted at all other ports in which the disease was endemic.

It is also worthy of mention that the prevalence of mosquitoes in ships in Freetown did not represent a risk of malaria alone, for it was found that the vectors of filaria, dengue and yellow fever were also present in some cases. The early recommendations of the investigators therefore proposed not merely anopheline control, but a control of mosquitoes in a much wider sense which aimed at the elimination of all mosquito-borne diseases, of which malaria was only one.

As a preliminary measure, advice was given to the Port Authorities on the following lines:

Shore-going to be limited strictly.
Personnel to return on board before sundown.
Only persons taking quinine to be given shore permits. (Mepacrine prophylaxis was not in vogue at this time.)
All quarters, alleyways and public rooms, and as much of the rest of the ship as practicable to be sprayed each morning and evening with kerosene or pyrethrum solution.
Existing wire screens to be properly adjusted.
Mosquito nets to be used at night.
Fans to be employed.

5 gr. quinine bihydrochloride to be taken daily by all personnel while at Freetown and until reaching a home port.

Any illness arising soon after arrival in a home port to be reported to the doctor with the information about the risk of exposure to malaria.

It was impossible for the investigators to give accurate local figures from ships in transit to show the effect produced by these measures. There was certainly a marked reduction in the cases of malaria in those ships recorded in the home ports on arrival, and it was considered reasonable to assume that this reduction was due in part to the measures taken in and around Freetown.

There was, however, one group of ships for which figures could be obtained locally, and from these figures more accurate conclusions could be drawn as to the efficacy of the measures adopted. This group of vessels consisted of those which were permanently stationed for duty in Freetown Harbour, and conditions in these were closely studied in the case of twenty vessels over a period of eight months.

These ships were mostly oil tankers, water tankers and water distilling ships which were moving about the harbour freely and constantly visiting shore. They were, therefore, more closely and much more constantly exposed to risk of malaria than any ship in transit, for the latter would only spend a few days in harbour. The frequency with which anophelines were found on board these harbour ships gave some indication of the magnitude of the risk they were running. For example, between September 1940 and August 1941, anophelines were collected on board one or other of these vessels on 20 different occasions.

Soon after the commencement of the investigation it became obvious that the condition of Freetown itself as well as that of the shore-side villages would have to be ascertained, and that every available measure would have to be put into force at an early date in order to control the breeding places of mosquitoes locally. It was found that anophelines were widespread throughout the whole area and that large numbers of the local population were heavily infected with malaria, particularly the young children, of whom as many as 97 per cent. were infected in some villages. Such a rate of infection in children indicated the seriousness of the danger which villages adjacent to the harbour constituted to ships in the anchorage, particularly should such villages be within flight or wind borne range of mosquitoes. As a result, an organisation for spraying, draining and obliterating breeding grounds by engineering projects was recommended, and much of it undertaken.

From the point of view of the Fighting Services, and particularly that of the Royal Navy whose interests were likely to be concerned with port areas, the most important result brought to light by the investigators was that in time of war, lack of consultation with the local authorities regarding the sites to be selected for such establishments as air stations and shore side bases, would frequently entail an avoidable malaria risk.

It was urged that the development of all permanent anti-malaria measures should be guided and controlled by the civil medical authorities with the full co-operation of the Navy, Army, and the Air Force. To this end it was considered that the proper co-ordination of effort and the greatest economy in outlay could best be effected by the formation of a permanent Anti-malaria Committee in such places, on which representatives of all the bodies concerned should serve. This project was actively adopted for the remainder of the war in all areas in which malaria was endemic, and which had to be developed to meet the requirements of an influx of large numbers of personnel of the three Fighting Services.

As regards these anti-malaria committees, it would be wrong to assume that their conception, birth and ultimate survival were effected with that ease which might at first sight appear to have been the case. Certainly as regards the Navy, the reaction to these committees varied considerably from place to place, and it is a matter for some regret that the Senior Service tended to show an apparent lack of interest in some potentially malarious areas, which was a matter for comment, if not for grave criticism on the part of the other Fighting Services. In some districts the Navy played an active part in the formation of the anti-malaria committees, and in implementing the committees' recommendations. But in others the Navy's representation on the local committees was merely formal, and the committees' recommendations seemed frequently to be ignored, if considered at all. It should be realised that areas in which the Navy failed to play its part were few and far between. It is also well to remember that though in such cases this attitude of mind might well have been interpreted as apathy rather than active opposition, it was in fact neither, but was rather an example of the 'teething troubles' which had to be endured during the long task of rendering malaria-minded a Fighting Service which for generations had felt no need of it. It is also as well to record that in every area in which an anti-malaria committee functioned, the peculiar circumstances of the Royal Navy, particularly as regards night clothing, were such that it was impossible for every recommendation of the committee to be implemented, and for this reason it might well have appeared to persons who were ignorant of the Navy's difficulty, that lack of co-operation was being displayed. Perhaps the greatest difficulties which were encountered concerned the long and unwieldy chain of remote administrative control which existed in the Far East, and which frequently led to delay while local commanders sought authority for, or ratification of, their acts from administrative chiefs far away in another country.

In many areas matters were reversed, and the bulk of the anti-malaria pioneer work was carried out and maintained under naval direction. Naval Commanding Officers came to realise in due course that the implementing of these measures was their personal responsibility. The Naval Air Arm itself played a tremendous part in anti-malaria

precautions when jungle areas were cleared in order to establish Naval Air Stations. A consultant entomologist was appointed to the Navy, and a number of young, active and skilled entomologists entered the Service as officers of the 'Special Branch'. A Naval School of Tropical Medicine was established in Ceylon under the control of Flag Officer (Air), East Indies, the staff of which undertook the training of naval personnel in anti-malaria requirements. Finally, the Naval Tropical Research Unit was established in the closing stages of the war.

It will be seen, therefore, that in due course the Navy became 'malaria minded', and once such a mental change had been effected the Navy naturally set out to make sure that a high standard of efficiency was attained consistent with all the other activities of the Senior Service. The discovery of D.D.T. and the introduction of mepacrine vastly simplified the outlook, and long before the end of the war the incidence of malaria in the Navy had fallen to insignificant proportions.

TYPHUS FEVER

The incidence of pediculosis increased considerably during the war under operational conditions of over-crowding in men-of-war, with lack of opportunity for proper personal cleanliness and the laundering of clothing. The condition was rare in the Tropics, but widespread at times in the colder climates, being related to wearing heavy clothing for long periods. It has been recorded that pediculosis was particularly prevalent among personnel of ships operating in Arctic convoys.

Outbreaks of typhus fever became a possibility, especially when H.M. Ships were used for transporting internees from Russia to the United Kingdom. Epidemics in the Mediterranean following enemy attacks also constituted a danger to the Navy.

Reliance for control had been placed on careful routine inspections for lice infection, and treatment by anti-louse powder and disinfection of clothing. The introduction of D.D.T. made control much easier and more effective. The impregnation of clothing with D.D.T., though carried out extensively by the Army, was not considered necessary for the Navy, though the method was always available if required. Vaccines were also available for preventive inoculation.

YELLOW FEVER

The decision to form large Naval Bases on the west coast of Africa during the war made the danger of yellow fever one of vital concern. In addition the increase and range of aerial communication made the possibility of conveying infected mosquitos and patients incubating the disease to other parts of the world a very real one. The strictest measures of inoculating travellers and the disinfection of aircraft passing through endemic areas were necessary, and once again D.D.T. proved of the greatest value. In all these necessary precautions, which were made the subject of Admiralty Fleet Orders, the Navy played its part efficiently.

THE DYSENTERIES

Adequate sanitation, the provision of a pure water supply and the elimination of flies were of supreme importance in the control of intestinal diseases during the war. The sailor afloat had, on the whole, little cause for anxiety on this account, though there was need for investigation into the numerous outbreaks of diarrhoea which occurred in ships from time to time and the origin of which was frequently obscure.

Afloat, the Frederick E.C.D. Water Steriliser was fitted to all ships from sloops upwards wherever possible. This apparatus was designed by the Adviser on Occupational Health to the Medical Director-General of the Navy. Briefly, it consisted of small automatic machines which could be fitted into a ship, one fore and one aft, each being in the vicinity of main fresh water tanks. In principle, the machine was made to operate immediately fresh water was pumped into the ship, either from a direct shore supply or from a water lighter alongside.

As the fresh water was pumped into the tanks so the machine added first a quantity of ammonium sulphate, and a little later a quantity of sodium chloride. The latter was passed through an electrolytic cell which converted some into sodium hypochlorite. This sodium hypochlorite combined with the ammonium sulphate to produce monochloramine and dichloramine which would be injected into the fresh water as it flowed into the tanks, thereby sterilising it. The proportions added were standardised so that the machine would automatically sterilise whatever quantity of fresh water was received.

The object of this process was to eliminate the irksome, and frequently inaccurate sterilising of fresh water by the manual addition of a bleaching powder solution to each fresh water tank after the water had been pumped in. This method had been adopted in every ship in the Navy by long custom and usage. It was regarded as a medical responsibility, invariably delegated by the ship's medical officer to a member of his sick berth staff, who in turn frequently delegated it to a subordinate rating of the engine room staff.

In peace-time, owing to the improved arrangements made for H.M. Ships the world over, it had become usual for shore-side water to be already sterilised before being received on board. Hand chlorination had therefore become little used in the course of years. Under war conditions, however, shore water supply was less reliable, the condition of the tanks of water boats themselves was not above criticism, and in any case H.M. Ships were likely to find themselves taking on board fresh water in isolated places where the water supply was invariably bad. It therefore became necessary for chlorination to be actively resuscitated, and the hand method once more became customary wherever the purity of local water gave rise to the slightest suspicion. This method was, however, very much 'hit and miss', depending on the skill and knowledge

of the person actually carrying it out. It was also inconvenient. Perhaps the greatest of its domestic disadvantages was that being a medical responsibility, there was a tendency to 'play for safety', and to over-chlorinate rather than under-chlorinate. The result was that the Medical Department found itself blamed and unpopular on account of the unappetising taste of the drinking water. Such matters as this are capable of exerting a powerful influence on the harmonious aspect of communal life afloat.

Ostensibly, the Frederick E.C.D. Water Steriliser should have been a welcome addition to every ship into which it was introduced. Its value to preventive medicine afloat and its convenience are obvious. It is therefore surprising to find that the apparatus did not receive the whole-hearted support which would have been expected. Here again, although the value of the sterilising was never in doubt, and even though its convenience was admitted, nevertheless in a large number of ships its introduction resulted in an administrative conflict which tended to neutralise its efficacy. In this respect Service tradition and domestic customs afloat had, as always, to be studied. The chlorination of fresh water in H.M. Ships had always been regarded as a medical responsibility, and this fact had been accepted by ships' medical officers. In simple language, the introduction of the Frederick E.C.D. Steriliser meant that an extra piece of machinery had to be worked when necessary and maintained in good running order. A conflict was therefore likely to arise between the ship's medical and engineering departments. Hitherto, the engineers had been responsible for pumping fresh water inboard. The quality of the water, the decision on its purity, and the practical chlorination of it by hand were matters for the doctors. In some ships the engineers had helped and in other rare cases had undertaken the practical details under the medical officer's direction. The Frederick machine, however, provided an administrative problem which was difficult to solve by mutual agreement, and it almost showed signs of developing into a major interdepartmental issue. In some ships the engineers refused to take any interest in the machine, or even to acknowledge its existence. In others, while acknowledging the machine's existence and that it might be unreasonable to expect a medical officer to maintain and work it, the presence in its structure of an electrolytic cell offered a tempting loophole through which to suggest, that if anyone was responsible it must be the electricians, and that the steriliser should be regarded as part of the equipment of the Torpedo, later the Electrical, Branch. So the argument continued. In the writer's own ship, a light cruiser, an equitable agreement was reached whereby the Frederick E.C.D. apparatus was maintained and kept in running order by the engineers. But once fresh water began to be pumped into the ship, it was agreed that the actual switching on and supervision of the machine during the process of purification should be carried out by

the Medical Department. Later on the engineers in this ship met the doctors more than half way, and agreed not only to maintain the machine, but to operate it during its actual use, but such a gesture was purely gratuitous, and though the machine was being operated by an engineer, a doctor was expected to be present at the same time.

In the course of time the Frederick E.C.D. Steriliser ceased to be a matter for domestic arrangement, and it became the full responsibility of the engineers to maintain these plants in running order.

That such an aid to preventive medicine afloat should have led to conflict is regrettable, and to this fact may possibly be traced a tendency for the machine to be unpopular, to be regarded as temperamental, and to fall into disuse in many ships. It is of some interest and importance to record in this History that a time arrived, after the war had ended, when the naval constructors began to consider the future design of men-of-war in the light of war experience. As has already been explained, habitability in relation to the introduction of technical machinery and equipment had been closely studied. Every square inch of space which could be saved became of importance, and every ounce of machinery had to be considered in relation to a ship's centre of gravity and 'top weight'. The Frederick E.C.D. apparatus invariably came under scrutiny in this respect, small as it was. As part of an investigation which aimed at saving the weight and space of non-essential equipment, a vast amount of evidence was carefully collected from H.M. Ships into which the Frederick E.C.D. Steriliser had been included. It was revealed conclusively that the apparatus in the majority of ships had been used so rarely as to make its presence an unnecessary luxury. Thus, what had been regarded as a valuable asset in a man-of-war has been proved to have failed to justify its existence.

As has been explained, the provision of a pure water supply and the comparative ease with which fly-borne infection could be controlled by routine life afloat kept the incidence of the dysenteric infections down to a minimum in H.M. Ships.

On the other hand, ashore, especially in camps and establishments hastily set up in unsalubrious places in the Tropics, the Navy had to learn the Army ways of camp sanitation, chlorination of water, and disposal of excreta and refuse. Great care had to be exercised in the cooking and preparation of food, and the control of the fly menace necessitated constant propaganda and ceaseless vigilance. The control of flies was vastly simplified by the use of D.D.T., which undoubtedly reduced the incidence of intestinal diseases.

Bacillary dysentery was fairly common among naval personnel in some areas, but the use of sulphaguanidine rendered it a comparatively mild disease, and sources of pollution and infection were greatly reduced. This drug also proved of great value as a prophylactic as well as curative agent.

As regards amoebic dysentery, the incidence in the Navy was never high during the war years. This was a disease with which many generations of sailors had become well acquainted on the China Station; and the Navy had thus always trained its medical officers to recognise the possibility of amoebic dysentery once a ship was, so to speak, east of Suez. The active service naval medical officer and sick berth rating remembered too that amoebic infection may present itself in a variety of forms, abdominal or otherwise. Nevertheless, the introduction of inexperienced medical officers and nursing staff meant that cases of amoebic dysentery were sometimes overlooked because the possibility was not thought of; and consequently small epidemics arose in some areas, but they were quickly checked. The danger of this disease was perhaps greatest immediately the war had ended, when the Navy took over the task of reconstructing ports such as Singapore, Penang and Hong Kong, in which a powerful reservoir of amoebiasis had been left behind as a legacy by the Japanese.

In conducting the necessary details in its campaign against amoebic as well as other dysenteries endemic in tropical areas which had been occupied, the Navy was frequently fortunate in being able to obtain the guidance of Army hygiene experts whose experience was of long standing. Towards the end of the war arrangements had been made, and it became customary, for naval medical officers and sick berth staff to undergo a course in camp sanitation and military hygiene at Aldershot before taking up any appointment ashore in the East. Unfortunately, the calls of the Service at the time were such that not all could be spared to receive this valuable instruction.

In most places of any size in the Tropics it was found that a perfectly good local civilian sanitary authority existed already, and it was comparatively easy for the Navy, when establishing its shore base, to arrange for its own hygiene system to be absorbed into the greater organisation which had already been established in the district for many years.

In some places, however, though it was asserted by the local authority that an efficient health organisation was maintained, experience proved that such was not the case, and that what appeared to be a highly organised Public Health Department was in fact little more than a representation on paper of a system which bore no relation to what was actually taking place in practice. In such a district the Medical Department of an occupying Fighting Service might well find itself faced not with the initiation of health and preventive medical measures in the neighbourhood, but with the far more difficult task of enforcing the measures of the local authority which the latter had introduced long before, but had allowed to fall into abeyance. Experience showed it to be a common failing of the eastern administrative mind in relation to things modern, to purchase western equipment or to launch western projects suggested by western ideas, but to apply to them the neglect

and dilatory methods of the East. The Services soon appreciated the fact that health education and preventive medicine were among the most difficult incidents to accomplish among peoples clamouring for emancipation and self-government.

One Eastern port developed and occupied by the Services during the war suffices as an example of this problem. Here the Local Government was that of an independent State, which prided itself, among other things, on its efficient Public Health Department. The local water supply was effected by a modern waterworks, constructed on western lines, and situated on the banks of a wide river. Water drawn from the river was stored in a reservoir, finally purified by the mechanical addition of chlorine, and subsequently pumped through water mains over a distance of seven miles to the main town, supplying many villages en route. The establishing of a large Naval Base, accommodating several thousand personnel, adjacent to the main town called for an extension of the existing pipe line, and this was agreed to by the Local Government and constructed at Service expense, albeit after great delay. The dysenteries were very prevalent, and the quality of the water supplied came under suspicion, for it seemed always to be inconsistent with the precautions of purification which were alleged to be taken. The river supply was known to contain a high proportion of coliform organisms to a dangerous degree.

Typhoid was also suspected, and cholera was locally endemic. The written reports of the Local Government Health Authorities always showed the water to be fit for consumption, but private examination by Service experts usually differed, as did the reports of the Royal Naval laboratories in Ceylon, to which specimens of the local water were sent by air for analysis. It was also suspected that the technique of the local Medical Officer of Health was not above reproach, for Service observers had frequent opportunities of witnessing the actual taking of specimens of water for examination by his Government Department. There was no doubt that the standard technique for taking such specimens was sadly lacking, from the absence of a blow lamp to the contamination of so-called sterile containers.

The investigation of such a problem called for a tactful approach to a Government Department which prided itself on its modern and up-to-date methods.

After delicate negotiations it was arranged that the local Service Senior Medical Officers should be conducted over the local waterworks. This establishment was found to be in the charge of a resident superintendent, who directed an Asiatic staff. It was observed that the main reservoir tended to serve the purpose of a local bathing pool as well as being made use of as a laundry. It was also observed that the chlorination plant was not in use, and the reason given for this was that it was impossible, in war circumstances, to obtain a regular supply of cylinders of gas. It was asserted too that certain of the metal receiving

caps for cylinders had fractured and could not be replaced. It was tactfully suggested to the sanitary engineer, who had accompanied the party as the representative of the Local Government, that the Army was in a position to supply cylinders of gas regularly and free of charge, and also that the workshop of the local Naval Base would be glad to manufacture new receiving caps for the chlorination machine. These offers were accepted, and a suggestion that a ledger should be kept in which the daily chlorine content of the water should be recorded was well received.

The gas cylinders and spare apparatus were supplied as agreed, and under the pretence of ascertaining that these items supplied from Service sources were in proper working order, it was possible for the local Service medical officers to visit the waterworks unaccompanied, in order to have first-hand knowledge of the preparation and purification of the fresh water consumed by the community. Naturally, omissions were frequently discovered. For example, the chlorine content of the water recorded in the ledger frequently bore no resemblance to that of the specimens tested in the various villages which were supplied. It seemed that the ledger record was always meticulously kept, whether the chlorination machine was employed or not. In fact, as these visits continued, a battle of wits developed between the Service medical authorities and the superintendent of the waterworks, and though the visits of the former were deliberately spontaneous, the element of surprise was usually defeated by the highly developed intelligence system of the latter. In course of time the visits ceased to be informal, and though conducted on a friendly basis, it gradually became accepted that a Service medical officer's purpose was to inspect as well as to advise. The Local Government was adamant in its refusal to permit chlorination of the water to become the responsibility of a Service representative placed inside the waterworks. Nevertheless, sensing the danger of such a possibility, and the serious loss of 'face' which such would entail, the Local Government brought pressure to bear on its employees, and a reasonable degree of efficient water purification was maintained and Service supervision recognised.

Such a result took many months to achieve, and attention had naturally been concerned with only the purification aspect of the water at source. Once this had been placed on a proper footing, it had been assumed that the water supply of the local Service camps and establishments would be satisfactory. This, however, did not prove to be the case, and it was found that, although the water leaving the waterworks was in a highly purified state, it had nevertheless become heavily contaminated during its flow through the pipeline to its place of distribution. This called for further investigation after tactful negotiations with the Local Government. Two facts were now revealed, firstly that the local sanitary system had not yet progressed so far as to provide a sewage system, and

secondly that the main pipeline was faulty and leaking at numerous points in its path. It was realised that such leakage was itself of little importance provided a steady high pressure of water was maintained inside the pipe itself. But in this case the pressure of water was not only low, but usually fluctuated, and consequently these variations in pressure inside the pipe encouraged contamination to be drawn in from outside the pipe through the various leaks which existed. This was particularly likely to occur during the period of heavy monsoon rains. Only two remedies were possible, the laying of a new pipeline and measures to achieve and maintain a steady high pressure of water. Both of these were undertaken more or less at Service expense, but the result was never seen before the end of the war.

These details have here been recorded merely as a single example of the difficulties which confronted from time to time the Medical Departments of the Navy, Army and Air Force, whose aim was to provide a safe fresh water supply in an area in which many thousands of their personnel were accommodated. How such an aim can fail is well illustrated by the fact that in this particular port, in spite of all the efforts which were made, it was always necessary to maintain a large number of men on the sole work of providing drinking water in the Service bases, every drop of which had to be boiled in large metal containers placed on open wood fires which were kept going by day and night. As fast as the water was boiled it was bottled, cooled and kept ready for use. The enormity of this task will be appreciated even more by the realisation that wood for fuel was in short supply and strictly rationed in that area.

In addition to the dangers of the commoner tropical diseases, the Navy's efforts to achieve an efficient preventive medicine organisation ashore was stimulated by the knowledge that poliomyelitis was endemic in some areas and might even be the subject of fly-borne infection in certain cases. The Navy, in company with the other Services, suffered from mild epidemics of this disease, the consequences of which were frequently tragic. Also, the circumstances of tropical service, with the demands for early burial, attached to all fatal cases a dramatic character which tended to exercise an adverse effect on local morale. The case is on record of a young doctor who developed a widespread functional paralysis under the mistaken impression that he had been infected with the virus of poliomyelitis. It is also on record that some National Service male nursing staff were apprehensive when being directed to nurse cases of this disease. But, fortunately, such instances were rare and were quite unknown among naval sick berth staff.

TYPHOID FEVERS

Naturally enteric and the paratyphoid infections have always been the subject of rigid precautions in the Navy afloat, and regulations have existed for many years which have aimed at a pure water supply, the

control of all foodstuffs brought on board H.M. Ships, and a high state of prophylactic inoculation of all ships' companies. In the case of oversea Shore Bases these precautions were even more rigidly enforced. As regards inoculation, in view of the fact that a small number of mild epidemics of typhoid occurred during the war amongst inoculated personnel, some doubt was entertained of the efficiency of standard T.A.B. vaccines as immunising agents. Another question considered was whether the annual 'booster dose' was sufficient. It was also observed that the custom of the Army, certainly in India, was to inoculate afresh with a local strain of vaccine, every soldier arriving in the country, irrespective of the fact that he had already been recently inoculated in the United Kingdom or on board his troopship with a standard vaccine purporting to confer immunity. This routine of the Army had apparently been effected in the light of experience, but the Navy continued to adhere to its own system of inoculation in the case of naval personnel serving in India and Ceylon. The possibility of the Navy conforming to the Army practice was considered when the question was seriously raised early in 1945. A naval officer was inoculated immediately before leaving England, and two months later developed typhoid in India, which was so severe as almost to prove fatal. Nevertheless, the view of the Navy was that such a case was an isolated one, and, perhaps reasonably, it was pointed out that from its earliest inception it had never been claimed that routine inoculation would confer an absolute immunity against the typhoid group of infections. All that had been claimed was that a high degree of immunity would be conferred, and that, should the disease nevertheless be contracted, it would probably run a mild course and would be unlikely to end fatally. Such assessment of the value of inoculation in time of war was frank and sensible, for it had the effect of bringing to mind the important fact that inoculation was merely an essential precaution which held its place as one of several precautionary measures. In other words, because a community had been inoculated, it was not therefore to be assumed that food and water precautions could in any way be relaxed.

SMALLPOX

This disease calls for little comment in this History. The general state of vaccination in the Royal Navy was satisfactory during the war, and though isolated cases occurred there were no epidemics. The Navy was called upon to co-operate in the control measures against the importation of smallpox into the United Kingdom by personnel travelling by air, and such control was especially necessary during the post-war repatriation period. A system of registration and the issue of special cards to all who travelled by air was instituted, and this system aimed at the tracing of contacts and the early reporting of any case of smallpox which might occur.

SCRUB TYPHUS

Though more a concern of the Army, outbreaks of this disease occurred also among naval personnel during the war.

Naval records give an account of what was probably the first outbreak of scrub typhus to occur amongst Allied troops during the war. On October 8, 1941, a battalion of Royal Marines, totalling 1,059 persons, landed on Addu Atoll in the Maldive Islands. Their duty was to take preliminary steps towards the conversion of the Atoll for use as a Fleet anchorage, and to construct an airfield at Gan, the largest of the islands. Their first work consisted of clearing areas on which to accommodate themselves, of making roads and jetties, and the construction of gun emplacements. This preliminary work entailed a considerable amount of scrub clearance, which had to be done by hand, as no mechanical assistance was available. The men worked stripped to the waist in the intense heat, and all remained healthy for the first few days. On October 18, the first case occurred of an undiagnosed illness, and more cases occurred with each succeeding day. The number of sick increased, and the progress of work was seriously affected. By November 20, 48 cases had occurred, of which one had died in the second week of the illness.

The small tented hospital accompanying the battalion became inadequate to deal with the situation as the number of cases continued to increase, and H.M. Hospital Ship *Vita*, then in the Red Sea, was ordered to proceed to Addu Atoll, and arrived there on November 20, 1941.

A description of the clinical details of the disease is unnecessary, as scrub typhus is now recognised as an occupational risk likely to attend the development of remote tropical regions under conditions of war.

In the case of the Addu Atoll outbreak, diagnosis was assisted by the knowledge that scrub typhus was endemic in the area. The chief difficulty at the start was to distinguish the infection from malaria, which was also prevalent in the benign, sub-tertian and quartan forms. But it was soon realised that though the onset was similar in each disease, the temperature in typhus, once elevated, was not likely to fall to normal again until the end of the illness. The slow pulse in the first week of typhus was a useful guide, and the spleen was rarely palpable. Quinine had no effect upon the temperature and repeated blood examinations revealed no malarial parasites. In due course diagnosis was facilitated by an agglutination reaction, once cultures of *Bacillus proteus* had been sent from Colombo on request in order to allow performance of the Weil-Felix test.

Scrub typhus is, of course, a well-recognised disease, having first been described in 1878. The Addu Atoll epidemic presented the common features of the disease, and cases followed the usual course. Although the mortality during the epidemic was low, the prostration which

resulted was gross with marked loss of weight and muscular weakness. Convalescence was very slow, and this was obviously quite important from the point of view of the working efficiency of the battalion as a whole.

Once the identity of the illness was definitely established as scrub typhus, investigation of the source of the infection was begun at Gan Island, where all the cases had arisen with one exception. The latter case came from Hitadu, and the man had never been ashore in Gan. It was therefore assumed that similar sources of infection, though perhaps not so abundant, existed at Hitadu. That the vector invariably was a mite was shown by the reaction to the OX K strain of *bacillus proteus* (F). A search for mites was begun among the undergrowth of the island and they were soon shown to exist in considerable numbers. The vegetation of Gan consisted of coconut palms growing fairly thickly over the whole of the island, and, between the trees, a moderately open growth consisting of leafy plants, long grass and young palm trees. Throughout this undergrowth were numerous rats which were arborescent in their habits. Flying foxes and small bats were also numerous, as were wild birds. The examination of specimens of leaves and grass collected on the island showed the presence of larval mites especially on the leaves of young palm trees.

The specimens found were about $\frac{1}{100}$ in. in length and of a yellowish colour. These were hexapods, chelicerae being sharp pointed, and the pedipalps projecting as clawlike appendages. Morphologically they resembled the larvae of *Trombicula deliensis*. Larval forms were found in the fur of rats, and occasionally were also isolated.

Rats were plentiful on the island, both in the undergrowth and in the villages. The *Rattus rattus* and *Rattus frugivorus* were the commonest arborescents in this area; the *Rattus norvegicus* was also common. Several specimens were caught and examined. On the bodies of two, larvae and adult mites were recovered. One family consisting of an adult rat and four young were killed and their blood examined by the Weil-Felix test. The positive results obtained in the adult rat and one of the young proved that although the titres were low, disease due to *Rickettsia orientalis* did actually exist among the rat population.

As regards the local population, no direct evidence of a typhus-like illness could be obtained when the inhabitants were questioned through the medium of an interpreter. 'Fever' was common among the children and adults, and most of the latter were found to have the enlarged spleens of chronic malaria. Filariasis also existed. The mortality rate among the children was said to be high, but no causation could be advanced apart from 'fever'.

If Gan was indeed an endemic area of scrub typhus, it was to be expected that the illness might well exist locally as a childhood one, modified by some degree of inherited immunity. It was also to be

expected that some evidence of immunity would remain, as the opportunity of re-infection existed at all times. This theory was confirmed by testing the blood of a number of native adults and children picked at random.

As regards the Marine personnel infected during the epidemic, it was found that the majority of the cases had been engaged in the actual work of scrub clearance, a proportion were signallers employed in putting up telephone wires through the general vegetation across the island, and the remainder had walked through the scrub on numerous occasions in the course of their duties. Rats were also frequent visitors to the camps.

To eradicate the disease it was obvious that all larvae and adult mites would have to be destroyed, and the rat population eliminated. This was an obvious impossibility. Mite-proof suits for use by personnel were not available, even if they could have been worn in the prevailing heat. Mite repellents and prophylactic vaccine had not yet come to light. Only simple procedures could be carried out, and the main steps taken were:

(1) Orders were issued that wherever possible troops were to avoid passing through the scrub, and were to keep strictly to the clear paths.
(2) Before clearing any scrub the area was first to be sprayed with kerosene and burned.
(3) Rat proofing of stores and galleys was carried out as far as possible.

The incidence of the disease was certainly reduced by these measures, but they can only be described as palliative in character.

It remained for the research of others at a later date in the war to devise effective prophylactic remedies against scrub typhus. Greater care was taken in choosing camping sites and in jungle clearance. As regards personal protection, diethylphthalate was found to be a highly effective repellent against the mite when rubbed into the socks and bottoms of the trousers. Dibutylphthalate was later found to be a more efficient mite repellent, but had certain disadvantages. Both of these preparations were made available to the Navy in large quantities, and meanwhile research work for a reliable vaccine for preventive inoculation was undertaken.

VENEREAL DISEASES*

An overall survey of the spread of venereal diseases suggests that much valuable pioneer work, both administrative and clinical, was performed by the Royal Navy during the war years on behalf of the civil community. The reason for this is not that which would first naturally

* Compiled from the records of the Editor, Surgeon Captain J. G. Maguire, C.B.E., R.N., and the late Surgeon Captain T. Lloyd Jones.

come to mind, i.e. a high venereal incidence inside the Service itself. The true reason is that at least for a period, the impact of war on the large cities of the British Isles brought about social changes which had an important bearing on this particular subject. National Service, bomb damage, evacuation of civilians and the like, meant that populations were constantly moving and changing. A proportion of these were suffering from venereal disease. Of this proportion some managed to continue treatment wherever they went, others became defaulters of necessity, while a few probably failed to receive treatment at all. The national statistics were thus bound to be influenced, and their accuracy impossible to maintain. That this state of affairs ever came about has been denied in some quarters but common sense dictates that exigencies of war must have affected adversely the treatment of the venereal in the same way as the treatment of all other diseases. Furthermore, common sense compels the suggestion that national statistics of the venereal incidence of the civil population are themselves only a rough guide, being a mere representation provided by voluntary patients from among a total quantity which is quite unknown and can be no more than the subject of conjecture.

On the other hand, the incidence of venereal disease in the Fighting Services, treatment being compulsory and concealment an offence, has always been an accurately known quantity. War-time proved no exception, and despite the difficulties involved, records were even more meticulously kept and were the subject of several innovations with the maintenance of accuracy in view. This fact was of great importance, not only in the Services, but to the civil community as well, for it meant that in the British Isles, no matter how disorganised civil medical administration might become, Service records would always be capable of indicating to some extent the trend of venereal disease in the community.

The incidence of each of the venereal diseases showed an increase in the Royal Navy during the war, and this increase could not wholly be explained by the proportionate increase in the Service population as a whole. Nevertheless, these diseases never at any time reached the alarming figures which were attained during the War of 1914–18. The diseases were confined almost exclusively to male personnel, and, as has been indicated earlier in this History, venereal disease presented no problem in the Women's Royal Naval Service.

As regards prophylaxis, in the United Kingdom the Navy conformed to the Government Regulation regarding the reporting of sources of infection, Regulation 33B, but in the Home Ports this procedure merely represented the confirmation of a system which had long existed whereby data were collected by the Naval Medical Officer of Health and promulgated to the local Civil Health Authorities. Records show that, in the Navy, men infected in the United Kingdom invariably traced infection with gonorrhoea to an amateur source rather than to a prostitute. In the

case of syphilis, infection by prostitutes was slightly more common. Oversea, infection by prostitutes tended to exclude the amateur, but in this case control was frequently easier as it was possible to place brothel areas out of bounds by disciplinary measures.

Other prophylactic measures were health education, which was always actively pursued, chemical prophylaxis available in shore bases and H.M. Ships afloat, and the free issue of the condom. With the introduction of modern drug therapy the arrangements for chemical prophylaxis tended to fall into abeyance.

Therapy was directed by naval medical officers qualified as genito-urinary specialists, one being appointed to each Fleet, each large hospital and hospital ship, and to the chief naval shore bases at home and oversea. Where no naval specialist was to be found skilled treatment was nevertheless obtainable by reciprocal arrangement with the other Services. Early in 1942 a Civil Consultant in Venereal Diseases was appointed to the Navy for the first time, and this office was first held by a retired surgeon captain, R.N., who had achieved a reputation of high professional standing in the civilian realm of venereology during the years between the two wars. This officer, who rejoined for service during the war, was appointed to the Naval Wing of Queen Alexandra's Hospital, Cosham, chief Naval establishment for purposes of therapy and research, and to provide a place in which all the more important venereal statistics of the Service could be entered, recorded and compiled.

Gonorrhoea. The treatment of gonorrhoea in the Navy in the years preceding sulphonamide therapy consisted chiefly of urethrovesical irrigations. The disease took months to cure and complications were of frequent occurrence. The introduction of the sulphonamides revolutionised the treatment of gonorrhoea in the Navy. This group of drugs was found to cure between 80 and 90 per cent. of all cases, and most of the terrors of the disease were removed. Unfortunately, as early as 1939, it was observed in the Navy that an increasing number of strains of organisms showed resistance to the drug, and although this suggestion was strenuously denied by certain of the drug manufacturers, it was subsequently well proved to be the case. As has been recorded elsewhere, drug resistance during the Italian Campaign in 1943 and 1944 was found to be as high as 70 per cent. in Service patients suffering from gonorrhoea. In the Navy it was found that many of these cases reacted favourably to fever therapy.

Penicillin became available to the Services in 1944, and the whole picture changed. Gonococci were found to be particularly sensitive to the anti-biotic, swollen and grotesque giant forms being killed soon after one intra-muscular or subcutaneous injection of an aqueous solution containing 20,000 Oxford units. After a second injection, three hours later most of the organisms had disappeared completely. Infections

resistant to the sulphonamides responded quickly and well. Numerous experiments were carried out and many schedules of treatment tried until eventually the scheme adopted in the Navy consisted of five injections, each containing 30,000 Oxford units of sodium penicillin, injected intra-muscularly at three-hourly intervals, making a total of 150,000 Oxford units. This scheme of treatment was found to meet with marked success. Relapses undoubtedly occurred, and the treatment appeared to be less satisfactory in hot climates, possibly due to unsatisfactory storage of the drug. But the percentage of relapses was small and a second treatment effected a cure in most cases. With prompt penicillin treatment complications became extremely rare, but it was impossible to estimate accurately the percentages of cures in the Navy, as it was not possible to follow up permanently many of the cases afloat under war conditions. On the other hand, as regards cases occurring on shore, the records of the main home ports showed an apparent rate of cure of approximately 95 per cent. Undoubtedly these records showed a very small relapse rate after one treatment, few failures after two treatments, no resistance strains and an almost complete absence of complications.

Further experiments in the Navy included attempts to find a vehicle which would delay the elimination of penicillin from the blood stream. Success was obtained with a solution containing penicillin, magnesium monohydrate and arachis oil. With this solution gonorrhoea was treated and cured in a high percentage of cases with only one injection containing 300,000 Oxford units. This solution was unfortunately unstable and had to be made up every few days, and it was eventually replaced by the stable oily solution discovered by Romanski and Rittman in America.

Syphilis. The introduction of arsenic in 1910, which marked a new era in the treatment of syphilis, was actively supported by the Navy from the beginning. Arseno-therapy in cases of syphilis was supplemented by the heavy metals in later years, and courses of treatment on modern lines had been long established in the Service before the war.

On the whole, the Navy was not faced with the problem of the defaulter in the same way as the civilian venereal disease clinic. Nevertheless, even under peace-time conditions, continuity of efficient anti-syphilitic therapy called for a high degree of organisation if the patient was to remain capable of active service afloat without interruption of his treatment. As a general rule, a man suffering from primary syphilis was sent into hospital as soon as possible. Here he was strenuously treated with the object of controlling his disease and rendering him non-infective. His outlook for the future was then assessed by a genito-urinary specialist, details of his treatment were recorded on Naval Form S.576 with recommendations regarding future serum investigations and courses of therapy, and the man was invariably drafted to a ship carrying a medical officer. Where possible, future courses of treatment

were carried out by a genito-urinary specialist, and finally no opinion of cure was given until the man had been admitted to hospital after his last course of treatment, and investigation of his cerebro-spinal fluid carried out after lumbar puncture. Should a man be discharged from the Service while still under treatment, he was provided with the necessary civilian attendance card and instructed to report to a civilian venereal disease clinic.

Inside the Service the system adopted had proved itself to be fool-proof in most cases, because the medical officer of the ship or establishment in which a man happened to be serving, always possessed an up-to-date knowledge of the man's state of treatment in the man's Form S.576 which accompanied his medical documents wherever he went. One serious omission did, however, exist in the system, which was that, should a man's medical documents be lost, all details of his treatment would be lost as well, as no central register of syphilis existed in the Navy.

Under war-time conditions, every effort was made to maintain continuity of anti-syphilitic treatment. But it soon became obvious that the existing system must be modified in some cases, and that the welfare of the patient, though paramount, must be studied in relation to the requirements of war. In other words, what was reasonable frequently had to be accepted in place of what was necessary. For example, it could not be guaranteed that a man under treatment for syphilis could always receive his initial course of therapy from a specialist under hospital conditions, neither could it be guaranteed that he would be drafted away to a ship carrying a medical officer, so that he might not become virtually overdue for a course of treatment or a blood test. Then again, although in conformity with vital clinical principles it had always been laid down by regulation that anti-syphilitic therapy should never in any circumstances be commenced until bacteriological confirmation of clinical manifestations had been obtained, it was realised that in a ship on the high seas during war, this rule must frequently be permitted to relax. In this respect it was observed with some regret that few medical officers entering the Navy from civil life had any knowledge of the use of a dark ground apparatus.

Perhaps the most serious problem concerned the loss of medical histories and Forms S.576 whenever one of H.M. Ships was sunk. This meant that a number of men would report for continuity treatment of whom the past clinical details were unknown, while others less scrupulous, knowing of the loss of their documents, would take advantage of the fact and default permanently. Efficient continuity of treatment was obviously impossible in these circumstances, and the Navy was forced to devise a system of duplication of records which, it must be admitted, was long overdue. The first measure was merely provisional and resulted in 1942, in the introduction of a Personal Card (S.576a). This

was a small document on which was recorded from the original Form S.576 the man's treatment to date. It was handed to him for retention and production as necessary. Two records of treatment now existed, one in company with the man's medical history and the other carried by the man himself. The form S.576a was originally produced as an emergency measure, and its contents were later modified. Obviously, it did not allow for its possible loss by the man himself, and cases soon arose where not only was the sinking of a ship attended by the loss of a man's S.576 with his official medical history, but by the loss of his S.576a as well with his personal belongings. No solution of this problem was arrived at until the Navy was able to establish a central register of syphilis, and this register, with the numerous reporting regulations necessary for its maintenance, could not be described as being in any way efficient until the closing stages of the war.

In connexion with the development of the treatment of syphilis with the arsenical preparations, it had long been realised that these substances are recognised hepato-toxins, and that a small percentage of cases under treatment might be expected to acquire toxic jaundice. During the early years of the war there was a sharp rise in the incidence of jaundice among patients under treatment for syphilis, and in some clinics in the country as many as 50 per cent. of patients were affected.

Naval patients were no exception, and by 1940 it was realised that a high proportion were developing toxic jaundice. This was particularly so in the Venereal Disease Department of the Royal Naval Barracks, Chatham. This department catered for the continuous treatment of men suffering from syphilis throughout the whole Nore Command, which covered a very wide area. By the end of 1940 the proportion of patients developing toxic jaundice was approximately one in three, an alarming incidence which not only represented a severe loss of man-power, but also encouraged unrest and discontent among the patients themselves.

In June 1941, research into this subject was commenced in the Royal Naval Hospital, Chatham, and the Royal Naval Barracks, Chatham, and assistance was provided by the Director of a famous civil clinic in the Metropolitan Area. The first line of research was prompted by the fact that the fresh water in the Chatham area at one time was heavily chlorinated, this necessity having been enforced by the local Civil Health Authorities after enemy bomb damage. It was shown that the distilled water employed for dissolving neoarsphenamine for injection also contained a high quantity of chlorine, and this fact raised the hypothesis that the jaundice was possibly due to the oxidising effect of chlorine on the arsenical preparation in solution, which would consequently be rendered more toxic. With regard to this hypothesis it must be understood that between 300–500 patients were receiving two injections each week. In order that there might be as little interference as possible with

the work of these men and the daily routine of the ship, speed was essential as far as was consistent with the usual precautions, and bulk preparation of the neoarsphenamine used in solution had to be resorted to. It was realised that bulk preparation itself might encourage toxicity, but when this procedure was abandoned the incidence of jaundice was in no way reduced.

In September 1941, a conference on this subject was called in the Medical Department, Admiralty, at which a number of venerealogists from the three Fighting Services were present. The conference was presided over by the Medical Director-General of the Navy, and it was attended by the Ministry of Health's Adviser in Venereal Diseases as well as the Medical Consultant to one of the famous drug houses. The conference, at which the Adviser to the Ministry of Health was by common accord regarded as arbitrator, first obtained some idea of the jaundice incidence in the Fighting Services and civil community, in the light of the practical experience of its members. Though the incidence among the civil community was claimed to be low, this statement was guarded. Nevertheless, there seemed to be no doubt that the figures in the Fighting Services were high, particularly those of the Navy.

The chlorine theory, which had been actively supported by the Authorities at Chatham, was early overthrown. This attractive theory had been encouraged largely by the reports of experiments carried out by one of the drug manufacturers. These experiments had alleged that mice injected with arsenical preparations dissolved in water having a high chlorine content showed evidence of increased toxicity of the arsenicals by a correspondingly high mice mortality. But it was revealed at the conference that these experiments had been inaccurately performed, and when accurately repeated were not confirmed. It would appear too that such experiments were difficult to perform at that time, for the exigencies of war had brought about shortages of albino mice of the correct experimental size.

The conference discussed briefly the possibility of increased toxicity of arsenical preparations as a whole, but at this point the subject of an infective jaundice conveyed by imperfectly sterilised syringes and needles was advanced for the first time.

There is no doubt that the replies of the members of the conference to the careful interrogation of the Ministry's Adviser, showed not only that there were wide variations in the methods employed for sterilising syringes and needles, but also that there was a great scarcity of instruments in most places, which meant that large numbers of injections were being carried out with very few needles and with even fewer syringes.

This theory of imperfect sterilisation was accepted by the Navy with some reserve, and the conference closed with a recommendation that for the next three months investigation should continue at Chatham on lines aimed at improved sterilisation technique.

During the next three months the Venereal Disease Department of the Royal Naval Barracks, Chatham, was given a greatly increased supply of syringes and needles. A routine was established whereby every syringe and every needle was carefully cleansed after use and then boiled for 15 minutes before being used again. It was found, however, that this technique made no difference to the incidence of jaundice, which even showed a slight increase among persons receiving arsenical therapy.

It must here be admitted that the Navy in any case viewed the various preparations of neoarsphenamine in use with some suspicion. It was felt that the drug industry must be suffering from a war-time shortage of skilled workers, that drug manufacture might well be embarrassed, and that storage and refrigerating might be at fault. Purely as a precaution in view of the high incidence of jaundice, early in 1942 a preparation of arseno-oxide replaced neoarsphenamine as the drug of choice in the Navy.* Opinions in this country differed on the therapeutic value of arseno-oxide, although it had been used extensively and reported on favourably in the U.S.A. and South Africa. Standard courses of treatment were established, and a certain amount of research was carried out in naval hospitals with a view to intensive schemes of treatment, consisting of daily injections of arseno-oxide and also continuous intravenous drip therapy, but these methods were not without serious risk, and could only be given to specially selected cases in properly equipped establishments.

Further trials with arseno-oxide were interrupted when it was ascertained that penicillin had anti-spirochaetal properties. This discovery had been made at Liverpool in 1942, and it was perhaps unfortunate that the discovery was made at a time when prolonged trial was not possible. If the war had not been at its greatest intensity, with manpower desperately needed, and when every attempt was being made to reduce the sickness rate from whatever cause, there would probably have been more hesitation in claiming penicillin as a cure for syphilis to the exclusion of the better proved drugs of greater antiquity. Nevertheless, the war justified the use of penicillin in cases of syphilis, and although it was impossible to forecast whether the immediate excellent results were likely to be permanent, they were certainly of great convenience at a time when there was a shortage of man-power.

Working on the theory that it was necessary to maintain the concentration of penicillin in the blood stream at a constant high level as had been found necessary with the sulphonamide drugs, and knowing that penicillin was eliminated through the kidneys in approximately four hours, it was decided that three-hourly injections would probably be effective. The early trials were made with varying doses of sodium penicillin in aqueous solution. In 1944 a scheme of treatment which

* See the views of T. Anwyl Davies, M.D., F.R.C.P., and Sir Sheldon Dudley in the Journal of the Royal Naval Medical Service, July 1943.

promised success was generally adopted throughout the Allied Services. This consisted of an injection of 40,000 Oxford Units of sodium penicillin in aqueous solution every three hours by day and night up to a total of 60 injections, i.e. a total of 2·4 mega units in seven and a half days. This treatment necessitated admission to hospital of all cases of syphilis, and, for purposes of serological follow up, all naval patients were kept on Shore Service for at least four months.

The naval consultant, working at the Naval Wing, Queen Alexandra Hospital, Cosham, did not entirely agree with the theory that it was necessary to keep a constant high level of penicillin in the blood stream. He claimed instead, that by giving single daily doses of 300,000 Oxford Units, the immediate clinical results compared favourably with the results obtained by 60 injections at 3-hourly intervals. It was, however, soon evident that 2·4 mega units was inadequate, no matter what system of injection was employed, and to achieve satisfactory results the dosage was raised to 3·9 mega units in primary, and 4·8 mega units in secondary cases of syphilis. Experiments were also made with the oily solution of penicillin, giving one or two injections daily, but no definite conclusion had been reached by the end of the war. In any case by that time naval workers had already doubted the wisdom of depending on penicillin alone for the treatment of syphilis, and it was evident that a combination of penicillin, arsenic and bismuth should be given. The view in the Navy was that a very valuable and non-toxic anti-biotic had been found, but its exact place in the scheme of treatment of syphilis had yet to be determined.

Reverting to the question of jaundice associated with the treatment of syphilis, it must be recorded at this point that any doubts regarding causation which might have been entertained in the Navy, had been resolved by the end of the war. This important subject had by then been more extensively investigated inside the Service itself, and the reports of the various authorities, particularly MacCallum and Bauer (1944), had been carefully studied. When the results of these investigations were applied to Service conditions and to the clinical features of the disease itself, it appeared probable that, although syphilis and the arsenical preparations can in themselves cause a high degree of liver damage, the high incidence of jaundice in the Navy in 1940 was due to a type of homologous serum jaundice transmitted by inefficient sterilisation of syringes and needles employed in the mass treatment of syphilis in large numbers by therapy with neoarsphenamine.

As regards treatment with penicillin, it was early realised that a lethal effect was exerted on both *gonococci* and *Treponema pallida*. At first this appeared to be a great advantage, but was later proved to be a serious disadvantage. When both diseases happened to be contracted at the same time, the incubation periods being different, it was found that the curative dose of penicillin for gonococci might well inhibit for a variable period

the growth of *Treponema pallidum*, and consequently there was a danger that the development of syphilis subsequently might be masked. In the Navy it was considered to be a distinct possibility that the administration of penicillin to battle casualties might mask the development of syphilis contracted some time before, and the disease being unsuspected might not reveal itself except in a complicated form in later life.

Chancroid, Lymphogranuloma Inguinale. During the war no real advances were made in the treatment of these diseases: it had already been proved in 1938 that chancroid and *lymphogranuloma inguinale* would both respond favourably to sulphonamide therapy. In the case of chancroid this form of therapy was a matter of great satisfaction in the Navy, especially in the Mediterranean area, and the more so as penicillin was later proved to have no effect on the disease.

Non-specific Urethritis. It must be admitted that there was a time in the Navy when any urethral discharge was classed as 'gonorrhoea' without further ado. Exposure to venereal infection followed by urethritis had only one name. In course of time a more enlightened Service realised that a urethritis of non-gonococcal causation, bacterial or abacterial, was of frequent occurrence in all parts of the world, and might exist following a venereal risk or quite apart from it. The war years showed a high incidence of this disease in the Navy in both bacterial and abacterial forms. The latter form was due either to a virus or a pleuro-pneumonia-like organism, or sometimes to chemical causes. In some cases it was associated with oxaluria. Although statistics had not been compiled, the general opinion in the Navy was that the incidence of non-specific urethritis showed an increase by the end of the war. It was found that the bacterial form sometimes responded favourably to the sulphonamides or penicillin, but there were many failures. In the case of abacterial urethritis there was no known specific. Urethro-vesical irrigations were helpful in a large number of cases, but where it could be obtained, fever therapy was probably the most effective form of treatment.

Penile Warts. The introduction of podophyllin as a treatment of *condylomata acuminata* in 1943 was of great value in the Navy. Relapses occasionally occurred, but the treatment proved to be much more successful than any of the older methods.

SCABIES

By the beginning of the Second World War the Navy had come to realise that scabies in adults is due to personal contact and often venereal in origin. The introduction of benzyl benzoate revolutionised the treatment of this disease. It was found that one application of the emulsion after a hot bath was often effective, and a second application twenty-four hours later rarely failed to complete the cure. The disinfection of clothing was no longer necessary, and the loss of man-power was reduced to a minimum.

PHLEBOTOMUS FEVER

Epidemics of phlebotomus fever have been associated with military operations, especially in the Mediterranean area, for as long as the disease has been known. The same history is attached to military operations in India. Burnett in 1816 described an epidemic of a short term fever occurring among the Naval Forces engaged in the Siege of Malta in 1799, and this fever was almost certainly phlebotomus.

In the early years of the present century considerable interest was shown in this disease by a number of workers, and the small midge, *phlebotomus papatasii*, was proved to be the vector of the virus of the disease.

In 1921 and 1922 the life history of the midge was studied by Whittingham, who described a scheme for the control of phlebotomus fever which depended mainly on the elimination of breeding grounds and the use of electric fans. The adoption of the measures described resulted in a considerable reduction in the number of cases occurring in Service establishments, but periodical outbreaks still occurred. It was found that the disease most often attacked newcomers to an endemic area, and in 1941 it was observed that in Peshawar cases were still frequent in spite of extensive measures of control. It was also realised that the standard measures of control were applicable only to permanent establishments, but were quite impracticable under conditions of modern warfare, especially in places extensively damaged by aerial bombardment.

This realisation led to a trend of research in the early years of the war which moved from environmental to personal preventive measures. In 1940 efforts were made by workers in India to produce a toxin by modification of the virus grown in chick embryo culture which could be used for the active immunising of persons going to an area where sand-fly fever was endemic. In 1944 other workers in the Middle East and Sicily found that serum containing the virus, which had been irradiated with ultra violet light, was capable of producing immunity without giving rise to the disease. The same workers proved that the insect repellent dimethylphthalate was of value in the prevention of phlebotomus fever.

The dangers of phlebotomus fever had always been well realised by the Naval Authorities in Malta, but shore-based personnel were few, and as regards precautionary measures, the Navy was able largely to rely upon the immunity conferred by ship life afloat.

During the war, owing to the rapid growth of Malta as the main base for naval operations in the Mediterranean, and as a staging post for H.M. Ships bound elsewhere, barrack accommodation had to be provided in the island for large numbers of shore-based personnel. This accommodation was found chiefly in the historical fortifications of

Verdula, Camarata, and the Fort and Lazaretto on Manoel Island. The increase in the numbers of shore-based personnel took place mainly after the Mediterranean had been re-opened after the invasion of North Africa at the end of 1942. By this time all the old buildings concerned had been badly damaged by bombs during the early part of the war, and heaps of rubble and wrecked buildings were intermingled with the living quarters. The overcrowding in all the barracks was considerable. In Verdula the men slept in hammocks, but on Manoel Island two and three-tier bunks were used. Electric fans were scarce and natural ventilation only was obtainable. Considerable numbers of men were newly arrived from the United Kingdom.

Obviously the conditions were favourable for an outbreak of phlebotomus fever, namely:

(1) Available breeding grounds for the vector in rubble and bomb damaged buildings.
(2) Large numbers of unseasoned and susceptible personnel.
(3) Easy access by the vector to personnel sleeping in hammocks or tiered bunks.

In 1944 a severe epidemic occurred affecting a total of 3,505 personnel, of which the shore establishments provided 2,795 cases (i.e. 79·7 per cent.).

The incidence rate was typical of an epidemic of phlebotomus fever. The disease occurred in two waves, each lasting three or four weeks. The first wave occurred at the beginning of the hot weather, and the second in the autumn, following a two months' lull. This type of incidence was typical of the results obtained by the various research workers, for the first wave of the disease was obviously due to phlebotomite hatched out from larvae which had survived the winter, while the autumn wave was due to the second brood. The interval of eight weeks between the peaks of the epidemic is the approximate time required for the vector to complete its life cycle.

To combat this epidemic in 1944 a general effort was made to improve the living conditions and to enforce the use of sand-fly nets wherever possible. Unfortunately, nets could not be used by men sleeping in hammocks, neither were they a very effective protection to tiered bunks. Being of very fine mesh the nets also greatly impeded air movement, and therefore caused considerable discomfort in hot weather, and in the overcrowded barracks they were intolerable at times.

By the time the 1944 epidemic had ended, the Naval Medical Authorities in Malta had begun to concentrate upon the discovery of important measures which might be likely to prevent a recurrence of the epidemic during 1945. By 1945 there had been no significant alleviation of overcrowding in the various barracks, and living conditions ashore were much the same as in 1944. But by 1945 the new synthetic

insecticide D.D.T. had become available, and it was decided to make wall spraying with 5 per cent. D.D.T. in crude kerosene an additional preventive measure. No power sprayers could be obtained, so improvised wall spraying apparatus was devised from A.R.P. stirrup pumps, by fitting a nozzle with a jet of $\frac{1}{64}$ in. diameter. Owing to the gritty particles in the insecticide spray the nozzle was made so that it could be readily taken apart when it got blocked. Twelve knapsack pressure operated sprayers also became available and gave excellent service. The inside walls of all living spaces were sprayed up to a height of 12 ft. from the floor, and special attention was given to the vicinity of windows and doors.

The dosage of wall spray was one quart per thousand square feet, and three sprayings were given during the potential epidemic period, although supplies of sufficient D.D.T. did not arrive in Malta until towards the end of June 1945.

The effect of the wall spraying was immediately apparent, and as the summer was extremely hot the use of nets was not enforced, yet few persons were bitten whilst sleeping in sprayed rooms. Verandahs, which it had formerly been impossible to use after dusk owing to the persistent attacks of sand-flies, became usable.

During the hot weather the experiment was tried of using mosquito nets impregnated with D.D.T. In the Royal Naval Hospital, Malta, ten men slept for four weeks under such nets on a verandah which was known to be infested with sand-flies, and with a number of cases of phlebotomus fever being nursed in an adjacent ward. During the period two men only reported one insect bite each, and none contracted sand-fly fever.

Despite these precautions an epidemic again occurred in 1945, but the effectiveness of D.D.T. spraying was revealed in the decreased severity on this occasion. In the 1945 epidemic a total of 1,457 cases occurred, of which 1,365 (93·7 per cent.) were shore-based personnel. The incidence rate per thousand amongst naval personnel in the 1944 epidemic was 349·36, but the incidence rate per thousand in the 1945 epidemic fell to 136·5, a considerable reduction.

It is of some interest to record that at all times the figures of the Navy showed a much higher incidence than in the Army and R.A.F. in Malta. But there were obvious reasons to account for this in that the Army and R.A.F. had better living accommodation with much less overcrowding, while their personnel included a high percentage of seasoned troops who had been in Malta for several years.

The 1945 epidemic may be accepted as showing the effectiveness of D.D.T. in the control of phlebotomus fever under active service conditions. Moreover the satisfactory results were obtained with improvised spraying apparatus and with the insecticide in short supply. It was of interest to note that by an oversight no spraying was carried out in

the lodging houses in Valetta and Sliema where many ratings slept when granted shore leave from H.M. Ships, and a number of cases of sand-fly fever thereby occurred which could have been prevented. The problem of spraying the living accommodation in the naval establishments in Malta, using improvised apparatus, presented considerable practical difficulties, but these were overcome in the best traditions of the Service by a firm resolve to prevent an outbreak in 1945 of similar dimensions to that in 1944.

Apart from a lowered incidence of phlebotomus fever, the preventive measures showed other beneficial effects for there was a considerable reduction in the number of mosquitoes and house-flies, which was probably responsible for the low sickness rate from dysentery and gastro-enteritis in the naval establishments in Malta during 1945.

PULMONARY TUBERCULOSIS

A full account of the clinical aspects of this disease during the war years has been contributed by the Consultant in Chest Diseases to the Royal Navy in Chapter 13 of the Medicine and Pathology Volume of this History.

During the Second World War the pioneer work of the Royal Navy in mass fluorography developed considerably, and by the end of the war apparatus had been installed at a number of large Naval Bases at home and overseas. In addition plans had been made for the introduction of mobile miniature X-ray units.

The number of 'pick-ups' of cases of pulmonary tuberculosis was considerable, which meant that very early treatment could be undertaken with the return to duty of a proportion of cases, and also possible sources of infection could be quickly brought under control. Facilities for these examinations were also extended to include a number of Admiralty civilian personnel.

In early reports on the health of the Royal Navy, pulmonary tuberculosis was included under many headings, such as 'Phthisis', 'Consumption' and 'Haemoptysis'. Tuberculosis of the lungs has long been recognised as an occupational disease of seamen, and the case fatality record indicates the virulent nature of tuberculosis at sea a century ago. But there are many conditions which, without X-rays or bacteriology, could be mistaken for pulmonary tuberculosis, and there is no doubt that at one time this must have been a major cause of error in such statistical returns as were made. In this respect the Mediterranean type of undulant fever is of especial interest to the Navy, for it was more often than not at first temporarily diagnosed as pulmonary tuberculosis. In fact, before 1861, when undulant fever was differentiated as a separate clinical entity, many cases remained permanently on the records as cases of phthisis, as was explained by Dudley in the Milroy Lectures in 1931. The errors of multiple entries in the sick list

of the same case in those days were, however, probably balanced to some extent by errors due to mistaken diagnosis. The probable real incidence of pulmonary tuberculosis in the Navy was about 8 per 1,000 per annum in the middle of the 19th century. Since then the rate dropped irregularly until 1906, by which time the diagnosis of the disease was more accurate. After this year the statistical records of the disease were more accurate also. Records show a downward trend up to 1913, the last complete year before the First World War. Statistical records were then discontinued and not resumed until 1921.

In the fourteen years 1900 to 1913, the invaliding rate from pulmonary tuberculosis averaged 2·2 per 1,000, and in the 14 years 1921 to 1934, the rate averaged 2·1 per 1,000. It will be seen, therefore, that in spite of all the efforts made in the Navy to prevent tuberculosis, over this period the incidence remained unchanged, and at a time when the incidence in the British Isles fell by approximately half. The real decline in naval tuberculosis took place in the latter half of the 19th century, and was parallel to the downward trend of the incidence of the same disease in the civil population. Both falls were probably due to the same natural causes of improvements in environment, better standard of living, and better medical diagnosis. But the fact that the naval decline in incidence stopped short at this point was due to the one decisive factor which is always present in a Service environment, i.e. density of population. The work for which a warship is designed prohibits any increase in the number of square feet of deck space per man, and this density of population can but increase as more space is taken up by machinery which requires additional men to work it.

In the 30 years preceding the war, many measures were introduced, such as periodical medical examinations and weighing of personnel, the elimination of dampness and dust between decks, improved protective qualities of naval rations, and increased and perfected air supply. Nevertheless, these measures were not accompanied by any decrease in the morbidity of pulmonary tuberculosis. However, it is for consideration, in view of the marked fall in the prevalence of civilian tuberculosis over the same period, whether the more modern recruit might not possibly have been more susceptible to the disease. Study of this proposition suggests that had the measures described not been adopted, the incidence of pulmonary tuberculosis in the Navy might well have increased instead of remaining roughly stationary.

All the research on droplet and air-borne infection had suggested that by far the most dangerous and massive doses of infective material were those passed directly from man to man at short range by coughing, sneezing or even speaking. It was obvious that once the average distance between the respiratory orifices of the members of a community had been reduced below a certain point, ventilation, however effective, could not possibly influence spread of infection. In 1926 great stress was laid

upon periodical medical examinations and weighing of naval personnel as preventive measures, in order to discover and eliminate early cases of pulmonary tuberculosis. But many sputum positive advanced cases failed to give any physical signs on meticulous clinical examination, and it was eventually realised that a loss of weight was a late rather than an early sign of tuberculosis, in fact, and that scarcely any of the concealed tuberculosis in the Navy was uncovered by these procedures.

The critical morbidity of 2·0 per 1,000 from the year 1921 onwards was approximately double that prevailing in the Army and Air Force, although in the Navy there was a larger proportion of men in those younger and older age groups who, in civilian life, showed a lower incidence of pulmonary tuberculosis than the average. As far as could be judged, the naval rate was considerably higher than that in men of the corresponding age and social class ashore, despite the fact that naval ratings formed a specially selected group who had passed through the sieve of a careful medical examination and who, except as regards actual environment, had been deliberately provided with a much higher standard of living than that of the average working man.

Another observation which indicated that the closeness of community life of the lower deck was the determining cause of the excessive tuberculosis morbidity among naval ratings, was the fact that the early incidence among naval officers was 1·0 per 1,000 per annum, i.e. less than half the morbidity among the ratings. It was here observed that the naval officer was nearly always provided with a separate cabin in which he slept, and that his daytime living accommodation was also more spacious.

MASS MINIATURE RADIOGRAPHY

Long before the outbreak of the war it had been known that chest X-ray examination would often detect pulmonary tuberculosis long before the disease was discoverable by clinical means, and before the lesions had become open and infectious. An investigation had actually been carried out on some batches of naval recruits, who were examined by ordinary X-ray technique at six monthly intervals for 2–3 years after entry. The results indicated that very few men entered the Navy suffering from active tuberculosis, and that therefore the vast majority of tuberculous infections must have been contracted after entry. These findings confirmed the view already expressed, that the high morbidity of pulmonary tuberculosis in sailors was doubtless the direct result of that crowded community life which seemed to be inseparable from the environment of a man-of-war.

It was therefore obvious that to adopt X-ray diagnosis for the early detection of pulmonary tuberculosis in the case of naval personnel, would lead to little reduction in the morbidity of the disease by the mere

elimination of recruits who were found to be tuberculous at the time of entry. No scheme of X-ray diagnosis could be expected to effect any significant reduction in the amount of pulmonary tuberculosis among serving sailors, unless it ensured that all men in the Navy were examined regularly. This meant that tens of thousands of X-ray examinations would have to be undertaken at frequent intervals, and the cost, time, and organisation of such an extensive scheme, using ordinary radiographic technique, presented almost insuperable difficulties, and did not seem practicable under naval conditions. The difficulties involved are described under 'Anonymous', *Journal of the Royal Naval Medical Service*, 1938, 24, 16.

In March 1939, however, advances in the field of mass miniature photo radiography of the chest prompted the Medical Department of the Admiralty to investigate the application of this method to the examination of naval ratings.

In conjunction with one of the established manufacturing firms, a series of tests was carried out at the Royal Naval Hospital, Chatham, in July 1939, making use of an experimental model apparatus. The results were encouraging, but the growing gravity of the international situation caused the proposed scheme to fall into abeyance for the time being. But in March 1940 the scheme was resurrected, and the same manufacturers eventually produced a most satisfactory self-contained unit for screen photography under the patented name of "Pulmograph". To accommodate the apparatus a single storey building was designed and erected, which included the various annexes necessary for it to be applied for the rapid examination of large numbers of personnel. The building was divided into a recording section, a main studio and a dark-room.

The recording section was adjacent to the entrance to the department, and was fitted with a wide counter to which personnel would pass on entering the department immediately after completing physical examination next door. Here the personal details of the man were recorded, and these details included such information as immediate future movements which would enable him quickly to be traced should he be required for further investigation in the event of his chest X-ray showing a suspicious result.

The pulmograph itself was so situated in the main studio that ingress and egress were unimpeded.

All men joining the Royal Naval Barracks, Chatham, were subjected to pulmograph examination at this time, and the organisation included the storage of film, and the subsequent hospital investigation of cases found to have suspected lesions. In the latter case the man was discharged to hospital forthwith, and was accommodated in a special ward under the charge of a specialist in chest diseases. The subsequent disposal of the man depended upon the result of these investigations.

The staff employed consisted of one radiologist, four radiographers, three sick berth ratings or V.A.Ds. for general duties and one typist. It was found that a staff of this size could deal comfortably with 1,800 examinations per day. It was essential that such a staff should consist of persons specially selected and trained in the technique involved.

The apparatus was actually installed at the end of June 1940, and its early working was greatly interrupted by enemy air activity, which necessitated minor repairs and alterations. Nevertheless, a large number of men were examined, and sufficient data became available from which to assess the potential value of the scheme in the future. Of the first 8,500 men to be examined 2·7 per cent. were found to have suspicious films. Steps were taken to obtain further films of most of these cases, but the drafting situation did not allow re-examination of the whole. After re-examination, 52 men were discharged to hospital, and of these 40 were considered to have a tuberculous lesion. Investigation of these 40 showed that 47·5 per cent. of them had sufficient evidence of disease to cause their being invalided from the Service, and the remainder exhibited enough signs to warrant their retention under observation for extended periods.

Being in its infancy, this pulmograph unit at Chatham naturally suffered from defects of organisation which could only be solved by the later introduction of Service legislation after its value had been proved. It was obvious that, if the scheme was to succeed, chest X-ray of all personnel at regular intervals must be made compulsory, and also that the authorities must play their part in permitting a man's movements to be interrupted if necessary for hospital investigation to be carried out.

After the first few months of its existence the pulmograph unit at Chatham proved beyond doubt that men who had been suffering from unsuspected tuberculosis of the lungs for an unknown period, could be detected at an early date by this method. The chances of a permanent and rapid arrest of their disease was therefore greater. About half of these unsuspected cases were non-infective, and could thus be removed from the naval community before they could become a possible danger to others. The other half of unsuspected cases were already infective, and might well have continued to spread the disease to other persons for an indefinite time had they not been radiographed.

As the war continued, pulmograph units were erected at many places throughout the Service, and chest examinations by this method became compulsory at yearly intervals. This may be described as perhaps the greatest preventive medicine development effected in the Navy during the war, and by no means the least of its advantages from the administrative point of view was that a permanent record became available for comparison should the question of subsequent disability ever arise. This record became invaluable during the process of demobilisation at the end of the war, and was eventually to play an important part in post war claims

which the Ministry of Pensions was called upon to consider when the allegation was made that the disease was attributable to Naval Service.

It is important to set on record that, although mass radiography permitted early diagnosis of pulmonary tuberculosis, the risk of infection could nevertheless never be eliminated completely from the naval community. The Medical Department of the Navy realised that cases of tuberculosis would always continue to be contracted ashore, missed at X-ray examinations, or developed during the intervals between examinations. In spite of its undoubted value as a diagnostic measure, it was felt that it would be unwise to dogmatise on the ultimate effects of mass radiography as a preventive measure. The reason for this considered outlook was that, in spite of removing many of the open cases of the disease, it was considered likely that the irreducible overcrowding of the living quarters in a man-of-war will remain the deciding factor in the incidence of tuberculosis of the lungs.

INDUSTRIAL MEDICINE AND HYGIENE

During the war years the importance of industrial medicine and hygiene in the Navy developed enormously as the result of an increasing industrialisation of the Service. Modern warships, naval air stations and many other Fleet Shore Establishments which deal with the use and development of scientific processes became factories to all intents and purposes. The Royal Dockyards employed large numbers of civilian 'industrial' workers, and a number of special ships were fitted out for maintenance work afloat, such as landing craft repair ships, destroyer depot ships, submarine depot ships, aircraft engine and aircraft component repair ships. These ships were equipped with a great variety of processes to deal with many forms of repair and manufacture.

Many new developments resulted from the research carried out during the war, and workers were frequently brought in direct contact with highly toxic compounds, from which a variety of cases of poisoning occurred from time to time.

For example, soon after the outbreak of war, German magnetic mines caused considerable damage to shipping, and a number were discovered and dismantled. Most of this work was done by naval and civilian experts attached to H.M.S. *Vernon*, the establishment which dealt with matters concerning mines and torpedoes. The protection of these courageous workers against personal injury by the frequent and inevitable explosions which occurred was hardly a matter of preventive medicine. But within a few weeks of the commencement of this work seven cases of poisoning by hexamite were seen. All the patients had handled the explosive without wearing gloves, and all had noticed that within a few hours the skin of the hands turned a bright orange colour. Within ten days a localised dermatitis developed, and two cases showed a degree of ulceration inside the mouth.

It was realised that during the War of 1914–18, similar cases had been reported among persons who had been in contact with German explosives, either civilians after bombing, or Army personnel dealing with German shells. Unfortunately, by 1939, previous experience with hexamite had been overlooked, and measures to prevent toxic effects in exposed persons were not established until after experience of the cases in H.M.S. *Vernon.*

In consequence, all establishments likely to handle the substance were informed immediately of the dangers, and the measures taken by those exposed were:

> the wearing of rubber gloves:
> smearing the hands with crude vaseline before handling the explosive:
> thorough washing and scrubbing of the hands with soap and water after possible contact.

Subsequent mild cases did occur from time to time, but always in individuals who had neglected the necessary precautions. Unfortunately, it was impossible to prepare any accurate figures with a view to assessing the proportion of cases which occurred among personnel exposed to hexamite, and the testing of normal individuals, in order to find the sensitivity of the population, was not possible under the conditions which then existed. Nevertheless, it was established beyond doubt that not all men exposed to the powder developed dermatitis. Therefore in this, as with all other types of contact dermatitis, individual idiosyncracy to the sensitising substance appeared to be the chief factor responsible.

By the end of the war it was realised more than ever before, that industrial medicine, especially from the preventive aspect, was likely to assume an ever increasing importance, and it was obvious that a full appreciation of the problems involved and a sound knowledge of the means of prevention of occupational diseases would be an essential part of the training of future naval medical officers. From this realisation grew the practice of designating the Senior Medical Officers of the Royal Dockyards 'Certifying Factory Surgeons', and eventually the Combined Services and Factory Department Medical Committee on Industrial Medicine was set up, on which served a naval representative. This committee has since proved to be of the greatest value to the Navy in the solution of many of its technical problems, and in the exchange of information of common interest to all three Services and to the Factory Department.

DROPLET INFECTIONS

The trivial complaints such as common colds, sore throats, and uncomplicated influenza are probably the biggest factors in loss of man-power in the Navy as in other walks of life. Together with

other minor infectious diseases caused by droplet infection, their control constitutes one of the great problems of preventive medicine.

During the war, the Navy was forced to accept, with reluctance, reduced scales of accommodation ashore far below the recognised limit of safety. Conditions were, naturally, worse afloat than ashore, and it may seem remarkable that very few major epidemics of diseases due to droplet infections occurred. However, there are various factors such as the effect of the forced ventilation system in ships which, as yet, are not properly understood but may have an important effect in reducing the incidence of such epidemics. Other factors of herd immunity also probably come into the picture. The introduction of air conditioning and the provision of laundries and other amenities in ships may do much to reduce the incidence of air-borne diseases, though many epidemiological problems in this respect, which have been indicated under the description of 'habitability', require an answer before any definite opinion could be given.

The war years confirmed that there is an enormous field open for research into the problem of air-borne infection in warships, and recommendations were made that the possibility should be studied of using the 'slit sampler' for obtaining bacterial counts. When such work has been adequately undertaken, it may be possible to lay down standards of bacterial counts appropriate to different warship problems under varying conditions of climate.

The war also showed that research on the control of air-borne infections ashore, especially in training ships with a high ratio of sickness from these diseases, is also urgently required. Certain advances were made in trials of thermostatically controlled chemical bactericides in the form of aerosols, but the results were inconclusive. It also became obvious that the use of oils such as spindle oil to control dust in dormitories requires consideration.

DIET

The diet of the Navy during the war left little to be desired considering the difficulties which had to be overcome, and, in spite of a number of claims to the contrary, it is here emphasised that no adverse effects on health were found to be attributable to deficiencies in diet. Advances in refrigeration and dehydration enabled ample supplies of meat and vegetables to be carried even on the longest of cruising operations. In addition in the closing stages of the war, the supply problem at sea was solved with the assistance of the various store ships forming part of the Fleet Train.

Reports were received from time to time, particularly from small ships operating in Northern Waters, of ill health and sometimes bleeding gums, which it was suggested might be sub-clinical or pre-scurvy states. In this connexion a large amount of research was undertaken, and critical examination in no case substantiated this theory. It

seemed, in fact, that the personnel affected were largely members of that part of the peace-time sea-going community in whom dental fitness and oral hygiene were doubtful quantities, and the cause of the symptoms was shown to be Vincent's angina in these cases. As a precaution, additional supplies of vitamins in capsule form were supplied to ships in Northern Waters for use in case of emergency, and as limejuice contains almost no vitamin C, the routine issue was replaced by a lemon powder rich in this vitamin.

Action messing, as distinct from diet in general, was a matter which received close consideration during the war. This subject concerned the provision of adequate and suitable food and drink for naval personnel required to be constantly at their posts with the guns etc., for many hours or even days on end. The requirements varied depending on the type of ship and the prevailing climatic conditions. Although guidance was given from time to time, the Admiralty did not attempt to lay down any hard and fast rules on the question of 'action messing', but each ship was left to build up a suitable organisation in the light of the experience of its own peculiar needs, and some account will be given of the systems adopted in the Operational Section of this History.

RODENT CONTROL

Grave concern was caused during the war by the ravages to material and food stuffs by rats and mice, and the Services were asked by the Ministry of Food to co-operate in a nation-wide campaign to eliminate the menace. Surveys of rodent infestation of all naval establishments at home were carried out, and modern methods of destruction by the use of poison baits were adopted. The poison bait technique was also used in ships afloat, and gave promise of obviating the laborious and costly method of fumigation by hydrocyanic acid gas. The latter form of fumigation was always difficult to carry out under active service conditions, as it could not fail to involve a grave loss of time caused by the fumigation and immobilisation of the ship concerned. Poison bait was also employed oversea where the problems of plague and other rat-borne diseases had always to be borne in mind.

The war revealed how desirable it was that in all Commands of the Navy uniform methods should be adopted, and that mobile civilian squads should be employed, each member being trained in the latest scientific technique in rodent destruction. Such a system obviously represented an advance on the former haphazard and primitive method of rat catching, and would make the annual 'rat week' a thing of the past.

STATISTICS

In peace-time it was the custom for the Admiralty to publish annually as '*The Health of the Navy*' a numerical record to show the trend of sickness in the Service. The information from which these figures were

compiled was obtained chiefly from Medical Officers' Journals rendered quarterly from each ship and establishment. *The Health of the Navy* provided for long term statistics, but gave no information about the hosts of minor illnesses shown on daily 'attending lists' which are usually the predominant cause of loss of man-power. Such short term cases of sickness probably provide a more accurate index of inefficiency due to adverse living conditions.

After the outbreak of war it became obvious that not only for purposes of historical record, but in order to aid research, the system of naval medical statistics must be improved. The members of the Royal Naval Personnel Research Committee urged that accurate statistical data were vitally essential if the results of their investigations were to be properly evaluated and compared. Unfortunately, the statistical machinery of the Medical Department of the Navy was virtually non-existent on the lines which were considered desirable, and it had long been realised that in this respect the Navy fell far short of the Medical Departments of the other Fighting Services. Also, such machinery as did exist began to be affected adversely as the war progressed. In the administrative offices many of the most experienced men were called up for service, and the clerical staff did not grow in nearly as great a ratio as the amount and urgency of the extra work which needed attention. A time came when great efforts were made to reduce all paper work which was not directly essential to the war effort, and as part of this reduction, statistical work was especially prone to be regarded as redundant. To the medical statistician this policy was deplorable, even if inevitable, because the war gave a unique opportunity for the collection of data on health matters which might never recur. If properly collected and analysed, such data would have provided priceless information and guidance on improving the health of future generations of sailors. The loss for ever of all this valuable material was, in the words of Sir Sheldon Dudley, 'heart-breaking'. Nevertheless, a certain amount was saved from the statistical wreckage by employing, as a surgeon commander, R.N.V.R., an eminent medical statistician, and by appointing the best known statistician in the United Kingdom as a civilian consultant to the Royal Navy. These two gentlemen, in spite of the acute shortage of staff and other difficulties in collecting statistical data during the course of a major war, produced a number of illuminating reports. For example, original discoveries were made in the causes and spread of tuberculosis from the statistical analysis of some hundreds of thousands of X-ray photographs from the naval miniature mass radiography units. An analysis was also made of the invaliding returns during peace and the early years of the war, which revealed some unsuspected phenomena of the causes and age distribution of invaliding disability, which cannot fail to be of value to the future medical and manning administration of the Navy.

Unfortunately, owing to even further staff reductions, such analysis was not maintained throughout the whole war. In due course a statistical committee was formed to examine how far naval vital statistics and records could be improved, simplified and integrated with the statistical methods and records in other Admiralty Departments. As regards medical statistics, the Navy was eventually influenced by the views of a series of Inter-Services Committees and a common purpose was arrived at, though its full results were not to be seen until long after the war had ended.

In 1945 a new form of return of sickness rates for ships was introduced, which was of value for obtaining data by which sickness in different ships serving under varying climatic conditions could be compared, and this return was the precursor of the more modern methods of assessing the effects of air conditioning on health, and the habitability of ships in extremes of climate.

It can be stated with some feeling, that not the least of the omissions to be revealed by the impact of war was the urgent need for adequate machinery for the recording and compiling of vital medical statistics in the Royal Navy in future years. Such statistics as are available are being prepared for inclusion in the Statistical Volume of this History.

TRAINING

As has been explained earlier in this chapter, the most important medical lesson learned in the war was that executive and combatant officers must be taught that the enforcing of hygienic measures to preserve the health, morale and fighting efficiency of their troops is as important as any other military duty.

This lesson was taken to heart and the responsibility placed securely on the shoulders of commanding officers in accordance with Admiralty Fleet Order. It is fair to say that, as a result, the Navy became hygiene minded, but in order to drive home this lesson the war showed that it was necessary to augment this responsibility by the incorporation of general instruction in hygiene as part of the basic training of all personnel.

During the war, reliance had to be placed mainly on the Army for training facilities, and large numbers of officers, ratings, R.M. ranks and sick berth staff were given courses at the Army School of Hygiene at Mytchett, while special courses were given to medical officers. Courses in hygiene were also given later with great success at the Air Station at Middle Wallop.

Although still largely relying on the assistance of the Army, towards the end of the war the Navy had done much towards training many of its own personnel through the medium of the School of Tropical Medicine and Hygiene established in Ceylon, and the Naval Tropical Research Unit. Also as regards training in tropical hygiene, great

assistance was given by the pioneers responsible for the construction of Naval Air Stations overseas.

Ancillary to training measures in preventive medicine in the Navy were the various activities of the Royal Naval Medical School, which was removed from Greenwich and accommodated at Clevedon, Somerset, for most of the war.

Mention must also be made of the publication of a new First-Aid Manual in 1943, and an up-to-date Handbook of the Royal Naval Sick Berth Staff published in 1944.

Nevertheless, experience showed that such training measures in hygiene as the Navy did institute during the war were merely temporary in nature, and no more than a preliminary approach towards greater efforts of a more general nature which were obviously desirable. It was realised that training in hygiene must be afforded to all personnel without exception, and that such training should be continued from time to time throughout a man's service career as opportunity offers. The training should obviously take the form of a series of lectures implemented by teaching from films and film strips, and should include field training for certain branches of the Service whose duties may approximate more nearly to those of the Army. The necessity was also proved for the Navy to equip itself with the necessary facilities to carry out its own training, in order that its personnel should be self-reliant and capable of coping with the various hygiene problems with which they might expect to be faced on service ashore or afloat in any part of the world.

HEALTH OF MEN UNDER TRAINING

Space does not permit more than a passing reference to this subject. But its importance is not denied, and the following observations on the physical condition of 2,783 men considered fit for naval training, and an analysis of the incidence of sickness in a community of men of similar physique living under the conditions specified are considered of interest.

A record has been made of the physical condition of 2,783 men who were free from symptoms, not suffering from any progressive organic disease or defects which incapacitated them, and who were about to undergo naval training. The physical standard has been assessed on the incidence of minor defects and variation of the weight from that laid down in standard average weight tables. The data were obtained by clinical examination and scrutiny of the medical records. It was not possible to follow up these men and record the incidence of disease among them during their training, but an analysis has been made of the incidence of incapacitating sickness among a group of men who can be taken to be of similar average age and physical condition to those who had been described and who were undergoing training under the living conditions specified. It may be said that the aims of

the record are (1) to show the incidence of minor defects in men in good physical condition and thereby give some idea of what may be considered normal standards in fit men, and (2) to analyse the incidence and causes of incapacitating illnesses among men of a similar physique while living under conditions which are described. For easy reference, tables are placed at the end of each section:

1. *Physical Condition.*

Table 1 shows the actual number of defects present and also the incidence per 100 men:

The total number of men reviewed was 2,783.
There were 1,658 in Group 1 (aged 18–19 years)
624 in Group 2 (aged 20–29 years)
and 501 in Group 3 (aged 30–41 years).

For purposes of comparison it is unfortunate that the men were not more evenly distributed among the different age groups.

In the case of 1,037 men only (702 in Group 1, 183 in Group 2, and 152 in Group 3) the condition of the tonsils was noted and they were asked whether or not they received regular dental treatment and what illnesses, if any, had caused loss of work or absence from school in the last three years.

Weight. The men were considered to be over weight or under weight if they varied more than 10 per cent. either way from the average weight for their height and age, as quoted by Brockbank and by Fisk and Crawford.

It was found that 18·6 per cent. of the men aged 18–19 years, 27·0 per cent. of the men from 20–29 years and 41·5 per cent. of those from 30–41 years were under weight, while only 5·5 per cent. in the first group, 5·7 per cent. in the second, and 7·1 per cent. in the third group, were overweight.

A sufficiently large number of figures was not available to make it seem of any value to make out an average weight table. This would probably have been interesting, as the figures which are available seem to suggest that, in a large proportion of healthy men, the average weight is lower than that given in the standard tables. At least it is probably fair to say that the figures confirm that the healthy man is often under weight and much less frequently over weight.

Vision. The following were taken to have defective vision:

Those with vision of 6/12 or less with both eyes.
Those with vision as low as 6/36 or under in either or both eyes.
Those whose vision was better than these, but who were already wearing glasses for distant vision.

It will be seen from the table that 14·4 per cent. of the total number had visual defects which had already been corrected by glasses and in 4·8 per cent. vision was defective but glasses were not being worn. The

incidence of defect was found to be higher as age advanced and a greater proportion of the defects had been corrected in the older men.

Teeth. Note was taken only of those men who had (*a*) at least four grossly carious teeth with cavities beyond the aid of conservative treatment, (*b*) septic roots or (*c*) any degree of sepsis of the gums up to actual pyorrhoea. The object of setting this reasonable standard was to discover the number of men who required fairly urgent dental attention and whose dental condition might be considered to be detrimental to their health. It was found that among 1,037 men of whom the enquiry regarding regular treatment was made:

94 or 13·4 per cent. in Group 1
29 or 15·8 per cent. in Group 2
and 28 or 18·4 per cent. in Group 3

visited their dentists regularly. The veracity of their statements was confirmed by their dental condition. That regular treatment was sought more often by the older men, may be due to their being better able to afford dental treatment, or to the fact that under the existing National Health Insurance Scheme, free treatment was not so frequently available to those in the younger age groups.

Eight per cent. of the men had dental caries or sepsis to the extent described above and these were fairly evenly distributed throughout the different age groups. As would be expected, the incidence was not higher in the older men, since a greater proportion of them received regular dental attention.

Aural Defects. These included subjects suffering from perforated tympanic membranes, those who had had mastoidectomy performed and had residual auditory impairment, and those who were suffering from otitis media.

Hernia. Fifteen men (0·5 per cent.) came into this category. In all cases the hernia was inguinal; and in only one case was the man aware of it before it was discovered by the medical officer of the National Service Medical Board or afterwards.

Abnormalities of the Testis. Twenty-four men (0·8 per cent.) had some abnormality of the testis. There were 10 cases of hydrocele, one of cyst of the epididymis and 13 cases of undescended testis. The incidence was similar in all three age groups.

Varicocele, Varicose Veins and Haemorrhoids. Under these headings are included all degrees of the respective conditions; it has already been stated that none of the defects discovered were severe enough to cause incapacity. The haemorrhoids were of the external type. It was seen that the incidence of varicocele increased gradually with age and haemorrhoids and varicose veins were much more common in those aged 30 and over than in the younger men.

Skin Diseases. It was found that 126 (4·5 per cent.) of the men suffered from skin affections to a minor degree. The incidence was much higher

in Groups 1 and 2 than in Group 3, probably because acne was the most frequent. The diseases and number of cases of each were as follows:

Acne 37, seborrhoeic dermatitis 9, ichthyosis 3, psoriasis 5, eczema 2, oil dermatitis or folliculitis 14, furunculosis 2, impetigo 1, herpes facialis 2, intertrigo of the scrotum or axilla 26, pruritis ani 1, urticaria 1, scabies 19, pediculosis pubis 4.

Feet Defects. Pes planus, mild pes cavus, hallux valgus or hammer toes were found in 4·4 per cent. of the men. There was no marked difference in the incidence in the three age groups.

Spinal Deformities. There was one case of kyphosis and 16 other cases of scoliosis. The more frequent occurrence of spinal abnormalities in the youngest men was due to the fact that in all cases they resulted from faulty posture or asthenia, and it was to be expected that these would improve when growth and muscular development had matured.

Albuminuria. There were 17 cases of physiological albuminuria and the incidence was three times as high in men under 30 years as it was in the remainder. These were either cases of orthostatic albuminuria, or cases in which albumin was present in the morning specimen, but where there was no impairment of renal function or evidence of renal or arterial degeneration.

Cardiac Murmurs. 2.8 per cent. of the men had cardiac murmurs in the pulmonary or mitral area. These were systolic and not conducted or associated with signs of organic heart disease. The exercise tolerance test was satisfactory.

Rapid Pulse. Any pulse rate of 100 or over was noted. There was no apparent associated cardiac disease or signs of hyperthyroidism. 150 men (5·3 per cent.) came into this category and there was nothing of note in the age incidence.

Miscellaneous. The following abnormalities were discovered but were too infrequent to justify their inclusion in the defect table:

Rachitic sequelae 3, deformities of fingers 2, congenital ptosis 1, strabismus 2, blepharitis or conjunctivitis 4, old fractures with slip impairment of function 3, renal glycosuria 1.

Enlarged or Septic Tonsils. The throats of 1,037 men were examined by means of a hand torch and spatula and the condition of the tonsils was noted. The tonsils were considered pathological (*a*) if one or both were seen to be obviously enlarged without the patient phonating or 'gagging' or (*b*) if pus was present.

Tonsillar defects were present in the case of:

56 or 7·9 per cent. of men aged 18–19 years,
9 or 4·9 per cent. of men aged 20–29 years,
7 or 4·6 per cent. of men aged 30–41 years.

The incidence was therefore one and a half times as great in Group 1 men as it was in the others.

TABLE I

Defects

Age group	All ages		18–19		20–29		30–41	
	No.	%	No.	%	No.	%	No.	%
Overweight . . .	164	5·8	92	5·5	36	5·7	36	7·1
Underweight . . .	687	24·6	310	18·6	169	27·0	208	41·5
Defective vision corrected .	402	14·4	199	12·0	93	14·9	110	21·9
Defective vision uncorrected	134	4·8	89	5·3	28	4·4	17	3·3
Dental defects . . .	223	8·0	145	8·7	39	6·2	39	7·8
Aural defects . . .	30	1·0	17	1·0	8	1·2	5	0·9
Hernia	15	0·5	6	0·3	3	0·4	6	1·1
Abnormal testis . .	24	0·8	14	0·8	6	0·9	4	0·8
Varicocele . . .	123	4·4	56	3·3	34	5·4	33	6·6
Varicose veins . . .	57	2·0	20	1·2	10	1·6	27	5·3
Haemorrhoids . . .	17	0·6	3	0·2	2	0·3	12	2·3
Skin defects . . .	126	4·5	91	5·4	28	4·4	7	1·4
Feet defects . . .	125	4·4	70	4·2	33	5·3	22	4·3
Spinal defects . . .	17	0·6	13	0·7	2	0·3	2	0·4
Albuminuria . . .	17	0·6	12	0·7	4	0·6	1	0·2
Cardiac murmurs . .	52	1·8	25	1·5	17	2·7	10	1·9
Pulse 100 and over . .	150	5·3	85	5·1	38	6·0	27	5·3

2. *Living Conditions.*

It is now proposed to give some idea of the type of life which the men led, noting in particular factors which concern health. The day was planned thus:

Working time	9¾ hours
Free time	6 hours
Sleeping time	8¼ hours

There were six working days, two half days off duty being allowed per week. Working hours were taken up by instruction and physical training; in this time were also included 2¾ hours which were taken up by meals and rest periods. The day's routine varied according to the stage of training reached, but at any given time about 56 per cent. of the men led an outdoor life requiring a moderate amount of muscular

exertion while the life of the remaining 44 per cent. was sedentary with the addition of regular physical training.

Diet. Copies of the menus were available and it was possible to check up the diet with some accuracy. Scrutiny of the menus revealed that they differed little in nutritive value from week to week. Therefore accurate details of the ingredients of the various items on the menus on seven consecutive days were obtained. These are shown in Table II. The protein, fat and carbohydrate content and gross calorific value of this food is shown in Table III. It will be seen that the diet is a very good one, the average daily energy value being 3,943 calories gross which meets the requirements for a man doing heavy work, as laid down at the conference between representatives of the Advisory Committee on Nutrition and the Nutrition Committee of the British Medical Association in 1934. From a practical point of view the diet is well balanced. 15·4 per cent. of the total calories are provided by protein, more than 60 per cent. of it being animal protein; 45·0 per cent. of the energy is provided by carbohydrates and 40·5 per cent. by fat, practically 90 per cent. of the latter being of animal origin. With the exception of fresh fruit, which is deficient in all war-time diets, the diet is well assorted and fresh vegetables are plentiful.

Four meals daily were provided at regular hours.

Climate. This description of the climate and environment is necessarily cursory, but it is hoped that a general impression of surrounding conditions is conveyed. The only accurate data which can be given are average weekly wet and dry bulb thermometer readings and these are shown in Table IV. These figures were obtained by taking the average of two daily readings taken at 10 a.m. and 6 p.m.

It can be seen that the atmosphere was humid. North-easterly and South-easterly winds were prevalent. Smoke pollution was minimal and the atmosphere was clear. The land was low-lying and the soil of a sandy nature. No accurate details of rainfall or hours of sunshine are available but, from information obtained from local sources, it is deduced that both were above the average for the locality for the year in question.

Accommodation. The men slept three in a room with an average of 800 cubic feet per person. Heating arrangements were electrical and there were no fireplaces, but the ventilation was adequate. Windows were of the casement variety. In all respects the conditions satisfied the Model Bylaws' requirements. Accommodation for feeding was also very satisfactory.

Clothing and Personal Hygiene. The men were naturally well clothed and shod. They received routine medical and dental examinations and treatment. A hygiene lecture on personal cleanliness, the prevention of venereal diseases, and the importance of early treatment of disease was given. Facilities were available for the maintenance of a high standard in these respects.

TABLE II

Specimen of One Week's Diet

MONDAY

Bacon	2¼ oz.	Dried fruit	1 oz.
Beef	9 oz.	Cornflour	⅜ oz.
Tomatoes	4 oz.	Marmalade	1 oz.
Dried peas	2½ oz.	Butter	1½ oz.
Carrots	2 oz.	Margarine	½ oz.
Turnips	2 oz.	Bread	10 oz.
Potatoes	12 oz.	Sugar	2 oz.
Cabbage	8 oz.	Chocolate	¼ oz.
Flour	2¼ oz.	Fresh milk	3 oz.
Fat	½ oz.	Tinned milk	1 oz.

TUESDAY

Oatmeal	1 oz.	Sheep's liver	4 oz.
Syrup	½ oz.	Dried fruit	2 oz.
Salt cod	6 oz.	Custard powder	⅜ oz.
Flour	2⅜ oz.	Scones	1½ oz.
Fat	1¼ oz.	Butter	1½ oz.
Dried peas	1 oz.	Margarine	½ oz.
Carrots	2 oz.	Bread	10 oz.
Potatoes	10 oz.	Sugar	2 oz.
Onions	1 oz.	Chocolate	¼ oz.
Kidney	1 oz.	Fresh milk	3 oz.
Steak	4 oz.	Tinned milk	1 oz.

WEDNESDAY

Sausage	4 oz.	Syrup	1 oz.
Roast beef	5 oz.	Scones	2 oz.
Fish	6 oz.	Potato chips	4 oz.
Potatoes	12 oz.	Butter	1½ oz.
Cabbage	8 oz.	Margarine	½ oz.
Dried peas	1 oz.	Bread	10 oz.
Carrot	2 oz.	Sugar	2 oz.
Turnip	2 oz.	Chocolate	¼ oz.
Flour	2⅜ oz.	Fresh milk	3 oz.
Fat	1 1/64 oz.	Tinned milk	1 oz.

THURSDAY

Bacon	2¼ oz.	Flour	2¼ oz.
Steak	4 oz.	Fat	1 oz.
Sausage	4 oz.	Jam	1 oz.
Sardines	2 oz.	Butter	1½ oz.
Potatoes	4 oz.	Margarine	½ oz.
Chipped potatoes	4 oz.	Bread	10 oz.
Carrots	10 oz.	Sugar	2 oz.
Turnips	4 oz.	Chocolate	¼ oz.
Onions	1 oz.	Fresh milk	3 oz.
Dried peas	1 oz.	Tinned milk	1 oz.

FRIDAY

Oatmeal	1 oz.	Rice	1 oz.
Syrup	½ oz.	Scones	1½ oz.
Fish	6 oz.	Cheese	4 oz.
Flour	½ oz.	Red cabbage	2½ oz.
Fat	1/64 oz.	Butter	1½ oz.
Mutton	5 oz.	Margarine	½ oz.
Potatoes	8 oz.	Bread	10 oz.
Dried peas	4 oz.	Sugar	2 oz.
Turnip	4 oz.	Chocolate	½ oz.
Carrots	4 oz.	Fresh milk	3 oz.
		Tinned milk	1 oz.

SATURDAY

Sausage	4 oz.	Dried fruit	1 oz.
Beef	9 oz.	Jam	1 oz.
Potatoes	16 oz.	Baked Beans	3½ oz.
Carrots	2 oz.	Butter	1½ oz.
Turnips	2 oz.	Margarine	½ oz.
Parsnips	6 oz.	Bread	10 oz.
Onions	1 oz.	Sugar	2 oz.
Dried peas	1 oz.	Chocolate	½ oz.
Flour	2½ oz.	Fresh milk	3 oz.
Fat	1 oz.	Tinned milk	1 oz.

SUNDAY

Bacon	2½ oz.	Scones	2 oz.
Egg	1	Corned beef	4 oz.
Split peas	2 oz.	Butter	1½ oz.
Carrots	4 oz.	Margarine	½ oz.
Turnips	4 oz.	Bread	10 oz.
Potatoes	8 oz.	Sugar	2 oz.
Brussel sprouts	8 oz.	Chocolate	½ oz.
Roast pork	5 oz.	Fresh milk	3 oz.
Dried Fruit	2½ oz.	Tinned milk	1 oz.
Custard powder	½ oz.		

TABLE III

Gross Calorific Value of Diet

Day	CHO. (g.)	Total protein (g.)	Animal protein (g.)	Total fat (g.)	Animal fat (g.)	Total calories
Monday	426	156	98	191	176	4,163
Tuesday	430	143	93	128	109	3,541
Wednesday	464	140	88	180	166	4,150
Thursday	416	151	111	228	216	4,445
Friday	409	163	98	136	117	3,610
Saturday	470	107	53	177	162	4,012
Sunday	373	168	117	157	140	3,679
Totals	2,988	1,028	658	1,197	1,086	27,600
Daily average	427	147	94	171	155	3,943

TABLE IV

Wet and Dry Bulb Readings

Week ending	Dry	Wet	Difference	Week ending	Dry	Wet	Difference
January				July			
11	36·5	35·5	1·0	5	64·0	58·8	5·2
18	32·8	31·8	1·0	12	69·0	63·5	5·5
25	35·3	35·1	0·2	19	64·8	59·8	5·0
				26	63·9	59·6	4·3
February				August			
1	34·0	33·4	0·6	2	61·6	58·4	3·2
8	35·4	34·9	0·5	9	60·9	56·0	4·9
15	40·5	39·7	0·8	16	62·2	57·4	4·8
22	36·3	35·8	0·5	23	60·5	56·5	4·0
				30	62·0	57·1	4·9
March				September			
1	38·9	36·9	2·0	6	61·7	59·2	2·5
8	40·6	39·3	1·3	13	58·6	55·0	3·6
15	39·0	37·9	1·1	20	56·6	53·8	2·8
22	40·0	38·5	1·5	27	60·8	58·9	1·9
29	42·5	40·8	1·7				
April				October			
5	41·7	39·4	2·3	4	58·3	55·8	2·5
12	43·3	39·7	3·6	11	57·7	56·2	1·5
19	48·6	45·9	2·7	18	51·7	49·3	2·4
26	45·1	42·3	2·8	25	50·4	46·8	3·6
May				November			
3	44·4	42·7	1·7	1	43·9	40·4	3·5
10	45·5	42·7	2·8	8	42·2	38·9	3·3
17	49·4	45·8	3·6	15	43·8	42·6	1·2
24	52·4	49·5	2·9	22	45·9	44·9	1·0
31	51·6	48·1	3·5	29	47·1	46·2	0·9
June				December			
7	50·7	48·8	1·9	6	41·9	40·9	1·0
14	52·5	49·6	2·9	13	44·0	42·7	1·3
21	61·8	57·9	3·9	20	41·2	40·2	1·0
28	66·4	60·4	6·0	27	41·5	40·1	1·4

3. *Incidence of Sickness.*

In Table V is shown the case incidence per 1,000 of population of groups of diseases which caused incapacity during each quarter of a year. The reason the figures are calculated on quarterly and not a yearly basis is because the population under consideration was a shifting one, and in the circumstances the method chosen is more accurate. Here we see the average daily population during the four quarters:

1st Quarter	3,919
2nd Quarter	3,675
3rd Quarter	3,582
4th Quarter	3,622

Only patients who were ill for more than 24 hours (i.e. incapacitated) were included. It was noticed that 'feverish colds' were the predominating cause of sickness; therefore it was thought that it would be of interest to tabulate the weekly incidence per 1,000 of population not only of colds which caused incapacity, but also of those which did not cause loss of work. This has been done in Table VI.

Feverish Colds. The term influenza has come to be used in a similar loose way to that of rheumatism. It might be said that influenza on a sickness certificate may indicate either a vague and trivial pyrexial or apyrexial attack or a serious attack of a serious disease, just as rheumatism may indicate anything from slight muscular stiffness to rheumatic fever. The term 'feverish cold' is therefore used in preference to that of 'influenza' to avoid confusion and the 'splitting of hairs'. The cases included under this heading had pyrexia of at least 99·4 degrees plus some or all of the following signs and symptoms:

(*a*) Coryza
(*b*) Cough, with or without moist sounds in the chest
(*c*) Sore throat due to pharyngitis
(*d*) Pain referable to the frontal sinuses or maxillary sinuses
(*e*) Aches and pains and shivering attacks.

Some of these would definitely be cases of influenza but the majority were cases of acute coryza or common cold with pyrexia. As the diagnoses were made by different medical officers it has been thought advisable to include them all under the heading of feverish colds, which, while not being strictly accurate, is probably more accurate than describing them as influenza as has possibly been done in literature in the past.

Respiratory Diseases. Under this heading were included all respiratory diseases except common colds and tuberculosis. More than 95 per cent. of the cases suffered from acute infections of the respiratory system such as laryngitis, pneumonia, bronchitis, pleurisy or pleural effusion. The remainder were cases of asthma, bronchiectasis, or haemoptysis.

Acute Infections. All diseases definitely communicable and those probably communicable have been grouped together in this section. The percentage of cases due to the particular ailments was as follows:

	per cent.
Acute infectious fevers	34·1
Acute tonsillitis	64·8
Rheumatic fever	1·0

Rubella accounted for the vast majority of cases due to infectious fevers.

Cardiovascular Diseases. The causes of incapacity of this type were:

	per cent.
Organic cardiac disease	40
Functional cardiac disease	20
Varicose veins	40

50 per cent. of those suffering from organic lesions gave a definite history of rheumatic fever or rheumatism. Functional incapacity was either due to tachycardia and functional symptoms or due to Da Costa's syndrome.

Gastro-intestinal Diseases. These were comprised of the following ailments:

	per cent.
Peptic ulcer, gastritis, gastro-enteritis, dyspepsia	56·7
Enteritis, intestinal colic and stasis	17·2
Acute appendicitis	8·5
Haemorrhoids	14·5
Catarrhal jaundice, parotitis, glossitis	3·0

In practically all the cases of peptic ulcer there was a past history of symptoms of peptic ulcer or dyspepsia.

Nervous Diseases. These can be differentiated as follows :

Only 10·4 per cent. were suffering from organic lesions of the central nervous system. In 66·6 per cent. the symptoms were functional or the men were suffering from minor mental upsets such as hysteria or mild anxiety states. In 22·9 per cent. of cases the aid of an expert psychiatrist was necessary.

Rheumatism. Included under this heading were the following sub-acute or chronic affections:

Lumbago, myositis, myalgia torticollis, fibrositis, rheumatic teno-synovitis and arthritis.

Locomotor Diseases. This term is used to indicate cases of pes planus, pes cavus, hallux valgus, bunion, hammer toes, septic corns, bursitis and synovitis.

Nose, Throat and Ear Diseases and Diseases of Teeth etc. These were comprised of the following:

	per cent.
Nose, throat and ear diseases (excluding tonsillitis and laryngitis)	24·2
Diseases of eyes	8·2
Dental sepsis and extractions	67·5

Urogenital Diseases. This title designates all diseases or abnormalities of the urogenital system.

Skin Diseases. These may be differentiated into three groups:

	per cent.
Acute pyogenic infections	13·9
Chronic skin diseases	9·2
Scabies	76·8

The acute infections included cases of furunculosis, impetigo, sycosis, cellulitis, and abscesses.

Tuberculosis. 78·5 per cent. of the lesions were pulmonary and the remainder surgical. Of the pulmonary cases, none had a personal past history of tuberculosis, 45·4 per cent. had histories of chronic bronchitis or pneumonia, 18·1 per cent. had some family history of tuberculosis, and the remainder had neither personal chest histories nor any family history of tuberculosis.

Miscellaneous. Here are included cases of anaemia, lymphadenitis and diabetes mellitus and insipidus.

Venereal Diseases and Accidents. Cases included here do not require any comment.

Causes of loss of work by 1,037 *Men in three years before joining the Service and the number of days lost.*

Questioning on this point revealed that:

	days incapacity
Colds and influenza caused	711
Other respiratory infections	191
Accidents and sepsis	794
Skin diseases	38
Diseases of nose and ear	121
Infectious fevers	192
Gastro-intestinal diseases	197
Neurasthenia	28
Making a total of	2,272
Average per man per year	0·73

One could ponder over these figures for quite a long time with interest. However, only the following comments are made:

1. Many of these ailments are preventable.
2. Nearly half of the days of incapacity were due to colds and other respiratory infections.
3. If one man is incapacitated for 0·73 days each year, then in a group of 500 men one of them is totally incapacitated for a whole of each year.
4. The men under discussion were all under 42 years of age, and it is to be expected therefore that the above figures compare favourably with those for all ages.

TABLE V

Case Incidence per 1,000 *of Population*

	First quarter	Second quarter	Third quarter	Fourth quarter
Feverish colds	151·0	51·4	20·9	78·9
Respiratory diseases	28·8	15·2	6·7	14·3
Acute infections	23·3	11·7	4·1	9·1
Cardiovascular diseases	2·3	2·1	1·1	1·1
Gastrointestinal diseases	9·6	12·8	10·8	5·5
Nervous diseases	6·6	4·0	2·5	1·1
Rheumatism	8·9	5·9	4·1	3·8
Locomotor diseases	0·7	1·9	0·5	2·2
N.T.E. eyes, teeth, etc.	22·0	25·5	16·7	19·6
Urogenital diseases	3·8	3·5	2·2	3·3
Skin diseases	88·2	79·1	56·6	58·8
Tuberculosis	1·7	0·5	0·5	0·8
Venereal diseases	0·9	1·0	0·5	1·1
Miscellaneous	1·7	1·2	0·0	0·5
Accidents	17·8	16·3	16·1	9·3

TABLE VI

Weekly Incidence of Colds per 1,000

Week ending	Cases	Week ending	Cases	Week ending	Cases
January 11	34·6	May 10	26·9	September 6	20·6
,, 18	61·0	,, 17	17·1	,, 13	14·8
,, 25	59·5	,, 24	21·0	,, 20	24·0
February 1	38·3	,, 31	11·6	,, 27	20·9
,, 8	35·6	June 7	4·2	October 4	13·9
,, 15	22·1	,, 14	6·3	,, 11	12·9
,, 22	26·7	,, 21	8·7	,, 18	23·8
March 1	34·5	,, 28	11·4	,, 25	27·4
,, 8	26·0	July 5	12·3	November 1	48·2
,, 15	25·6	,, 12	11·3	,, 8	35·5
,, 22	36·9	,, 19	8·5	,, 15	41·2
,, 29	30·0	,, 26	11·1	,, 22	45·5
April 5	25·8	August 2	9·9	,, 29	44·6
,, 12	31·8	,, 9	13·7	December 6	53·7
,, 19	30·7	,, 16	14·4	,, 13	54·8
,, 26	20·3	,, 23	12·9	,, 20	57·2
May 3	25·9	,, 30	13·4	,, 27	34·2

SUMMARY

Certain points arising out of the findings which have been described will now be summarised and discussed.

Physical Condition. Under weight was frequent and the incidence of it increased with age. As the men under consideration were 'healthy', the figures seem to suggest some confirmation of the opinion of Fisk and Crawford who say that the average weight for the age of 30 years is the ideal one to maintain throughout life. It may not yet be fully appreciated to how great an extent deficient weight (according to average standards) is compatible with health, since standard average

weight tables have been compiled from the weights of unfit as well as fit people. Further investigation might be justified, especially when it is seen that 41·41 out of every 1,000 applicants for the Army in the year 1935–6 were rejected on account of insufficient weight. That increased weight was not often met with in fit men, confirms the fact that overweight is often pathological. For the most part, the incidence of defects can be taken to be accurate for fit men only (i.e. men with a good capacity for exercise). However, the findings with regard to dental defects, physiological albuminuria, and varicocele can be compared with those for the community as a whole since their presence would not debar from military service.

Only 8·0 per cent. of the men had four or more grossly carious teeth or sepsis of the gums. Morris, on the other hand, found that as many as 29 per cent. of men under 30 years and 33 per cent. of those under 40 years had at least six cavities, severe pyorrhoea or insufficient teeth. Physiological albuminuria was present in 0·6 per cent. of the men and it was more frequent in men under 30 years. MacLean detected it in 4·62 per cent. of apparently healthy recruits.

Varicoceles were found in 4·4 per cent. of cases and their prevalence increased with age. Fisk and Crawford give the incidence as 8·1 per cent. in men of all ages up to 54 years and all age groups were almost equally affected.

Living Conditions. These were good in all respects. To the points which have already been noted should be added, the 'sheltered and protected' existence of the men and the fact that they did not have to travel long distances to and from their place of work. The favourable features were counterbalanced to a small extent by the strangeness and the newness of the life and, in some cases, by apprehension and anxiety due to the uncertainty of the future and recent domestic upheavals resulting from their conscription.

Incidence of Sickness. About half the cases of incapacity were due to feverish colds and other acute respiratory infections, approximately a quarter were due to skin diseases, and about a tenth to disorders of the eyes, nose, ears or teeth. There was nothing significant in the remaining seventh of the cases, except that psychoneurosis was rarer than might have been expected considering the radical change which had been wrought in the environment and everyday routine of the men. The majority of dental cases were due to multiple extractions which routine dental examinations had shown to be necessary. Therefore many of these cases would not have occurred in civilian life.

By far the most important causes of loss of work by 1,037 men were found to be influenza, common colds, other respiratory infections, accidents and sepsis. Difficulty was experienced in tracing literature on the incidence of non-infectious diseases in this country. However McKinlay, dealing with causes of incapacity in persons of all ages,

says that respiratory infections, rheumatism, digestive disorders, and skin diseases and superficial sepsis, in that order of frequency, account for about two thirds of all cases. The outstanding feature of the figures in all cases is the frequency with which respiratory infections, most of them acute, affect the young and old whether the physique is good or below average. Rheumatism is not so frequent a cause of incapacity in young fit men as it is shown to be in the members of McKinlay's series.

It may be said in conclusion that the following facts have emerged:

1. A large proportion of men were under average weight.
2. Defects of teeth, tonsils and feet were often present and, while they may not all have been preventable, many were correctable; defects were often present without the men being aware of them.
3. Respiratory diseases were the outstanding causes of incapacity.

The incidence of defects and incapacity might be lessened to some extent by the education of the public in matters of health and routine medical and dental inspections and treatment, especially during the first ten years after school-leaving age. The provision of more complete statistics on the causes of incapacity under different living conditions in different localities, as has been advocated by McKinlay, Morris and others, would also assist.

HYGIENE ADMINISTRATION

In peace-time the administration of hygiene and preventive medicine in the Navy was directed by a qualified member of the Staff of the Medical Director-General. Local Naval Medical Officers of Health were employed, in the rank of surgeon captain, in each of the Home Ports in the United Kingdom. Oversea, Naval Medical Officers of Health were employed in Malta, Ceylon and Singapore. Afloat, the Fleet Medical Officers of the Home and Mediterranean Fleets were also borne as specialists in hygiene.

During the war years the establishment of Naval Medical Officers of Health was increased ashore and afloat, at home and oversea as necessity arose. An additional medical officer for hygiene duties was appointed to the staff of the Medical Director-General, and extra oversea appointments included specialists in hygiene on the staff of the Commander-in-Chief South Atlantic, in South Africa, in Bombay on the staff of Senior Officer Royal Naval Establishments India, Hong Kong, and on the staff of the Commander-in-Chief of the British Pacific Fleet. A specialist in Naval Hygiene was also appointed to the staff of the Supreme Commander, South East Asia.

In the space available, an outline has been given of some of the major incidents and items of interest in the practice of Naval Preventive Medicine during the war. As a result of the impetus of war, some of the advances must be considered as notable, and in some instances as of such far reaching importance as to exert a profound effect on the health and well-being of the Navy. Regret has been expressed for the omission of a great deal of research material which the Authorities concerned felt unable to release for publication in this History. Such matters as the health of the Submarine Service, for example, would obviously not have been omitted without good reason. Nevertheless, opportunity has been taken to indicate something of the problems which still remain to be solved and to remind the reader that by no means the least effect of the war years was the institution of a vast organisation for research in the Senior Service, the permanent task of which will be to continue to investigate an enormous variety of problems of fundamental importance in the realm of marine medicine.

CHAPTER 13
THE NAVAL AIR ARM

INCEPTION AND EVOLUTION

ALTHOUGH flying in the Royal Navy dates from before the War of 1914–18, the present Naval Air Arm is of very recent origin. It was not until as late as 1939 that the administration finally passed under the control of the Admiralty. In consequence the greater part of the organisation has been evolved under war-time conditions, and this fact has greatly influenced many of the developments. Much has had to be improvised and put into practice without the opportunity for extensive trials, and the fact that the general organisation has not been found seriously wanting is an excellent indication of its basic soundness.

For many years the Royal Air Force had been entirely responsible for the supply and maintenance of Fleet Air Arm aircraft, and had trained all and provided some of the pilots. It also provided many ancillary services including the medical examination of flying personnel and their care while disembarked. At the time of the transfer to Admiralty control, therefore, it was necessary for the Royal Naval Medical Service to make provision for this specialised care to continue. For this purpose a completely new organisation was designed, but this was not in full working order when war broke out in September 1939.

A great deal of the pioneer work in aeronautics was carried out by the Royal Navy, and, at the end of the First World War, naval medical officers were co-operating in much of the early research work in aviation medicine. As the experience gained at that time forms the basis of our present knowledge, we must realise the extent of this early work if we are to see recent developments in their correct perspective.

THE ROYAL NAVAL AIR SERVICE

In June 1914, just before the outbreak of the First World War, the Royal Naval Air Service was formed. This Service was defined as follows:

> 'It will comprise all naval aircraft and personnel either for action or reserve service and will be administered by the Admiralty. It will consist of an Air Department at the Admiralty, a Central Air Office, a Royal Naval Flying School and Royal Naval Air Stations. It will include all seaplanes, aeroplanes, airships, seaplane ships, balloons, kites, and any other type of aircraft that may from time to time be employed for naval purposes.'

In terms of actual numbers, however, this meant only 130 officers and 700 ratings and, in all, 90 aircraft, many of which were unserviceable, and seven airships.

The pilots and observers of this revolutionary Service were initially recruited entirely from serving Executive Royal Naval Officers, and the

first volunteers received their elementary flying instruction from civilians at the Royal Aero Club ground at Eastchurch. Later, this ground became the first Royal Naval Flying School, the instructional staff being, in the first instance, these few trained naval pilots. The regular naval personnel was afterwards supplemented by the direct entries authorised at the time of the formation of the Service. These were granted commissions as probationary Flight Sub-Lieutenants in the Royal Navy.

From the medical point of view it is important to realise that no formal medical examination for flying fitness was in use at that time, nor was one introduced until several years of war had proved its necessity. The Royal Naval Executive Officers who volunteered simply had the evidence of their entrance examination as cadets, and the direct entries an examination for A1 fitness, if any at all. By the standards of the day anyone who was fit enough for executive duties was automatically fit for flying. As any physical defects which may have been missed were to a large extent counterbalanced by enthusiasm, it was not until some time had elapsed and recruitment was on a much larger scale that the fallacy of this policy became evident.

In the First World War, the outbreak of hostilities followed closely on the formation of the new Service, and called for considerable expansion. The existing Naval Air Stations on the South and East coasts of Britain assumed a greater importance and were rapidly enlarged to cope with their new commitments. Sites were picked for new stations both in this country and on the Continent, and advanced bases were established at the latter primarily to provide cover for the Expeditionary Force.

At this time, owing to the commitments of the Royal Flying Corps in Flanders, the Royal Naval Air Service, in addition to Fleet co-operation duties—a field which had scarcely passed from the experimental stage—carried out the work which now is done by the Royal Air Force Coastal Command. This involved extensive patrols of the North Sea and Channel areas. Also, in September 1914,the Navy assumed responsibility for the defence of Britain against hostile aircraft. This involved not only the provision of fighter aircraft, but of long-range bombers with which to attack the enemy at his bases, this being an accepted part of 'defence' at the time.

These were heavy responsibilities for a new and untried Service, and could be met only by overtaxing both men and machines. Patrols lasting many hours were carried out over the sea even under the worst weather conditions. Aircraft engines, though a miracle of reliability for the times, were always liable to fail at awkward moments. The power developed by them was very low in proportion to their great weight, and the substantial mountings they needed meant that the remainder of the aircraft was of an almost absurdly flimsy construction. Seaplanes and flying-boats were notoriously difficult to fly-off and land at the exposed bases

of the East Coast, and very few of these patrol aircraft carried long-range wireless telegraphy sets in the earlier years. Carrier pigeons were supplied to minimise the danger of being lost at sea, but in adverse weather conditions they sometimes failed to get through, the unfortunate aircrew being left with a thin chance of being found before their aircraft disintegrated beneath them. Other fliers were experimenting with carrier-borne aircraft, apart from the seaplane-carrier proper. The seaplanes, launched by flying along a short deck on a wheeled trolley and discarding this when airborne, were more than likely to crack-up when landing on a North Sea swell. At one stage land planes were used and with these, at the conclusion of the patrol, a crash landing in the sea was inevitable, no parachute being carried.

NAVAL MEDICAL REACTIONS TO THE NEW SERVICE

All this was very hazardous and in the selection of pilots a premium was set on youth and initiative and a new type of naval officer was born. As the Senior Medical Officer of H.M.S. *Furious* wrote in his Journal for 1917:

> 'Of the officers, quite a considerable number belonged to the Royal Naval Air Service and were in their early twenties, in fact very little more than boys in habits and manners; personally I was very pleased to be shipmates with such beings, full of merriment and energy, which tended to alter the usual tone of the wardroom mess and which was fortunately not resented by the older members of the mess, although these young members, being very little acquainted with Service customs and regulations, looked upon them as being rather arbitrary at times.
>
> However, it was fully realised that individuals employed on such hazardous work should not allow their minds to think too much of the dangerous side of their calling. . . . It certainly is very interesting to observe and watch the psychology of such individuals; youth seems an indispensable qualification for this branch of the Service.'

Despite an increase in the training programme, the numbers of pilots rarely exceeded demands and so, as has often happened, the experienced pilots—especially those trained before the war—worked continuously for long periods without adequate rest or leave. In these circumstances the surprising thing is that breakdowns were not more frequent, and it speaks volumes for the endurance and skill of these pioneers. Of course, at the end, even the best of them would crack under these conditions, leading to a permanent wastage of highly skilled personnel in many cases. An officer who was stationed at Yarmouth Naval Air Station at the time writes:

> 'The physical exertion in handling the machines and the nervous strain in navigating them in weather which was generally bad, undermined the health of the pilots and it was found that about two or, at the most, three a week of such patrols was all that they could stand.'

In addition to these patrol duties, the units at Dunkirk and other stations on the Continent were constantly engaged in offensive work, and several R.N.A.S. squadrons were attached to the advanced R.F.C. units. Here, of course, the constant likelihood of combat with enemy aircraft and the dangers of anti-aircraft fire tended to enhance the effect of the other factors concerned in the failure of an individual to maintain his flying efficiency. Service aircraft were tricky enough to handle in the most favourable flying conditions and aerial warfare must have imposed an enormous strain.

The medical units at these Naval Air Stations were on similar lines to those at other naval shore establishments, but in some cases the medical officer was appointed to a wing, this including several stations. Many people were not then convinced of the necessity for one or more medical officers at each station. *Vide* extract below from the *Journal of the Royal Naval Medical Service*, 1918, Volume 4:

> 'The medical officer can look after two or three aerodromes each occupied by one or two squadrons. There is not enough work to have a doctor to each aerodrome, and one is not needed as, in the case of accidents, he is no more use than a good sick berth rating until the case is in hospital.'

Many stations remained without a medical officer of their own for several years, calling upon local practitioners and hospital facilities in the event of sickness or accident. Neither at these stations nor in aircraft carriers were the medical officers specialists in aviation medicine. Such specialisation was only then being born, and we owe much to the keenness and observation of those doctors for, lacking as they did a basis of scientific knowledge, they were obliged to apply their medical skill empirically and in many cases were markedly successful. They soon realised that aviation had its own peculiar medical problems and that not the least of these was the conservation of trained flying personnel. It became more and more obvious that one should not expect a protracted period of service from even a very experienced flier, however willing he may be, and with this came the realisation that if a pilot or observer was allowed to reach his breaking point his future use to the Service would be jeopardised. In this connexion a doctor who was Senior Medical Officer at one of the largest stations writes:

> 'In 1915 I began to tumble to the fact that if we did not conserve our pilots by spells of leave to relieve strain we were asking for fatalities. It took me a long time to persuade the Executive of the necessity to send on leave officers who, to his eyes, appeared fit to carry on and who could ill be spared from the front in strenuous times. I argued that it was better to spare a good man for a few weeks and get him back a better man, who knew his job and the conditions, than to carry on for a few more days or weeks and kill him, having to take a "green" hand in his place. This argument won the granting of regular periods of leave and of special leave when recommended by medical officers. We had no special tests and the medical

officers were guided by their intimate knowledge of the individuals gained in the communal life of the mess. They watched their pilots for change of manner, disposition, habits, etc., and I do not think there was much "swinging of the lead".'

And another officer who was also Senior Medical Officer at the same station confirms this when he says:

'Valuable work has been done by the Air Board Medical Research Committee on the signs and symptoms of physical and nervous breakdowns in flying men, but I am sure the best way of economising in pilots is by resting the men before they give definite objective signs of overstrain. To secure the maximum saving in personnel the doctor should try and know the flying officers personally and make allies of their Squadron Commanders, who will often be able to point out those pilots who are showing signs of staleness or overwork.'

In both of these quotations it is interesting to observe that the special duties of a medical officer in charge of flying personnel are well recognised.

THE SPECIAL MEDICAL BOARD

As the number of pilots rapidly grew and the extent of operational work widened another serious problem arose. An increasing body of opinion held that the wastage of trained personnel was too high, quite apart from those cases in which either necessity or ignorance caused overstrain and breakdown in persons with a basically sound psychological make-up. Further, figures from the training schools showed that an alarmingly large number of pupils did not complete their training; and here, of course, the operational factor could be completely ruled out. If the schools were to produce their quota, this wastage had to be reduced and the attention of the experts was turned to the methods of selection applied to potential pilots with a view to greater discrimination. It will be recalled that no specialised examination for flying fitness was then made, and it became increasingly obvious that this was the reason for many of the failures, both under training and with minimal operational stress. After investigation, a Special Medical Board was established, in October 1916, to examine all new entries for the Flying Services, and also to perform re-boards on cases of illness and breakdown. This board was aided by the Air Board Research Committee (Medical), which co-ordinated the research work done by the separate Services, and investigated the vast amount of clinical material which passed through the examination board. Much work was carried out on the perfecting of tests with which to assess flying efficiency, and gradually a form of standardised examination was evolved. This examination was comprehensive, and consisted of a detailed medical and surgical survey, including ophthalmic and aural investigation and such specialised tests as the self-balancing test, the balancing rod test and Barany's chair. No examination was made for heterophoria as the importance of this was not

realised at the time and tests for this purpose were not introduced until the end of 1918. The age limits of the candidates were 17½ years and 30 years, and it was found that inside this range the optimum age was from 19½ years to 26½ years—as judged by subsequent records. Those candidates were preferred whose civil occupations were associated with fairly high intellectual attainments and also gave opportunities for athletic recreation, and an interrogation was made in which the candidates were asked their reasons for preferring the Flying Service, and further questioned about their past Service record, if any, and their keeness for aggressive sports. During the physical examination, resolution in performing the tests was particularly looked for. The importance of temperament was recognised, though no attempt was made to determine the temperamental suitability of candidates by means of a psychological examination.

This inability to pick out those with a faulty temperament is far from remedied even to-day, but the remainder of the examination was relatively efficient as became manifest when the number of failures was reduced by over 50 per cent.

The examination of a past Service record sometimes afforded valuable evidence of the candidate's psychological make-up. This method, however, was not infallible, as certain officers in the front line who volunteered for flying duties did so to escape the filth, discomfort and more immediate dangers of the trenches. Many people cast envious eyes at the flier in those days, as he was thought to fight a more gentlemanly war such time as he was not relaxing in comfortable billets well behind the lines. In cases where these were the main incentives to volunteer it is little wonder that some did not succeed. These were fortunately a small minority of the whole, and the officer who passed the severe tests of the front usually made an apt pupil and a successful aviator.

The Special Medical Board was expanded until it could deal with 200 candidates a day, and by November 1918, it had examined over 60,000.

PROBLEMS IN AVIATION MEDICINE

The Medical Research Committee was constantly encouraging research in aviation medicine and many attempts were made to devise tests for those attributes which were considered a necessity for the successful flier. Ingenious reaction-time tests were perfected, much attention was paid to vestibular functions and their assessment and, above all, the foundations of our present knowledge of anoxia were laid down. The development of the high altitude scouting aircraft brought the problem of oxygen-want out into the open. Before this, most flying was carried out at an altitude lower than that at which the atmospheric oxygen reached dangerously low partial pressures, and owing to the insidiousness of partial want, it was rarely apparent to the aircrews

themselves. Now it became imperative to supply extra oxygen, and many devices were constructed to do this, most of which suffered from the disadvantages of great weight, unwieldiness and relative inefficiency. The idea that 'he-men' did not need extra oxygen was very widely held at the time, and this, combined with a prejudice against 'contraptions', caused much needless inefficiency in the air and not a few fatalities. The Germans had an advantage in this respect as the service 'ceilings' of their Zeppelins were higher than those of most pursuit aircraft and their 'emergency ceilings' well within the zone of dangerous anoxia. Many of these lighter-than-air craft carried an apparatus for giving extra oxygen to the crew, but it was unwieldy and difficult to adapt to aeroplanes.

Flying stress was a difficult problem, rendered the more serious because it was so intangible. Despite a great deal of research, no test of physical efficiency was devised by which the degree of established stress could be accurately determined. It was recognised, however, that physical deterioration usually went hand-in-hand with the development of fatigue and, failing any other yard-stick, this fact was used in the assessment of the latter. It soon became apparent that prevention was all important and that many cases could be avoided if action was taken in time, and before the end of the war, much had been done on these lines with gratifying results. As a better understanding of the causation was gained, the rôle of the medical officer began to emerge. More emphasis was laid on 'positive health', and it was found that a keen and intelligent medical officer could do much to prevent these undesirable sequelae of operational flying, always provided that the Executive was prepared to listen to him and to act on his advice. Although these duties were within the capabilities of most doctors, the idea of specialisation in aviation medicine was rapidly gaining ground.

FORMATION OF THE ROYAL AIR FORCE

In 1918 the Royal Air Force was formed. The completely separate nature of the new force was emphasised from the outset. It did, however, initially adopt Army titles and much of Army procedure and discipline. This was an obvious development because it consisted largely of Royal Flying Corps personnel, and an executive organisation like that of the Army was thought to be more practical in what was to be essentially a land-based force. The loss of naval identity is significant because it explains why Naval Aviation, and with it Naval Aviation Medicine, suffered such a decline in the post war years. When the Royal Air Force was first formed, its Medical Service consisted of seconded Navy and Army Medical Officers, most of whom had been stationed at home or Continental aerodromes or had been engaged in Aviation Medicine research. These, of course, represented the bulk of the medical officers in both Services who had been intimately connected with flying and

who had become interested in its problems. Thus, when the Royal Air Force Medical Service was eventually formed, many of these officers were invited to transfer, their services and specialised knowledge being lost to the Navy.

With the responsibility for naval flying in the hands of the Royal Air Force, and all facilities for medical and other research similarly controlled, it is not surprising that, as far as the Navy was concerned, aviation medicine was to be a closed book for many years. There was little or no incentive for naval medical officers to learn anything more about the subject than could be picked up during a commission in a carrier, and even such appointments were relatively few in number.

THE FLEET AIR ARM OF THE R.A.F.

After the Armistice, in November 1918, the Royal Air Force which had grown to a huge organisation, was drastically cut down by demobilisation. The peace-time strength allowed for permanent commissions to be granted to only just over a thousand officers, and the total number of squadrons was also greatly reduced. Of the latter it was decided to form five squadrons for Fleet duties—three landplanes and two seaplanes. The demand for flying personnel to work with the Navy was therefore not great and could largely be met by those experienced naval fliers who had turned over to the Royal Air Force. It is, however, interesting to note that the first course at the newly established Air Force Cadet College, Cranwell, in 1920 contained seventeen midshipmen who had been allowed to transfer from the Navy. These were, of course, not necessarily intended for duties with the Fleet.

For some years naval flying made little progress. It was realised that the position with regard to flying personnel was not entirely satisfactory, and, in 1924, a change was made whereby the Navy undertook to provide the bulk of the flying personnel for Fleet duties. It was agreed that 70 per cent. of the pilots would be naval officers trained by the Royal Air Force, and the observers and telegraphist-air gunners were to be recruited entirely from naval personnel. This latter was considered necessary because it was thought that only a trained naval officer could perform the requisite air reconnaissance and spotting duties, and the telegraphist-air gunner was required to understand many of the intricacies of naval wireless telegraphy and signalling. The remaining 30 per cent. of pilots, and all the maintenance personnel, ashore and afloat, were to be provided by the Royal Air Force. The design and production of Fleet aircraft were also in their hands, as was the complete flying training for pilots, both basic and specialised. It was a rule that all officers piloting R.A.F. aircraft should hold R.A.F. Commissions, and so the naval officers who were to be trained as pilots were seconded to the R.A.F. and held commissions in that force at the same time as their

naval commissions. Their seniority was, however, not the same in the two Services because, however senior a naval officer the pupil might be, he held a junior R.A.F. rank for training purposes.

For the naval officer, specialisation in pilot or observer duties was placed on a similar footing to the other non-substantive qualifications. Executive sub-lieutenants and lieutenants under 28 who were in possession of their sea watch-keeping certificate, volunteered for these duties in the same way as they might do for gunnery, torpedo or navigation. The Branch was also open to Royal Marine Officers who, with very few exceptions, volunteered for pilot duties. It was intended that these specialists should revert to general duties for a period (usually one commission—about 2–2½ years) during their time as lieutenant or lieutenant commander, but would retain their R.A.F rank and their liability to fly in an emergency. An officer could be reverted to general duties at any time if unsuitable, or could do so at his own request after four years in the speciality.

MEDICAL ARRANGEMENTS FOR THE FLEET AIR ARM OF THE R.A.F.

This arrangement succeeded quite well, within its obvious limitations. When embarked, all personnel came under naval discipline, and ashore under the R.A.F. at such stations as Gosport, Lee-on-Solent, Donibristle and Leuchars. Here their medical care was the concern of the Station Medical officer, either an R.A.F. medical officer or a civilian medical practitioner employed by the R.A.F. on a " contract " basis.

When the question of the medical examination and care of flying personnel was first raised, it soon became apparent that the R.A.F. would be responsible for the major part. When embarked, they were naturally looked after by naval medical officers, but most of the specialised examinations were the concern of R.A.F. doctors who had evolved the standards and perfected the technique of testing. The officers volunteering for observer duties had only an ordinary physical examination by the medical officer of their ship or station, and for a number of years had no formal examination for flying fitness. The candidates for pilot duties, on the other hand, were examined at the Central Medical Establishment of the R.A.F. (or sometimes at Overseas Commands of the R.A.F.) and R.A.F. medical documents (R.A.F. Forms 48) were issued for them. Subsequently, the majority of annual medical examinations and all the boards for the determining of flying fitness were carried out by the R.A.F., and often special facilities were arranged so that the examination of personnel in aircraft carriers based abroad could be performed at R.A.F. stations when an opportunity arose. In cases of sickness or accident while embarked, the naval medical officer would treat the case, and make out an R.A.F. Form 39 concerning it, but, except in trivial cases, he was not in a position to decide officially on

flying fitness. Apparatus for use in performing special medical examinations was allowed in carriers, but only a few naval medical officers had received any instruction as to its use, and their findings were subject to amendment by R.A.F. medical boards.

A few naval medical officers, usually prospective senior medical officers of carriers, were sent to the Central Medical Establishment of the R.A.F. for a course of instruction. These courses usually lasted about three to four weeks and gave an adequate grounding in the practical application of the R.A.F. manual, 'The Medical Examination for Fitness for Flying' (A.P.130). However, only the barest outline of the rapidly expanding subject of aviation medicine could be given in the time available. Once embarked, it was difficult for these medical officers to keep conversant with progress in these subjects, for a carrier cannot offer many facilities for research. When the squadrons disembarked, they passed out of the naval doctor's ken, and it was difficult to 'follow-up' interesting cases. All this was very disappointing to the keen doctor and it is not surprising, in the circumstances, that there were very few naval medical officers who had a working knowledge of aviation medicine at the time of the change-over in 1939. This was a disadvantage which caused much delay at the beginning and took a long time to make good.

There were many in the Royal Naval Medical Service who deplored this state of affairs, and some who foresaw modern developments in a surprisingly detailed manner. In this connexion it is very interesting to read in an article by the Senior Medical Officer of H.M.S. *Furious* entitled " A Utopian Idea of the Medical Selection for the Fleet Air Arm' and included in his *Journal* for 1925:

> 'With the advent of naval pilots, naval observers and naval ratings for flying duties, it would appear that the day is fast arriving when the medical side of this work, and the organisation attached thereto, should be placed on a solid foundation . . . . anticipating the day when the Fleet Air Arm is entirely Navy . . . . a portion of the Royal Naval Medical Service should be trained and become expert in the medical aspect of aviation . . . . until this branch was a *fait accompli* the school of training would have to be the R.A.F. Central Medical Establishment, but in course of time this could be done at our own Central Medical School of Aviation . . . . It would be situated in, say, Portsmouth . . . . This would be more convenient than London possibly, having a naval hospital under its lee for cases requiring observation and/or treatment. The records could be kept there and the Medical Department could be kept informed . . . . The medical forms used by the R.A.F. have been evolved by years of experience. Many of these would be useful for maintaining medical records of the Fleet Air Arm . . . .'

and he goes on to elaborate the composition and functions of this school and ends:

> 'It may be that this idea is antithetic to Service conditions, economics and policy . . . . and as such could not be used or considered, being merely the idea of an enthusiast.'

No doubt this scheme did appear too revolutionary to warrant serious consideration at the time, but it is striking to note that nearly all the prophesies it contained have come true. It is attractive, if somewhat depressing, to speculate on the benefits which could have been gained had such an organisation been perfected and in working order before the outbreak of war.

The medical staff of a carrier in peace-time was rarely large and mostly preoccupied with the physical risks of flying. Crashes were far from infrequent, and most carriers maintained a standing first-aid party both on the flight deck and in the attendant destroyer while flying was in progress.

Signs of strain and breakdown were not often seen. The Fleet Air Arm squadrons spent a large part of their time ashore, and, even when embarked, the pace was leisurely and the facilities for mental and physical recreation good. Much training was done, but all the existing carriers could be used for this purpose and facilities were rarely overtaxed until the few years preceding the War of 1939–45. The careful medical examination given to pilots on entry made breakdowns under these conditions very unlikely. Of those who subsequently failed for medical reasons, it is instructive to note that the neuro-psychotic factor played a much smaller part than it does in war-time. This was partly due to the fact that the 'stock' was better, and partly because operational stress, or a prospect of it, is the most important single cause of anxiety states. None the less, the peace-time hazards of carrier flying were very real, and, for many years, it was the most highly specialised art in aviation. In the earlier years, no transverse arrestor wires were fitted, and skill was more at a premium than ever. The Senior Medical Officer of the *Argus* wrote in his Journal for 1925:

> 'Deck landing is the worst form of flying. There is always a big mental strain on the pilots. They never enjoy their time in the air from a ship as they always dread the landing on the deck that is to come.'

And, while this is possibly an extreme view, it shows that the dangers were well recognised at that time. To these dangers must be added that of being lost at sea. This was always very real in the days before the radio beacon was fitted in carriers, and was not entirely eliminated by that device.

When flying personnel were appointed to a ship, they received instructions from both the Admiralty and the Air Ministry, this being to emphasise the fact that they were appointed for ship's duties as well as flying duties.

The dual control of naval flying, evolved in 1924, was adequate so long as peace was assured, but, even organised on this basis, the Service was prevented from developing by the limitations imposed on the construction programme.

TRANSFER OF THE FLEET AIR ARM TO THE ADMIRALTY

Towards the end of the fourth decade, the change in the international situation necessitated expansion of the Fighting Services. More trained fliers and aircraft were needed to fill the requirements of the new aircraft carrier *Ark Royal*, laid down in 1935, and the carriers of the *Illustrious* class included in the 1937 programme. The needs could not be met by further drafts upon executive naval officers who hitherto had provided the main source of naval flying personnel. The transfer of the Fleet Air Arm to the Admiralty became inevitable and took place late in 1937. The transfer brought its problems. New sources of supply had to be found. In the case of officers, the Air Branch of the Royal Navy was to consist almost entirely of officers holding short service commissions and previously trained for flying duties. Ratings were to be allowed to qualify for pilot duties. To meet the need for non-flying personnel, the Royal Air Force allowed some of its senior skilled personnel to transfer to the Navy and in addition lent a number of mechanics, some 1,500 in all, until such time as the new naval mechanics could be trained up to the required standard. To meet the need for reserves, an Air Branch of the R.N.V.R. was formed. The Royal Air Force undertook responsibility for medical examination of all candidates for pilot or observer duties until a Naval Medical Board was set up for the purpose. The pamphlets giving the regulations for entry detailed the standards required so that prospective candidates could arrange a preliminary medical examination by a general practitioner, thus avoiding useless applications. Direct recruiting of observers' mates and air-gunners was also introduced.

NAVAL AIR STATIONS

In order to provide facilities ashore for training and the accommodation of disembarked squadrons, certain stations were to be taken over by the Navy. These were to form the nucleus of a system of Naval Air Stations, and several of them were the Royal Air Force Coastal Command Stations which, for some time past, had been used by the Fleet Air Arm. The following is a list of the stations in question with their intended function under the new administration:

Lee-on-Solent	Float-plane training; observers' final training.
Ford . .	Primary observers' school.
Worthy Down	Air Gunners' school.
Eastleigh .	General ground training.
Donibristle .	Facilities for disembarked squadrons in Scottish waters; base for deck landing training; general ground training.
Lympne .	Technical training.

The administration of these Naval Air Stations at home was to be in the hands of a Flag Officer, the Rear Admiral, Naval Air Stations, whose headquarters would be at Lee-on-Solent.

MEDICAL ARRANGEMENTS

After this brief executive outline we come to a consideration of the medical arrangements necessary for the re-organised Service. It will be easy to understand that these not only had to be very extensive but, in many cases, would represent a departure from current naval practice. The following were regarded as minimal requirements:

1. A medical board for the examination of initial entries and the re-examination of flying personnel.
2. A central medical administration for the Naval Air Stations.
3. A records office or offices in which the medical data of the flying personnel could be kept.

It will be remembered that, for many years, the Royal Air Force had been responsible for the holding of medical boards on Naval flying personnel. Decisions as to flying fitness, whether in new entries or after sickness, were entirely in its hands. No naval medical board existed for this purpose. As the Navy was now to assume full responsibility for these medical examinations, it was decided to establish an Admiralty Medical Board for the purpose.

THE ADMIRALTY MEDICAL BOARD

This first Admiralty Medical Board for the determination of flying fitness was to sit at the Medical Department of the Navy in London. It was, however, intended to be mobile if the numbers of entries at any provincial centre were large enough to warrant it. It consisted of a surgeon captain as President and three surgeon commanders, and the services of other specialists were available as required. As the experience of the members of the Board in flying matters was limited, at least one of them was attached to the Royal Air Force for a course of instruction lasting three months. The Board started to function unofficially in the winter of 1938 to relieve the R.A.F. Boards, and assumed its full duties on February 20, 1939. It was then responsible for the entry examinations of all outside candidates for R.N. Air Branch, or R.N.V.R. Air Branch commissions, and also for the Fleet entry, both officers and ratings.

The Board took as its standards those of the Royal Air Force. Which of these standards was to be applied to each of the various branches of naval flying personnel was a vexed question. The pilots caused no difficulty; those who were already flying had been passed A1B, the R.A.F. full flying duties standard, and had undergone annual medical examinations to ensure their retention of this standard. The same standards and procedure could be applied to those new entries accepted for pilot duties. The observers and air gunners, however, presented many problems. The Executive Royal Naval Officers who had been specialising in observer duties had rarely received any stringent examination. The observers' mates and air gunners were required to pass a

medical examination which would eliminate those with a blatantly bad family or personal history, or some gross physical defect, but which did not approach in severity the R.A.F. combatant passenger standard A3B. Thus, to all intents and purposes, the existing passenger flying personnel had never been examined as to their fitness for flying duties, and none of them held the relevant R.A.F. medical documents. Arrangements had to be made to bring these people into line with the new entry. It was laid down as a general principle that if the duties of an officer or rating had been satisfactory, due allowance for this was to be made in cases where there was only a borderline degree of unfitness. From the outset it was decided that the R.N.V.R. observers should hold an A3B category, but the standards for R.N. Air Branch observers were not finally decided for some time. Soon after the latter branch was formed, in early 1938, it was decided that these short service officers should specialise in both pilot and observer duties. They would all therefore be examined to the higher pilot standard A1B. A number was so examined by the R.A.F. during 1938. Later in that year the idea of dual specialisation was abandoned, and the Admiralty Medical Board, which was functioning unofficially to aid the R.A.F., examined a number of candidate observers to the A3B standard, the higher category appearing to be then unnecessary. Only a few weeks later, in January 1939, the authorities, disturbed by the failure of a few R.N. Air Branch officers to reach a satisfactory standard in their speciality, considered it desirable to be able to transfer an officer under training from a pilot's course to an observer's course or vice versa. This, once again, entailed all the candidates possessing the higher category. Thus, when the Admiralty Medical Board officially came into operation, the standards it adopted were as follows:

> For R.N. and R.M. officers, ratings and other ranks transferring to the Fleet Air Arm for pilot or observer duties, and for R.N. Air Branch candidates for either speciality the standard would be A.1B. For R.N.V.R. pilots it would also be A1B, but for R.N.V.R. observers it would be A3B or a modification of this.

PROPOSALS OF THE MEDICAL DIRECTOR-GENERAL OF THE NAVY

These arrangements were very short lived, however, as yet another change was made in the selection of the R.N. Air Branch candidates. It was finally decided to pick them definitely as pilot or observer, without the option of changing over later if unsuccessful. As soon as these details were settled the Medical Director-General put up comprehensive proposals with regard to the examination and medical care of naval flying personnel:

> 'It is considered that for ease of classification and to produce conformity throughout the flying personnel of the Fleet Air Arm the following proposals would be of great advantage. If they are accepted full medical records

of every member of the Fleet Air Arm would be immediately available for each medical board.

It is understood that the reasons for the decision to make the physical standard for (A) Branch observers the same as that for (A) Branch pilots are no longer present, as the Selection Board now definitely selects candidates either as pilot or observer.

The existing medical standards for observer officers, observers' mates and air gunners were laid down some time ago before the present high-speed aircraft came into use. Conditions have now so changed that this class of officer and rating has to undergo great physical strain and is just as subject to the risk of incapacitation as are the pilots.

The proposals are as follows:

1. That the flying personnel of the Fleet Air Arm should be divided, for medical classification, into two groups:
   (*a*) Officers and ratings employed as pilots (to include officer and rating pilots R.N. and R.M., officer pilots R.N. (A) branch and R.N.V.R. (A) branch).
   (*b*) Officers and ratings employed in observer duties (to include officer and warrant officer observers R.N. and R.M., officer observers R.N.(A) branch and R.N.V.R.(A) branch, observers' mates and air gunners).
2. That pilot candidates be examined as at present for fitness to learn to fly by the Admiralty Medical Board and the Royal Air Force Medical Boards, and that they continue their annual medical examination.
3. That candidates for officer observer, observer's mate and air gunner undergo the examination for pilot with the modification as laid down by the Royal Air Force (the A3B Category). That each member of this group has the special medical documents. That each member of this group undergoes the annual medical examination.

It is considered that by instituting the somewhat higher medical examination for officer observers there would be little or no loss as due attention would be paid to the officer's experience in observer's duties. If these proposals are concurred in, the medical examination, standards and arrangements will conform entirely with those of the Royal Air Force.'

These proposals were agreed to and embodied in the first medical instructional order for the Fleet Air Arm. This detailed the arrangements for medical examinations on entry, for the holding of medical boards and for annual medical examinations. It explained the flying categories and gave notes on the compilation and disposal of medical documents. Further, it laid down that all the trained flying personnel who had never been examined, observers, observers' mates and air gunners, were to have a full medical examination to the A3B standard when an opportunity arose. Many of these people were stationed abroad or were members of detached flights in capital ships or cruisers. It would have been out of the question to have them all examined by medical boards, and arrangements were to be made for the examination

to take place in an aircraft carrier or at a Naval or R.A.F. Station. An R.A.F. Form 42 (Naval M.248) was to be made out and forwarded, in lieu of the ordinary initial board form 826 (Naval M.255), to the Medical Director-General so that a medical history envelope 48 (Naval M.247) could be initiated for the officer or rating concerned.

It will be convenient to say something here about these special medical documents. They had been evolved by the Royal Air Force for keeping the medical records of all their personnel, flying and non-flying, and had proved very satisfactory in practice. Naval pilots attached to the R.A.F. had for years held the necessary documents which proved a very real advance on existing naval medical history sheets, particularly in the case of officers, who normally had none at all. It was proposed and accepted that the Navy should adopt these forms without any other change than the addition of naval form numbers.

The Royal Air Force system provided that all records of examinations or sickness were to be in duplicate. One copy of each, a flimsy, was to be retained in the personal medical history envelope (Form M.247) and the other copy, a card, sent to a central records office. In this way a permanent record was established for each individual to which reference could be made if the personal documents were lost, and from which new personal documents could be reconstructed.

The card copies of documents for naval flying personnel had, up to this time, been held by the Royal Air Force. This responsibility now passed to the Admiralty, and a records office for the purpose was set up in the Statistical Section of the Medical Department of the Navy.

MEDICAL ARRANGEMENTS FOR THE NAVAL AIR STATIONS

For administrative purposes aircraft carriers and oversea Naval Air Stations would, of course, come under the local Commanders-in-Chief. In these cases the Fleet Medical Officer or Staff Medical Officer concerned would constitute the immediate authority. The new Naval Air Stations at home were to come under a separate authority, and it was decided to appoint a Staff Medical Officer to the Rear Admiral, Naval Air Stations. The first medical officer to hold this post was a surgeon commander, R.N. This officer had been appointed to the Medical Department of the Navy in July 1938, to assist in the planning of the new medical arrangements, and later to Headquarters, Coastal Command, Royal Air Force at Lee-on-Solent.

The Staff Medical Officer's Office at Lee-on-Solent was to carry out other functions apart from the pure administration of the medical facilities in Naval Air Stations. It has already been stated that the records of sickness for flying personnel were to be kept by the Medical Director-General. It was necessary, however, to have at Lee, the Headquarters of the Air Arm, a concise record of officers' sickness and movements.

The Staff Medical Officer was to maintain this record, and, for the purpose, used the R.A.F. Form 853, inserting appointments as well as sickness and records of documents. To keep this record complete it was ordered that all medical documents rendered for flying personnel should be sent first to the Staff Medical Officer for scrutiny and onward transmission to the Medical Director-General. In this way it became an additional responsibility to ensure the correctness of the records before they were sent on. Further, the concise record of movements enabled the office to undertake the tracing of missing documents. It was, however, never intended that this service would be available unless reasonable efforts to obtain the papers had been made by the ship or station concerned.

RECIPROCITY WITH THE R.A.F. MEDICAL SERVICE

It was originally intended that the six new Naval Air Stations were to be taken over intact on April 1, 1939. A limited amount of medical equipment would therefore be present already, and deficiencies could be made up later by demands on the appropriate naval hospitals. Naval medical officers were far from plentiful at the time, and it was not possible to appoint one to each of the Naval Air Stations. Where there was no naval medical officer, the Navy was to adopt the current Royal Air Force practice of employing civilian medical practitioners. The Air Ministry had devised a scheme for employing them as medical attendants for the stations, paying them a daily rate if employed full-time, on a sessional basis, or for individual visits. They were responsible for first aid being given at accidents and for the care of sick personnel and their wives. Some of them were allowed to perform annual medical examinations and to sit on boards for the determination of flying fitness. It was customary to appoint 'stand-by' medical practitioners who would be available in the event of a grave emergency or in the absence of the station practitioner. Apparently the lack of Royal Air Force rank did not hinder their activities, and at least one of them has stated that the position of the civilian medical practitioner seemed to offer all the advantages of officer status without any of the disadvantages. Their standing was akin to that of the naval chaplain and, given co-operation by the Executive, they could make themselves very useful.

These arrangements were adopted by the Admiralty almost without change, and the doctors appointed by the Royal Air Force to Lee-on-Solent, Donibristle and Eastleigh continued under the naval administration. During the preceding years they had been responsible for the medical care of disembarked naval squadrons, and were conversant with their problems. The change-over was, in consequence, very smooth indeed. Full time civilian practitioners were appointed at Lee-on-Solent and Donibristle, while Eastleigh was served on a part-time basis, as also was Lympne.

The Air Ministry also accepted full responsibility for the medical care of Royal Air Force personnel attached to Naval Air Stations, and their families. It was agreed that the treatment to be given by the Navy was not to differ in any way from that of the Royal Air Force so long as the personnel were attached to naval units. This was essentially a reciprocal agreement, and naval personnel attached to Royal Air Force stations would be similarly treated. To keep the Royal Air Force central authorities informed, a statement of sickness among Royal Air Force personnel was to be rendered weekly on R.A.F. Form 38. This was to be sent to R.A.F. Records, Ruislip, through the Rear Admiral, Naval Air Stations accompanied by card copies of any Forms 39 completed in respect of R.A.F. personnel. It should be noted that a Form 39 had to be rendered for all R.A.F. officers and ranks who were sick, flying and non-flying, as all had similar medical records.

TRANSFER OF THE NAVAL AIR STATIONS

Arrangements were then complete and all was in order for the actual change-over. It also became possible to appoint Naval Medical Officers to take over on April 1, 1939, the expected date of transfer, but this in fact did not take place until May 24 for Lee, Donibristle, Worthy Down and Ford, and July 1 for Eastleigh and Lympne. In the course of these delays the Royal Air Force was in unofficial charge for a number of weeks. The sick bay facilities and general hygiene of the stations were found to be, with few exceptions, up to naval standards. In general the naval medical officers who took over expressed themselves as satisfied with the existing arrangements and recommended only minor modifications. No station was very far from a naval hospital, and it was not considered either necessary or desirable to make elaborate provisions for medical treatment in the vicinity of the stations themselves. For a major administrative change, the transfer was completed with astonishingly little trouble, this being to a large extent due to the adequacy of the planning which preceded it.

These original stations had only a limited capacity for expansion, and their situations were not entirely satisfactory from the point of view of Fleet requirements. It was considered necessary to provide at least one more station in the far north, and land for this purpose was surveyed at Hatston, near Kirkwall in the Orkneys, in early 1939. With the imminence of war, Scapa Flow had once again become a principal Fleet Base, and, among other things, provision had to be made for landing squadrons attached to Fleet carriers operating from the Flow. The construction of this station was still far from complete when war was declared. Soon, however, with squadrons working-up and carrying out deck landing training, with a busy Fleet Requirements Unit, and eventually with operational commitments of her own, H.M.S. *Sparrowhawk* became a very busy establishment indeed. Could the fall of France have been

foreseen, with the consequent limitations of the South Coast Naval Bases, the provision of Northern Naval Air Stations would perhaps have received a greater impetus. A further Southern Station in Somerset was also planned before the war, but work on this had barely started on the outbreak of hostilities.

THE THREAT OF WAR

By the summer of 1939, the threat of war seemed very real indeed. The Military Training Act caused some slight modifications with regard to the R.N.V.R. (A) Branch entry. Youths of conscription age, who volunteered and were found educationally and medically suitable for flying duties, were to carry out the six months' training in a Royal Naval Special Reserve laid down by law. At the end of this time suitable candidates would be given commissions as Midshipmen (A) R.N.V.R. and would be required to complete a further six months' training. They would remain in the reserve for ten years and be subject to the ordinary R.N.V.R. (A) Branch regulations. In this way the supply of suitable candidates was thought to be assured.

So ended the peace period, with belated but energetic attempts to make good our deficiencies. Increasing numbers of short service and reserve officers were under training, and the construction of new stations and aircraft carriers was proceeding apace. The medical arrangements, though in working order, were far from complete and much was left to be perfected under the stress of war-time conditions.

THE IMPACT OF WAR

The outbreak of war found numbers of Royal Navy Air Branch officers at various stages of training. There were also those candidates who had passed their 'medicals' and the Selection Board but had not actually started their training. All these provided an immediate training reserve, but expansion was urgently necessary. During the first two months of the war a number of candidates who had been recommended by the University Joint Recruiting Boards was accepted. This, the 'University' entry, depended largely on the possession of satisfactory Officers' Training Corps certificates, or other evidence of pre-military training. It made available at once a large number of keen officer candidates, but was abolished in October 1939. From this time all candidates for commissions in the Air Branch of the R.N.V.R. were to be selected from lower deck hostilities only ratings. The active service ratings were ineligible for temporary commissions but could, of course, be recommended for R.N. or R.N. Air Branch commissions if suitable. A relaxation of this rule permitted older men with considerable flying experience to be granted commissions from entry, the intention being to employ them chiefly on secondline duties, relieving the younger fliers for operational work. To be recommended for temporary R.N.V.R. commissions in either the Executive or the Air Branches the ratings

were obliged to spend at least three months in a seagoing ship. This minimum period was often extended, particularly if the ship was stationed abroad, and delays were frequent. For Executive commissions this procedure was obviously desirable, as it enabled suitable men to be picked according to proved ability in actual sea conditions. This, of course, would obviously apply also to the flying personnel, as they were basically naval officers and ratings. It was, however, soon recognised that, desirable as such training may be, it was not essential and would cause unwarrantable delays in the supply of potential pilots and observers. These latter were urgently required and the demand could be met only by arranging a direct entry without compulsory sea service.

In October 1939, a special medical board, the Central Air Branch Medical Board, was set up at H.M.S. *St. Vincent* with the primary object of relieving the Admiralty Medical Board of the responsibility for initial examinations of flying personnel. The latter board then concentrated on re-boards of flying personnel and acted as a higher authority for the branch board. The C.A.B.M.B. examined not only the new entries, but also the fleet entries, as this method of entry was not abolished. It also carried out re-examinations of candidates in cases where there had been delay in calling up after the initial examination. This de-centralisation relieved the Admiralty Medical Board of much routine work and left it free to concentrate on the problems raised by war-time sickness, a rapidly increasing field.

Thus, when a new direct entry was proposed, the medical arrangements already existed to cope with it. It was therefore decided to form an Executive Selection Board at *St. Vincent* which would work in conjunction with the C.A.B.M.B. in the examination of the candidates. This board was to consist of an Executive President, an Instructor Officer and a Naval Air Arm Officer detailed by the Rear Admiral, Naval Air Stations. Fleet entries, as well as the new direct entry, were to be dealt with.

In the words of the Admiralty Letter announcing this arrangement:

> '. . . Their Lordships have had under review the arrangements for the supply of personnel for training as pilots and observers in the Fleet Air Arm.
>
> Their Lordships contemplate that a large proportion of these personnel will be obtained by the selection of serving hostilities only and reserve ratings recommended for Temporary Air Branch Commissions under the arrangements laid down in A.F.O. 276/40, but it is unlikely that at present requirements can be fully met from that source.
>
> Their Lordships have therefore decided that it is necessary to provide an additional source by the direct entry of youths between the ages of 18½ and 20 from public and secondary schools under the conditions set out in the enclosed regulations.'

These regulations offered direct entry to 'well educated young gentlemen' of British nationality, who had reached the School Certificate

standard or higher. A good knowledge of elementary trigonometry and mathematics was an essential. They were instructed to apply to the nearest Combined Recruiting Centre where, if they satisfied the Naval recruiter, and were found to be Medical Grade 1, they were to be given a form to complete and return. This included provision for a candidate's previous headmaster to certify educational attainments, and was considered by the board at *St. Vincent* before the candidate was instructed to appear personally. When the time came the candidates appeared before both Medical and Selection Boards, and if they passed these obstacles, they were reserved for Naval Service and sent home to await call-up. The report of these medical examinations was sent to the Medical Department in London where the necessary medical documents were initiated and held in readiness for the candidates' first appointment.

A few R.N.R. and R.N.V.R. executive officers were allowed to volunteer for pilot or observer duties, and these officers retained their executive status. They were never numerous for the reasons already given as regards Royal Navy executive officers. In fact, although the letter quoted above implied that the bulk of pilots and observers would come from serving ratings, from this time on they were recruited very largely from the new direct entry.

The Fleet Air Arm was expanding rapidly, and if the initial examinations of the newcomers for flying fitness were not to be skimped, many more medical officers versed in the special technique would be needed. Perhaps more important, a nucleus of doctors was urgently required, adept at preventing or treating the ills peculiar to the flier, and at rendering an adequate and correct record of such sickness on the multitude of forms provided. So, early in 1940, a few medical officers were appointed to R.N.A.S. Lee-on-Solent to receive instruction in these matters. At this time, however, no real attempt had been made to organise a comprehensive course. A few lectures were given, particularly on the matter of documents, and the medical officers on these 'courses' picked up much of the detail of flying medical examinations by watching these being performed at *St. Vincent* by the C.A.M.B. Apart from this there was no instruction at all in aviation medicine.

MEDICAL PROVISIONS AT NEW AIR STATIONS

At the outbreak of war, the Naval Air Stations at home were far from being on a sound footing. Those which had been transferred from the R.A.F. were of course basically equipped and could be used from the outset, but, with the exception of Hatston, the new stations being built by the Navy were scarcely beyond the planning stage. Accommodation was everywhere inadequate for war-time complements, and extra living space was improvised from tents and other temporary structures until more permanent buildings were erected. At this time, all three Services had a lot of leeway to make up and much bitter argument over priorities

for buildings went on, the result being that delays were far too frequent, and several isolated stations spent a miserable first year with minimal recreational facilities. Sewage plants which were not designed for such large numbers and which could not quickly be enlarged, were often grossly overworked, with a falling off in efficiency and increased hazards to health. The provision of ablution blocks lagged behind the accommodation proper, the few cooks available had to use all their ingenuity to make do with small and ill-equipped galleys, and such non-essentials as canteens and cinemas were of course even longer delayed.

By naval standards, the sick bays of the stations turned over were small and not really adequate even for a peace-time complement. However, little radical structural change was carried out at the time, but in many cases the existing plans for first aid, etc., suffered extensive modification. The risk of lethal gases being used by an unscrupulous enemy was by no means remote. Many reliable authorities considered that airborne gas attacks were unlikely to cause any great mortality. It was recognised, however, from previous experience of blister gases, that the resultant morbidity and loss of working capacity might well be very great. In consequence, decontamination centres were erected in all home establishments.

Although the later policy with regard to first aid was not fully developed until after the air raids of 1940, it was recognised before this that some dispersal of first-aid stocks and personnel would be necessary. Further, it became apparent that the permanent male personnel of the Air Stations would be fully occupied by active defence duties, while the more transient members of the complement, trainees, etc., were too often changed to be of much use as first-aid parties. The only solution appeared to be the use of W.R.N.S. first-aid parties, with male stretcher parties to do the heavier work if necessary. Many had misgivings when this arrangement was made. They maintained that the girls would have neither the physical strength nor the temperament for the work. The experiences of the summer attacks of 1940 soon laid these doubts, however, and the W.R.N.S. emerged with much credit as the medical officers' Journals from R.N.A.S. Ford and other stations will testify. It was as near an ideal arrangement as could be expected. The girls were relatively permanent, they could be trained to the requisite standards and kept aware of developments, and, as they had no active defence duties, they could be relied upon to be present in an emergency.

Turning to the constructional work in progress, we find that only Hatston was partly completed at the outbreak of hostilities. The first squadrons had arrived there a few days previously to find no accommodation at all, and were at that time billeted in Kirkwall. No main drainage existed on the camp, and sick bay facilities were improvised by using part of a sleeping hut as a temporary ward. Cases requiring more skilled attention could be discharged either to the small local civil

hospital or to a hospital ship which lay in Kirkwall Bay. Later, the basement of an adjacent farm was taken over as a temporary sick bay. This farm was just outside the camp boundary, and was a substantial structure which would have given some considerable protection from bombs and blast. The medical staff used these quarters until late in 1940 when the proper station sick bay was completed. The construction of the latter raised many problems and it is perhaps relevant to mention these in some detail as all the work carried out was original, no naval precedents having been established at that time. A standardised type of sick bay had been evolved by the Civil Engineer-in-Chief's Department in consultation with the Medical Director-General for erection in Naval Air Stations under construction. Structures of this sort were, in 1940, being built at St. Merryn, Yeovilton, Arbroath and Crail. For several reasons this design was considered unsuitable for Hatston, particularly as regards the unfitness of the terrain and the lack in the design of protection against air attack. Therefore, the local authorities were instructed to design and erect a sick bay to suit the local conditions. It was then standard practice for sick bays to be erected within station boundaries, and this was accepted in spite of the fact that Hatston was one of the first stations to receive enemy attention. Because of this constant danger, and because the local hospital facilities, though the authorities were very willing and helpful, were far from adequate, it was decided to make at any rate part of the structure splinter-proof and reasonably blast-proof. In this way cases could be retained on the station in reasonable safety for a more leisurely evacuation later. To this end the decontamination centre and emergency theatre, which intercommunicated, were enclosed in a requisite thickness of walling, and communicated directly by splinter-proof passageway with an air raid shelter which was largely underground and very well protected. This was the only sick bay of the kind in the Naval Air Stations at home and it represented a very considerable departure from current practice.

In January and February 1940, two disembarked squadrons were using Kintyre Airport at Campbeltown, Argyll. One surgeon lieutenant from the ship to which they were attached was sent to look after their welfare, but all the arrangements were very makeshift. The squadron offices were improvised from packing cases and provision for medical care was correspondingly crude. A few drugs were purchased from the local chemist. There were no cots available, cases being either nursed in their own beds or sent to the local cottage hospital. However, this simple beginning was destined to develop later into one of the larger air stations when land on the other side of the peninsula was requisitioned as the Royal Naval Air Station, Machrihanish.

The stations at Yeovilton, St. Merryn, Arbroath and Crail were all nearing completion in the spring of 1940, and a standardised form of sick

bay had been evolved for erection on these sites. These were large and elaborate structures containing wards for officers, ratings and W.R.N.S., crash and operating theatres, X-ray rooms, offices, a galley and many other rooms. They were sited to be convenient as regards station routine and thus were very definitely inside the target perimeter in each case, sometimes immediately adjacent to hangars, workshops and sleeping accommodation, all legitimate targets. Once again this was due to the fact that the chances of bombing were thought to be small, and the potentialities of this form of attack underrated. Otherwise, there could scarcely have been such a radical change of opinion when the grim lessons of 1940 were driven home.

Had it been the intention of the authorities to allow a medical officer with surgical experience to each of these stations, the scale of equipment of instruments, etc., would have been more than adequate. As it turned out, rarely was anyone appointed who felt competent to use the operating facilities to the full. This applied particularly to the supply of orthopaedic appliances such as equipment for skeletal traction. These were often provided on a scale which could only be described as lavish, and, in most stations, remained quite unused. This was partly due to the natural reluctance of medical officers to commit themselves to unfamiliar and highly specialised techniques; but, more important, few were willing to impose upon patients the very real danger of being completely immobilised in the middle of a target area. In consequence, the bulk of surgical cases and serious medical ones were transferred to Service or civilian hospitals outside the area of immediate danger. Nevertheless, the large and airy treatment and inspection rooms, consulting rooms for a variety of purposes, adequate space for offices and the keeping of records and excellent ablution facilities were all very comfortable to work in and were a marked improvement on the converted sick bays.

ENEMY ATTACKS ON AIR STATIONS

Barely were arrangements completed, however, when the turn of events of 1940 made a change of policy necessary. It soon became apparent that, though we could deal adequately with the mass daylight raiders, the swift individual 'sneak' raiders and the heavier, if less accurate, night attacks were very much of a problem. The air stations on or near the south coast were obvious targets and came in for a great deal of attention. Lee-on-Solent, Ford and St. Merryn were among the Naval Air Stations attacked. Ford became far too vulnerable for the training of observers to continue there, and moreover, was urgently required by the Royal Air Force to augment the defences of the area. The decision to move to Trinidad was rapidly taken and implemented. Similar conditions existed at Lympne, and the air mechanics under training there were evacuated to Newcastle-under-Lyme. The siting of sick bays inside

the target area has been mentioned. By some malign fate they seemed to be singled out for attention. At Lee-on-Solent there was almost a direct hit which demolished the entire front of the sick bay and caused a few casualties, at St. Merryn the Petty Officers' ward was demolished and stores destroyed, while at Ford, in the words of the Medical Officer-in-Charge at the time:

> 'The bomb scored a direct hit on the sick bay but failed to explode. Had it done so it would have killed seven of the staff, including myself, and have destroyed about half the stores and most of the equipment. The moral of this is obvious and the movement of the sick bays from all air stations to a safe distance outside the target area is a matter of urgent necessity.'

In every case the work of the staff was conspicuously good. The sick berth attendants' conception of their duties was wide and in several instances they gave valuable aid quite apart from their medical duties. The W.R.N.S. first-aid parties more than justified their selection and allayed any doubts as to their competence. It was, however, absurd to expect medical arrangements to be anything other than rough and ready under the circumstances. Nothing other than bare first aid was practicable, and the lack of a place of safety in which casualties could be nursed was keenly felt. Dispersal of some kind was immediately necessary. As a temporary expedient, all those who were not required for active or passive defence duties on the station were sent away from the danger area at night time. To consider these urgent problems a meeting was held at the Admiralty on August 26, 1940. The provision of medical facilities away from the stations was only a minor feature of the discussions but it was resolved that:

> 'The existing sick quarters in R.N. Air Stations should be considered primarily as first-aid stations, and for the attendance of out-patients. Other patients should be dispersed, and for this purpose all Royal Naval Air Stations should investigate the possibility of using civil or Service hospitals in their vicinity, or alternatively, requisitioning an existing building as a sick quarters. The Medical Director-General should be consulted on the arrangements for each station.'

The Rear Admiral, Naval Air Stations was instructed to communicate these orders at once to all Naval Air Stations at home and to demand a report of action taken by each station by September 14.

In the main, action was taken very rapidly. In some places, however, it was found very difficult to obtain suitable accommodation. This is not surprising when one considers that many stations were built well away from large cities, and often in the vicinity of small coastal towns the houses of which were frequently filled with voluntary evacuees.

In some stations it was not thought necessary to provide a dispersed sick quarters. Arbroath alone of the larger stations proposed to take no action on the recommendation. This was because local hospitals were considered adequate, and because any one of the many houses in the

vicinity could be made into an emergency hospital 'in three or four hours'. Also, the sick bay itself was on the edge of the main 'target area'.

At Hatston no suitable accommodation could be found, and as the station sick bay was at least partially protected, no further action was taken.

In most cases the dispersal was carried out. Usually a large house a few miles from the aerodrome would be provisionally requisitioned. It would then be visited by a representative of the Medical Director-General who would assess the general suitability and approve any necessary alterations. The existing furniture, sometimes very valuable, had to be shifted, and in one case further premises had to be requisitioned in which to store the chattels from the proposed sick quarters. The main rooms were usually large enough to make serviceable wards, staff-rooms, etc., and the smaller rooms became cabins for officer patients, sisters and staff. In nearly every case the major alteration was the conversion of one of the formal, over-decorated rooms into an operating theatre. Plumbing was usually called for and often the laying of new water and electricity mains. At some stations, notably Lee-on-Solent where R.N. Hospital, Haslar, was so close, a house was requisitioned solely for the bed accommodation, no theatre being considered necessary.

The equipment came largely from the station sick bay in each case. However, owing to the distance of the sick quarters from the stations, a great deal of emergency stores had to remain at the latter. Thus again, a great demand for more material was created, and this was provided. Unfortunately, it was still found impossible to allow all of the stations a medical officer having the necessary skill in surgery. There were some stations, however, which were so far from adequate hospitals as to make disposal of emergencies difficult and a surgical specialist was appointed. Crail is an example. Others were close enough to some naval sick quarters to make the sharing of a surgical specialist practicable. This was subsequently done at Machrihanish with success.

In the majority of cases the new arrangements worked very well. Even if the new sick bays were not completely out of sight and sound of aircraft, they did represent an improvement on the siting of the station sick bays, quite apart from the increased safety. These latter were often very noisy indeed, particularly if some vagary of the wind made aircraft take-off or land over the sick bay. In cases where rest after a flying accident was desirable the continual noise of aero-engines was scarcely conducive to peace of mind. This noise factor was again prominent with regard to medical examinations. Accurate auscultation and the testing of hearing, even roughly, was sometimes made extremely difficult. These difficulties were minimised in the dispersed sick quarters, and there at least the sick could be examined without interruption, even if it was not usually found feasible to hold routine examinations of flying personnel so far from the camp.

These old houses usually stood in large private grounds which offered the pleasantest of surroundings for convalescents, and which could yield welcome vegetables and fruit crops for the patients and, with enterprise, for a part of the station personnel.

OPERATIONAL SORTIES FROM AIR STATIONS

The chief rôle of most of these stations was the training of potential carrier-based squadrons in the intricacies of naval flying. The expansion of the training programme made this commitment a great one, and nearly all the available hangar and airfield space was continually in use. There were, regrettably, no spare first-line squadrons at this time, but several which had been 'earmarked' for new carrier construction were shore-based while carrying out their final working-up before embarkation. Few of these were in a position to operate against the enemy from shore bases and, in fact, there were few Naval Stations which had the necessary equipment. Hatston was practically the only Naval Air Station which consistently staged operational sorties. As these were carried out under extremely adverse conditions, they hold the unenviable distinction of having produced the earliest signs of operational fatigue in the Naval Air Arm.

OPERATIONAL FATIGUE

The site of H.M.S. *Sparrowhawk* was near Kirkwall in Orkney. This latter is a small town, so small that the requirements of the Naval Base alone would have seriously overtaxed its lodging and recreational facilities. The Air Station was partially in operation long before the living accommodation was completed, and many officers were billeted in not very satisfactory lodgings ashore. There was only a temporary officers' mess in a sleeping hut. Recreation of an organised nature simply did not exist and there was little scope for individual initiative in this connexion. The terrain was largely unsuitable for playing fields, and such as there were could rarely be used in winter-time, partly because of water-logging and partly from an absence of daylight after working hours. The weather was usually deplorable, with strong winds and very frequent rains. There was then no camp cinema, while those in the town were crowded to the doors with unforeseen naval patrons. Occasionally epidemics made it desirable to put even these out of bounds. Add to all this the fact that leave was considered to be out of the question at first, so that even a small break in this monotony could not be expected. While living in these not very satisfactory conditions, aircrews were detailed to fly on many long sorties, chiefly to attack objectives on the Norwegian coast. Most of these attacks were carried out in Skua aircraft of three squadrons. While the Hatston Skuas certainly did sink a *Königsberg* class cruiser in Bergen harbour, their operational usefulness was limited by the small fuel capacity, which made a

prolonged search of the enemy coast impossible, and the poor bomb-load, one 500 lb. bomb or the equivalent. These limitations were countered on at least one occasion by embarking one of the Skua squadrons in a carrier, together with Swordfish fitted with long-range tanks, and flying this striking force off close to the Norwegian coast. Thus a protracted search was made possible before the aircraft had to turn for home, landing at either Hatston or Sumburgh. On other occasions the objective was Trondheim or Tromso, to which places the Skuas were again transported by carrier. After a raid of this sort they would again be disembarked at Hatston, but could expect neither rest nor diversion after their labours.

The strain of all this was of course great. The Senior Medical Officer at Hatston wrote in his Journal:

> '. . . During this period the whole station was working at top pressure. These raids were a very great strain, not only on flying crews, but also on the armourers and general staff. The fact that it was necessary to keep the squadrons always available increased the stress considerably. They would have benefited greatly if they could have been given 24 hours completely off after each raid. The crews stood up to conditions extremely well, but towards the end of the time they were reaching their limits. . . .
>
> The crews of some of the lost aircraft made their way back to this country after some time. These men were all completely exhausted, mentally and physically, but after 10 to 14 days' leave they recovered completely.'

This question of leave caused much concern. It was obviously necessary to keep as many skilled fliers as possible available all the time. There were no facilities for local leave in Orkney, and long leave, with all the recall difficulties, was considered far too hazardous. A stand-off of one or two days after an operation, as suggested above, would undoubtedly have helped even in the absence of a change of scene. As things were the flying personnel returned from one operation only to find themselves standing-by for another. Such methods were obviously self-limiting because no-one could endure such conditions for long, be they ever so brave and reliable. It was at first difficult to counter the ill effects, but some attempt was made to prevent complete wastage of personnel by the use of 'connivance leave'. This was granted as a period of 'extraordinary' leave to those showing signs of incipient breakdown. It was not sick leave, but was given by the captain on the advice of the medical officer. It was hoped, and this hope was sometimes justified, that such a person would recuperate fully in the leave period and return to duty without the 'stigma' of having been in the hands of the doctors, suffering from neuro-psychosis. Later, when conditions permitted, a continuous leave roster was introduced. This allowed one complete aircraft crew, both flying and ground staff, to be sent on leave at the one time. This was a marked improvement, as everyone could then look forward to leave in turn, which would not be cancelled except in

a grave emergency. This prospect kept up spirits in a most salutary fashion.

As far as could be judged it was the waiting which caused the most harm. When operational sorties were made, however dangerous and however problematical the damage to the enemy, a new purpose was seen in everyone. All worked with a will to give their inadequate weapons a maximum chance. Perhaps while waiting the possibilities became all too probable, while likelihoods were transformed into unpleasant certainties. Most people were happier when the heat of action blinded them to their fallibilities, while one successful action behind them did much to restore self-confidence.

At the end of April a squadron of Royal Air Force Blenheims joined Hatston and carried out several sorties. The reaction of their crews provided an interesting comparison:

> '. . . it was interesting to note that they did not appear to feel the strain as much as the Fleet Air Arm pilots. This was thought to be due to the facts that:
>
> (*a*) they had longer periods completely off-duty;
>
> (*b*) they were flying twin-engined machines;
>
> (*c*) they were working well within the endurance of their aircraft.'

However, in proportion to the amount of work done, the total incidence of neuro-psychosis was not heavy. It is most instructive to examine the available data and form an opinion as to the probable causes of breakdown in the few who did succumb. Comment has been made at some length on the factors common to all, the nature of operational hazards, the discomforts and lack of amenities. None of these 'environmental' risks operated unduly heavily against any one individual or group of individuals. We must, in consequence, draw the conclusion that variations in individual reactions were determined by differences in personality and temperament.

For nearly all this was the first taste of operational flying. The object for which they had been extensively trained had been achieved. Now the adequacy of that training and the quality of the material trained were under test. The few who fell by the wayside at this stage were, in the main, psychologically inadequate for such an occupation. They were people who should never have volunteered for flying duties, though admittedly peace-time routine and their former occupations may not have made this sufficiently obvious.

No discredit should fall upon them for this. Flying is an occupation which requires certain basic qualities which often cannot be assessed except in combat. The tests in this instance were severe, the strain very great. As the strain was fairly evenly distributed, one is tempted to wonder just why so few were affected under such adverse conditions.

One thing we must remember is that the majority of the aircrews at this time consisted of active-service personnel. Fighting was their

business in life, and they had joined the Navy either as executive officers or as naval fliers. They were thus less likely, as a body, to show unfavourable reactions to war-time conditions. One cannot generalise, however, and this group did of course show a number of early failures. This must not be taken as in any way a reflection on the Air Branch of the R.N.V.R., which, as time went by, came to be responsible for the greater part of naval flying. However, when recruiting is increased by several hundred per cent., the standards have to be lowered, candidates are accepted who might well be refused in peace-time and automatically a higher wastage both during training and afterwards becomes inevitable. That this wastage should be largely of R.N.V.R. personnel is no reflection on the Reserve as a whole.

A second feature of note was that the conflict was then only just one year old. Moreover, the Fleet Air Arm had come into the picture prominently only with the Norwegian Campaign. Thus the factor of prolonged operational stress, a most important one, did not yet apply.

Few other stations participated in operational work. Some of the Hatston aircraft later operated from St. Merryn against targets in the English Channel. The amount of damage they could cause to heavily protected targets was far too small to warrant their continued employment in these attacks, and eventually they were abandoned. Only occasional sorties were flown from other Naval Air Stations, but certain naval squadrons operated from R.A.F. stations. These latter included mine-laying Swordfish squadrons which, with extra fuel tanks fitted to the aircraft in the observer's seat, made many very uncomfortable journeys to the coasts of Europe.

MEDICAL ARRANGEMENTS IN AIRCRAFT CARRIERS

In the medical and nursing staffing of Aircraft Carriers a balance had to be drawn between immobilising valuable personnel and providing a staff adequate for most emergencies. The larger ships carried four medical officers, the smaller three or two. In common with all the fighting ships it was true that there was never enough routine medical work to keep these doctors occupied. But much more went on in a carrier, and an intelligent doctor would find much to occupy his free time quite apart from such duties as wine caterer or censor officer which might be thrust on him. Most of these ships maintained a flight deck first-aid party, including a medical officer during flying. The value of a medical officer in such circumstances was problematical, but his presence was often insisted on by the Executive, perhaps to enhance morale as much as anything else. In one ship the flight deck sick berth attendant carried what was described as an 'ostentatiously large' first-aid bag, more, we are led to believe, from the point of view of increasing confidence than any practical function. However, if time did hang on the doctors' hands when all was quiet, there were never enough of them when action came,

particularly if one of their number was injured. Fortunately a carrier lends itself to an easy interchange of personnel at sea, and on at least one occasion, medical officers were flown from one carrier to another to help with the treatment of casualties.

OPERATIONAL FATIGUE IN AIRCRAFT CARRIERS

The peculiar problem of the carrier medical officer was the care of flying personnel. This was interpreted in a variety of ways by different authorities. Some maintained that the medical officer must spend all his working hours and his spare time with the fliers in order to understand them fully. The other side maintained that the average flier could be understood quite adequately without regarding him covertly for early signs of neuro-psychosis. They took the view that a doctor is judged rather by his attitude in the sick bay, by his sympathy and understanding when problems do arise, than by his social successes. As ever, there was much truth on both sides, and certainly the medical officer should be in a position to recognise the early signs of incipient breakdown.

The conception of the carrier medical officer's work being in any way unusual was not widely held in the Navy during the earlier part of the war. But the number of Service medical officers versed in Fleet Air Arm problems was lamentably small, and no serious attempt was made to supplement their knowledge by means of courses for a considerable time. Some had received elementary instruction at Lee-on-Solent and *St. Vincent*, but the teaching was still to be co-ordinated. Most of the medical officers concerned had no instruction, but nearly all had formed very definite opinions by the end of a year, and did not hesitate to offer valuable advice on the improvements which they deemed desirable to maintain the efficiency of flying personnel. For example, the Senior Medical Officer of the *Ark Royal* placed on record:

> 'It is most unfortunate that arrangements cannot be made to relieve the squadrons more frequently. In my opinion each squadron should be posted to a shore base after a period of a few months. Operating from a carrier is entirely different from operating from a shore base. . . . A large number of these officers and men have been in the carrier for months and months without a break; they have been employed in most of the operations in Norway in addition to Oran, Dakar and Cagliari. Some of them have even carried out two operations on enemy objectives in one day. . . . Under such conditions one would expect a higher percentage of nervous disorders. . . .
>
> 'It is impossible to grant local leave under the present war conditions. Our squadrons are therefore deprived of the leave privileges which are enjoyed by their opposite numbers at home and by shore-based squadrons abroad. Leave can only be obtained by those who have been medically boarded and recommended for leave.'

Certainly much of this was inevitable. Pilots and observers obviously could not be made overnight.

But even if we accept that there was no real alternative to these conditions, it cannot be agreed that everything was done to keep the unfavourable factors under control. A ship may have to spend a large part of her time at sea, conditions of service may seem unduly hard, and, at times, hazardous. One cannot escape the conclusion, however, that the flying personnel working under such conditions expected, with some justification, that during the few hours or days they spent in port reasonable amenities should be provided for them.

There was, however, a growing awareness of the necessity for action, and as reserves of aircraft and men grew, so the scope of such action could be widened. With this end in view a meeting was held at the Admiralty in November 1940, to discuss 'The Problem of Flying Stress and Neurosis in Flying Personnel of the Fleet Air Arm'. This was a purely medical meeting, having no executive powers, but it laid down the principles upon which preventive medicine in the neuro-psychiatric sense was to be practised in the Fleet Air Arm. It further indicated the methods of disposal of cases showing early signs of operational stress. The members of this board were chosen as representatives of all the aspects of medicine as applied to naval flying, and included those who had experience in carriers, on Naval Air Stations and on the Central Board.

With regard to the prevention of flying stress, certain definite recommendations were made:

LEAVE

The following were considered minimal requirements:

(*a*) *Shore Training Air Stations*
The present position appeared satisfactory but efficiency would be improved by ensuring pilots one clear 24 hours off per week away from all duties.

(*b*) *Shore-based Operational Squadrons*
14 days leave every three months.
1 long week-end between long leaves.
24 hours complete stand-off after any major operation.

(*c*) *Carriers*
It was impossible to stipulate any definite programme for carriers, but it was recommended that every effort should be made to grant leave clear away from the ship whenever possible.

Thus, whereas leave was formerly regarded as a privilege, to be granted only when convenient to all concerned, it was now laid down as a principle that a scale of leave comparable with that in the Royal Air Force should be introduced. This was excellent as a principle. However, until more reserves were available, it was almost impossible to implement, particularly with regard to carriers based abroad. This was recognised in an Admiralty Letter on the subject:

'With regard to naval flying personnel serving on foreign stations, whether afloat or ashore, My Lords hope that Commanding Officers will in many cases be able to arrange for private hospitality for those taking recreational leave, especially as Colonial Allowance is not payable. It is realised that such arrangements are not possible in some places, e.g. at Gibraltar. In such cases the only remedy is early relief when this can be arranged.'

DUTIES

(*a*) It was considered important that all flying personnel should be given definite duties or responsibilities outside their purely flying duties, e.g. ships' duties, games supervision, physical training, etc.

(*b*) Flying personnel of shore-based operational squadrons should be changed about every six months. The maximum period of continuous flying service in a carrier should not exceed 12 months. In carriers on foreign service it might be possible to secure this by interchange with a spare squadron based on shore. R.A.F. experience had shown that it was unwise to allow flying personnel of a squadron to become too closely welded, as under these conditions losses had an unduly adverse effect on the morale of the remainder.

(*c*) Stand-by duties and periods of waiting before operational flying were in many cases as potent a cause of stress as the actual operational flying. Where possible they should be eliminated, and where they were essential every effort should be made to make them as brief and comfortable as possible.

(*d*) Flying personnel who had kept the middle or morning watches should not be detailed to fly during the following afternoon.

Only recommendation (*a*) needs comment. It will be seen that the meeting considered it important that flying personnel be given definite duties outside those connected with their squadron activities. This is interesting because just such a state of affairs had been accepted without question by the regular flying personnel before the war began and during its opening phases. Later, however, with an increase in reserve personnel many of whom had done no sea time at all, even as ratings, it became more of a problem. A flying man who had received the comprehensive training of a naval officer could be very useful at sea. He could take turns with the other executive officers who were often at this stage under complement, and in consequence often overworked. So long as the pilots and observers were not involved in other duties when flying was impending, this system was an excellent one. The new type of flying officer had no such naval background and could rarely be given responsible tasks outside his own duties. Many of these young officers were willing to learn, but there was little opportunity for the ship's officers to teach them. This was unfortunate, as it left the young officers with far too much time on their hands and did nothing to bridge the gulf between executive and flying personnel or, to be more exact, between the ship's officers and the squadrons. Whatever may be said to the contrary the duties of a junior officer in a squadron were very

rarely onerous apart from flying. He was expected to take an intelligent interest in his aircraft, but maintenance proper was not his concern. His turn as squadron duty officer might come up once a week or less often. He was bound to find time passing slowly unless other duties were found for him, particularly during periods when strategy or the weather made flying impossible. He usually had poor cabin accommodation, if fortunate enough not to be slinging in a hammock.

RECREATION

From the medical point of view it was urgently necessary to push on with proper recreational facilities at Air Stations. Meanwhile much could be done with improvisation, e.g. badminton in empty hangars. It was generally agreed by both R.A.F. and F.A.A. Medical Officers that the hospitality of local residents was of particular value in providing a complete change of environment.

It was recognised that such stations were often remote from adequate recreation and entertainment and, moreover, that the personnel would often lack the means either to travel far for diversion or to pay for it when they got there. Quite apart from these considerations, it was obviously desirable to provide adequate healthy recreation free on the stations.

SLEEP AND QUIET

Air Stations. It was considered that much could be done in the matter of quiet and a sense of security either by dispersal of personnel to billets clear of the airfield and its vicinity, or failing this, by the provision of comfortable sleeping quarters in blast-proof and relatively noiseless shelters. There is nothing more disturbing than the knowledge that a rush for cover may be required.

Carriers. In interviewing patients many comments had been received upon the difficulties in obtaining adequate sleep by day or by night, particularly before operational flights. To the natural difficulty of getting to sleep in such circumstances was added the noise of preparations, orders from loud-speakers and the ordinary life of the ship. It was considered probably impossible to remedy this, but it seemed to be an important factor in the early stages of flying stress and any possible improvements were worthy of consideration.

The recommendations with regard to air stations were made at a time when bombing was a real danger. Thus they lacked applicability to any other period. The situation in carriers was more difficult than the recommendation suggests. The squadron personnel were often less permanent than the ship's company and thus, officers and men alike, they tended to be relegated to the less desirable mess-decks and cabins. These were often on a deck which had to be evacuated at sea, and the unfortunate officers and ratings were forced to find a precarious billet

on some upper deck, in flats, lecture rooms or, if lucky, on the decks of the cabins of the more fortunate. This may not have applied to the Fleet Carriers with extensive accommodation, but in other carriers, and particularly the older ships, the situation left much to be desired.

IMPROVED EFFICIENCY OF FLEET AIR ARM MEDICAL OFFICERS

(*a*) It was desirable that during their preliminary training, before serving with the Fleet Air Arm, medical officers should receive special instruction in psychological medicine applied to flying.

(*b*) One medical officer at each air station should live in the mess. This would facilitate the detection of the earliest manifestations of incipient flying stress.

(*c*) Every opportunity should be given to medical officers attached to the Fleet Air Arm to gain flying experience as a passenger. The paramount importance of a nucleus of medical officers being trained as pilots had already been emphasised in previous papers.

Paragraph (*a*) was rapidly implemented and a course of lectures in psychological medicine as applied to flying was arranged at R.N. Hospital, Haslar, early in 1941. Orders granting facilities for medical officers to fly as passengers were promulgated by the Rear Admiral, Naval Air Stations, but it was a long time before *ab initio* pilot training for medical officers was considered desirable. Paragraph (*b*) reiterates the necessity for a medical officer to be constantly on the alert for signs of strain, both on and off duty. The comments of one of the *Ark Royal's* medical officers may be quoted:

> 'The Fleet Air Arm medical officer must know all the flying personnel. He must know not only their names, but must be able to form a good degree of knowledge of their characters, their professional ability, position in their squadrons, something of their jargon and of the stress to which they are subjected. He must be able to detect quickly a change in their outlook or habits and yet must never have the appearance of spying on them. He must stand in the light of a friend to whom they can turn for sympathy and advice. He must be prepared to listen to their grumbles, without too obviously siding with them or opposing them. He must be able to give friendly warnings without arousing antagonism, and advice without being sententious. Lastly, when it falls to his lot to "ground" a pilot or observer, or send him home for rehabilitation, he must be something of a diplomat, for he must at one and the same time provide hope for the airman's future and rob his enforced treatment of the imputation of being a failure.'

This admirably sums up the duties of a medical officer in the Naval Air Arm.

Having made these broad recommendations the meeting turned to consider the handling of neuro-psychiatric cases in detail. They considered that:

'There is often unnecessary delay before a case receives suitable treatment and there is frequently a lengthy period of uncertainty before a decision is taken as to eventual fitness for flying. It is felt that the present procedure of "boarding" is sound but that the best use of existing facilities was not being made by the medical officers due to lack of appreciation as to the possible line of action open to them.'

and the meeting laid down as aims:

(1) That medical officers should have discretionary power through the Commanding Officer to grant leave to the incipient case of flying stress. This leave should be regarded as ordinary leave and not sick leave since it was important to avoid any suggestion of illness. This should be applicable to all flying personnel, both officers and ratings.

This was put into effect early the following year.

(2) In the early case of stress or neurosis it was of the greatest importance, both from the medical and the executive points of view, that a decision should be made as soon as possible as to whether the case was considered a long or a short one. For practical purposes the long case may be regarded as a loss to the unit and would require replacement. The short case probably required a period of leave with little medical treatment. A maximum of two weeks was suggested for a short case from the time of boarding.

In the past it had been found that an officer or rating whose case was under review would be still theoretically attached to a squadron, in spite of the fact that his chances of regaining an operational standard were remote. This made the provision of reliefs more difficult, and probably sometimes adversely affected the operational efficiency of the squadron in consequence. Quite apart from these considerations, it was obviously undesirable to leave this type of patient in a state of uncertainty. Spending days or weeks in this manner, perhaps still on the station, perhaps in the wards of a general hospital, would do much to undermine what morale might remain.

(3) More use should be made of the existing specialist facilities in neuropsychiatry at the earliest stage of the illness. The admission to hospital for 24 hours for consultation was often indicated.

This is a re-emphasis of paragraph (2). A thing which was found to be particularly undesirable was the attempt at deep probing into personality which was sometimes done by unskilled medical officers. This amateur psycho-analysis often did a great deal of harm and prejudiced the chances of the legitimate specialist into whose hands the case was ultimately transferred.

(4) In cases of this type the fullest possible information about the patient was required by the medical board who were otherwise entirely dependent on the patient's own version of his recent history. Full medical notes should incorporate the executive officer's

> opinion upon the conduct, character, morale and efficiency of the patient and any recent changes therein, together with his estimate of the degree of stress to which the patient had been subjected and his reaction in comparison with other members of his unit. This was particularly important in those cases, at present fortunately very rare, where a decision must be made between illness and loss of morale.

Both medical boards and specialists had been sadly hampered by this lack of information. The case would often pass through a succession of hands, and first-hand information which may have been available at the outset often became distorted and less reliable as time went on. It was a long time, however, before the provision of this information was made compulsory.

In spite of the delays and difficulties experienced in implementing all these recommendations, it was recognised that, if realised, they would represent real progress.

OVERSEA NAVAL AIR STATIONS

As regards oversea Naval Air Stations, with the exception of that at Bermuda, none was in operation at the outbreak of war. The heavier and more extensive activities of the Navy in 1940 made the establishment of bases and training stations abroad an urgent necessity. None, however, was commenced until late in the year.

The reasons for the moving of No. 1 Observer School from R.N. Air Station, Ford, to Piarco, Trinidad, have already been explained. The decision was taken to provide training facilities for up to 150 observer pupils in this West Indian island. An advance party of officers and ratings, including the Senior Medical Officer and his sick berth chief petty officer, left England on September 19, and arrived in Trinidad on October 15, 1940, the station being commissioned on November 6. The camp was in process of construction when they arrived, being built in a clearing of a disused coconut estate. The clearing and levelling of the site was a formidable task, but the work, which commenced only on September 17, was far advanced when the party came on the scene. This was largely due to the enthusiasm of the authorities and workpeople locally, and to the modern equipment, 'bulldozers' and the like, which made the initial clearing and levelling much less arduous. The Senior Medical Officer comments in his Journal:

> '. . . one was amazed to find it (the camp) in such an advanced stage of construction observing that the work had only been in progress for four weeks. Quite a number of buildings was completed, roads well under way, main drainage and water system and electric light well advanced and a "go to it with a vengeance" spirit prevailed everywhere. Buildings sprang up like mushrooms overnight and by the time the Commanding Officer, the remainder of the officers and the ratings arrived (56 officers and 260 ratings) on November 6, the Camp was ready to receive them.'

Surely this must be an all-time record for Naval Air Station construction.

The water-supply was good and adequate and a new sewage plant was to be installed at the first opportunity. The diet was good and varied with an abundance of fruit. The shortages of food which were experienced when the U-boat war entered the Carribbean were not then in evidence. Recreation might have proved a problem, for the nearest town of any size, Port of Spain, was 13 miles distant, while transport was difficult and expensive. However, land was set aside for playing pitches, and a canteen and cinema-gymnasium were soon under construction. The interval before these were completed was made more pleasant for all by the hospitality shown to officers and ratings by the local residents.

The advance party had to set up a temporary sick bay in a sleeping hut, but the foundations of a large and modern sick bay were already laid. Thus, in spite of the fact that the Senior Medical Officer found it necessary to make several basic alterations in the plan, a small hospital of 36 beds was completed by December 18. This sick bay was designed to serve the Naval Base, H.M.S. *Benbow*, as well as the Air Station, and when finished it gave every satisfaction. It comprised several wards and the usual offices, treatment rooms, etc., which were well adapted to the local climate, and so, when the bulk of the equipment had arrived from England, the station was well provided medically. There was at first a shortage of sick berth staff owing to none of these being in the second or third parties to arrive. This was to some extent relieved by the excellent work of the local V.A.Ds.

The Colony was described as 'healthy' and was immune from the ravages of yellow fever, typhus, smallpox and plague. There were, however, certain diseases which caused some concern. Typhoid was endemic, but the incidence said to be negligible owing to mass inoculation and sanitary measures. Malaria was a problem and the victims many among the natives. However, the spleen-rate in the camp area was only 1·7 per cent. and thus ordinary anti-anopheline measures would be expected to succeed. These measures were pushed forward on a high priority. The incidence of venereal disease was very high particularly in Port of Spain where, it was reported, 80 per cent. of the women were infected and the defaulter rate at the local clinic was over 50 per cent. Sporadic cases of dysentery, commonly bacillary, did occur, but the incidence was not heavy. One of the more curious diseases which might be met with in the island was human paralytic rabies with the virus being carried by a vampire bat.

The health of the station was surprisingly good considering the inexperience of the personnel with regard to tropical conditions.

In the summer of 1940 a few Swordfish aircraft from the *Hermes* were disembarked at the airfield by the village of Hastings near Freetown,

Sierra Leone. This 'Y Flight' as it was called, formed a nucleus from which the R.N.A. Section, Hastings, was eventually formed. Subtertian malaria was rife, and the spleen-rate among the natives around the camp was very high, as also among the native soldiers who were stationed in the vicinity. The station had its share of malaria, particularly in the months before reasonable precautions could be taken. The journals from the medical officers concerned are largely taken up with the unremitting fight against this disease. At first the raw Europeans did not take kindly to the anti-anopheline precautions, the screening and the long clothing, and they paid a heavy price for their foolhardiness. Later, when a majority of the ratings and officers had some experience of the conditions, camp discipline with regard to these measures was self-enforced.

At Gibraltar temporary facilities were granted to the Fleet Air Arm by the Royal Air Force Station at North Front. Here a few aircraft and crews from the *Ark Royal* were occasionally disembarked. At first, however, there were few spare or unemployed aircraft in the carrier, and little use was made of the facility until later when the R.N.A. Section, R.A.F. Gibraltar, came into being. During 1940, such medical care as was necessary was provided by the R.A.F.

The outbreak of war in North Africa and the increasing work of the Fleet Air Arm in the Eastern Mediterranean made a base in Egypt a tactical necessity. On September 16, 1940, the Egyptian Air Force camp at Dekheila was taken over as H.M.S. *Nile II*, later becoming H.M.S. *Grebe*. Before this date the camp had been used by the Navy, but medical arrangements were of a temporary nature. Now it became necessary to provide a proper sick bay, and one described as 'light and well-built' was constructed on the station. This had two wards, a dressing-room, dispensary, a kitchen and a consulting room, and was at that time adequate for its purpose. While temporary 'heads' of a bucket type were still being used there was a considerable fly nuisance and menace from dysentery. However, main drainage was installed, though not without some difficulties due to faulty design, and conditions improved markedly when this was complete.

MEDICAL PROBLEMS IN THE NAVAL AIR ARM

It is not the purpose of this History to give a detailed account of aviation medicine as a whole during the war years, for it is well realised that the bulk of the problems which arose among flying personnel in the Royal Navy were in *pari materia* with the same problems of the Royal Air Force, and have been adequately dealt with in the Volume on Medicine and Pathology in this series (Chapters 1, iii, and 15, iii).

It only remains, therefore, to set on record such material as is considered to have been unique to the Naval Air Arm alone, and through which may be traced the development of its medical administration.

Chapter 12, Preventive Medicine, has already made mention of the pioneer work carried out at Naval Air Stations in the Tropics, and of the influence exerted on clothing changes by the Naval Air Arm.

As the war progressed, the voluminous reports of medical officers working with the Air Arm ashore and afloat were studied and classified and, in due course, the Medical Department of the Admiralty was able to view in clear perspective the requirements of this ever-expanding and obviously permanent Branch of the Royal Navy. In arriving at its decisions the Medical Department was frequently accused of procrastination. But this apparent delay was a necessary element in the gradual evolvement of measures which would be likely to succeed consistently with the maintenance of common sense and good reason in relation to the other vast medical commitments of the Navy in general.

At a time when the Naval Air Arm might be said to have 'come into its own,' there was a natural disposition of those medical officers who were experienced in aviation medicine to urge that what they considered to be desirable requirements for flying personnel should receive priority. There was, in fact, a growing tendency among some medical officers to regard the Naval Air Arm almost as a 'separate Navy', whose Commands and Establishments should be highly favoured at the expense of the rest of the Service.

The Medical Director-General bore with patience the recriminations and protests of Flag Officers and Principal Medical Officers. Realising the virtual impossibility of fulfilling all his vast commitments, he wisely continued to view the war picture as a whole, and to distribute his resources in medical man-power and equipment to the best advantage according to the ebb and flow of naval operations. Above all, he continued to bear in mind that 'versatility' is the essential requirement in a naval medical officer, and that no authority or provision existed for the creation of a separate section of Air Arm doctors within the framework of the Medical Branch of the Navy. However, during 1943 and 1944 it became possible for the medical demands of the Naval Air Arm to be fairly considered, and the preliminary proposals of the Medical Director-General were placed before the Board of Admiralty in the following form:

'Submitted some comments on the medical criticisms of Fleet Air Arm:

1. The medical arrangements in the Fleet Air Arm may not be ideal, but this is not altogether the fault of the Medical Branch. Under present Admiralty procedure, and the dangerous scarcity of medical officers, improvements are difficult, but some improvement could be effected and some discontent removed without the addition of medical personnel. Therefore an unofficial appreciation of the situation as I see it might be useful.

2. *Aviation Medicine.* This subject falls into two divisions (*a*) Physiological and (*b*) Psychological.

(*a*) The physiological division includes such things as night vision, ear trouble, "G", oxygen, etc. This is aviation medicine proper, and an adequate knowledge of it should be picked up in a short time by any keen doctor of average intelligence. To a great extent it is only old principles applied to a new *milieu*, and there is no need to make a speciality of it for the majority of Fleet Air Arm doctors. However, a few specialists in Aviation Medicine are required for instruction, research and consultation.

(*b*) Psychological medicine deals with the treatment and prevention of neurosis due to flying stress. To call mental breakdown in airmen "flying stress" is convenient, but is really incorrect, as it implies that the nervous disabilities of aircrews are different from breakdown due to any other mental strain than that caused by flying. " Flying stress" may, however, be the most important war disease we have to deal with because of the long time it takes to train an efficient airman and the rapidity with which, once trained, he may break down under the excessive strain of operational flying. In spite of all that the neuro-psychiatrists have written about it, there is no means of preventing flying stress except by the maintenance of morale, fixed and special extra periods of rest and leave, and limitation of hours of operational flying. This is a hard saying, but it is as well to realise that any number of squadron and wing medical officers or the most eminent of neuro-psychiatrists cannot do anything to save nervous breakdown if aircrews are overdriven, fatigued and discontented. It is for executive officers to see aircrews get an amount of leave which ordinarily they would consider absurd for personnel exposed to the strains of normal naval service. Rest is the essential prophylactic. It is useless to consider other subsidiary aids to the prevention of breakdown due to flying stress, however much easier or convenient they may be to organise, until rest can be administered in adequate doses.

3. It appears from the study of various reports that there is room for more welfare work, increased recreation, better accommodation, better transport amenities, etc., etc., but this is a general question which does not affect Fleet Air Arm only. It is a problem in all Service camps and makeshift accommodation; in which, moreover, the doctor's interference has been resented by some executive officers, while others have neglected "welfare" because they consider it was the doctor's responsibility. This anomalous position must be clarified.

4. *Responsibility of Health.* My views on this are set out in detail in 'Naval Medical Bulletin No. 7'. Shortly, the Medical officer is an adviser only; he has no executive authority and can only be directly responsible for the health of personnel after they have been placed on the sick list. It would seem desirable that this should be clearly stated in King's Regulations and Admiralty Instructions, as, though the principle is implied, it is nowhere explicitly stated in this form. If this principle were universally accepted by doctors and executive officers, I am sure it would lead to better liaison and more discussion of health subjects between executive and medical officers.

The former would realise that they had to prevent "flying stress" and the doctors would realise that they were expected to advise whenever they saw any indication to do so. Doctors would thus be allowed more latitude "to speak out of their turn" than other officers, which at present many of us are loth or too shy to do.

5. *Research and Instruction.* These subjects should as far as possible go together. It is essential that the Fleet Air Arm should conduct some research and investigation of its special problems, if instruction in aviation medicine is to be dynamic and alive, instead of dull and static. Research in aviation medicine should be catered for in addition to medical problems of submarine, asdic, gunnery, diving, clothing and other subjects. So far, however, no applications for help or advice have been received by the R.N.P.R.C. from the Fleet Air Arm. Doing our own research does not mean that the closest liaison should not always be kept with the Royal Air Force research and instruction centres.

6. *Re-organisation of Medical Service to Fleet Air Arm.* In view of the ever increasing importance of the Fleet Air Arm and the fact that the Fleet Air Arm will form an ever increasing proportion of the total Royal Navy, it is time that the medical organisation in the Fleet Air Arm was re-examined. Some of the main points for consideration are (1) a sub-directorate in the Medical Department under M.D.G., (2) specialists in aviation medicine. This does not mean every doctor who is attached to the Fleet Air Arm would be called a specialist or that all specialists in aviation medicine need to fly. (3) Flying doctors, their status, number and duties. (4) Interchange of doctors in the Fleet Air Arm with ordinary naval medical officers, and of course their employment in medical establishments and hospitals ashore other than Fleet Air Arm establishments. (5) Special medical establishments for aircrews. (6) Medical air statistics, etc.'

Broadly speaking, these recommendations of the Medical Director-General were approved. Steps were taken to implement the principles advanced, and as much as possible was done having regard to the difficulties attached to building, equipment and man-power at the time. Although great advances were made before the end of the war, the effects of the new developments could not be fully appreciated until the immediate post-war period.

The question of re-organising the disposition of medical officers and nursing staff for service with the Naval Air Arm received the closest consideration. It was realised that it would be desirable that a certain number of medical officers should possess practical flying experience in order to be able better to appreciate many of the psychological and physiological problems of aviation medicine. It was also considered desirable that a proportion of medical officers should be highly specialised in this particular subject.

INSTRUCTION IN AVIATION MEDICINE

In addition, it was regarded as essential that all medical officers likely to be employed with the Naval Air Arm ashore or afloat should

be adequately instructed in the elementary principles of aviation medicine before taking up such appointments. Nevertheless, the principle that a naval medical officer must be versatile and prepared to serve in any branch of the Service was still emphasised.

As a first step, arrangements were made to train a limited number of medical officers as pilots and specialists in aviation medicine. This training was carried out in the United States, at the Naval Air Station, Pensacola, in addition to which assistance was given by the Air Force Tactical Centre, Orlando, Florida, by the U.S.N. Pre-Flight School, Chapel Hill, North Carolina, and by the U.S. Army Air Force Medical Laboratories, Wright Field, Dayton, Ohio.

The numerous reports received from the medical officers under training strongly suggested that, as regards pure aviation medicine, much of the instruction was too elementary to be of any great value. The time devoted to physiology, flight physical examinations, and ophthalmology, was considered to have been well spent. The courses in psychology and neuro-psychiatry were regarded as disappointing, while our medical officers found it difficult to understand why classes in oto-rhino-laryngology and cardiology had been included at all. The general opinion was that few of the subjects taught were directly connected with aviation medicine, and that their inclusion tended to make some parts of the course burdensome and the hours unnecessarily long. It was also remarked that many of the instructors, although well versed in their own subjects, had little, if any, practical experience in the application of these subjects to operational flying. On the whole, the academic portion of this training was considered to have been a satisfactory introduction to aviation medicine and as forming a good starting point from which more advanced problems could be studied. But it was considered that much saving of time could have been effected by excluding irrelevant matter. That this view was reasonable is supported by study of the syllabus which shows that ten hours of the course were devoted to the subject of 'public speaking'.

As regards practical flying instruction, the first four weeks were spent in Stearman and N3N primary trainers. Twenty-one hours' dual instruction and 1½ hours' solo flying were obtained. This was followed by 6 hours' dual and 4 hours' solo flying of the N3N on floats. The sixth week was spent as a passenger in a Catalina, one hour's dual flying being allowed. The remainder of the training consisted of a 69 hours' course in navigation, as well as aerology, aerodynamics, recognition and code.

The instructors were mostly very young, but displayed great patience and sympathy.

Altogether, six naval medical officers were trained at Pensacola, two in each of the years 1942, 1943 and 1944. Of these, only one failed to qualify as a pilot.

In addition, there were seven other naval medical officers available in the Service who either had already gained their 'wings' before entering the Navy, or else held pilots 'A' licences on entering and were granted 'wings' after a short course.

THE ROYAL NAVAL AIR MEDICAL SCHOOL

On March 13, 1944, the Royal Naval Air Medical School was established at the Royal Naval Air Station, Eastleigh. Its broad functions were:

1. To instruct medical officers in the principles and practice of medicine as applied to the special requirements of naval flying personnel.
2. To instruct officers and ratings of other branches of the Navy in such medical subjects as they might require for the proper performance of their duties when attached to the Naval Air Arm.
3. To apply medical knowledge to the solution of problems arising out of naval flying which might become the subject of research.
4. To act in close collaboration with the Safety Equipment School.

It was arranged that a minimum of eight and a maximum of twelve medical officers should attend each course for a period of three weeks, and that there should be one course each month. The Air Medical Course covered the following subjects:

1. The physiology of high altitude flying and centrifugal force.
2. The psychiatric care of aircrew.
3. Oto-rhinology and ophthalmology as applied to aircrew.
4. The medical aspects of safety equipment.
5. The elementary theory of flight.
6. Practical flying experience.

In addition, a special course was arranged in safety equipment and air medical subjects for Commanding Officers of Aircraft Carriers and Naval Air Stations, and for Squadron Commanders and Commanders (Flying).

Other courses with which the Air Medical School gave assistance were the Safety Equipment Long Course, the Safety Equipment Short Course, the Synthetic Parachute Jumping Course and the Special Course for Accountant Officers and Air Store Officers of the Naval Air Arm.

Although there had been some delay in obtaining approval to establish the Air Medical School, once it had come into being, its progress and success were rapid. On March 6, 1944, it was quite impossible to envisage that the building allocated for occupation by the school would be ready for some months. At that time the walls were unfinished, there were no stores, no lights, no floor covering and no furniture. However, with the help of the Civil Engineer's Department and the staff of the school, all these deficiencies were made good, offices and lecture rooms

were fitted out, an excellent museum was constructed, and the establishment commenced instructional work on March 13, 1944, a remarkable achievement in so short a space of time.

Altogether, 157 medical officers had passed through the Air Medical School by the end of the war.

In addition to the functions outlined, the school, in conjunction with the R.N. Air Station, Eastleigh, and the Safety Equipment School was able to perform valuable experimental work. The Admiralty approved the institution of a contingency fund for this purpose, to cover the cost of the purchase of material for experimental work. The conditions attached to the administration of this fund suggested that anything in the nature of serious research might be gravely curtailed. For example, it was stipulated that the total expenditure in one year must not exceed £500, and that no individual item should be purchased at a cost of more than £50. Also, the fund could not be used for the purchase of books or stationery, and transactions through the fund had to be passed through the cash account of the R.N. Air Station, Eastleigh.

Nevertheless, it was pointed out that although the Admiralty did not desire to curtail useful experimental work, it must be clearly understood that the responsibility for the main research on Naval Air Safety Equipment rested with the Ministry of Aircraft Production, and that, before embarking on experimental work, it was desirable that the Safety Equipment and Air Medical Schools should maintain close contact with the Royal Aircraft Establishment, Farnborough, and with the Chief Naval Representative at the Ministry of Aircraft Production, with a view to avoiding duplication of effort.

In carrying out its work the Naval Air Medical School very naturally kept in close contact with the Central Air Medical Board. As related above, this board was formed at the beginning of the war, its function being to assess the fitness of Air Arm personnel for flying duties. As an adjunct to the Board in 1940, courses were instituted at Lee-on-Solent for the instruction of medical officers in the assessment of physical fitness for flying. At that time there was no existing arrangement for dealing with aircrew personnel who had broken down for pathological or psychological reasons, and they were dealt with by hospital Medical Boards of Survey in the same way as for General Service patients.

To overcome the defects of the system, the C.A.M.B. was moved to Waverley House, Lee-on-Solent in May 1942. The staff consisted of a surgeon commander as President, who also acted as medical specialist and psychiatrist; in addition an ophthalmic specialist was appointed, with one S.B.P.O., one L.S.B.A., and seven W.R.N.S., two of whom were writers, and three night vision testers.

In September 1942, two trained orthoptists were added. The volume of their work increased rapidly from 54 attendances per month at the beginning, to 515 attendances per month during the next year. In

October 1943, a third orthoptist was appointed. Each orthoptist held the rank of Third Officer, W.R.N.S.

In March 1943, a neuro-psychiatrist was appointed in order to relieve the President of additional work. As the C.A.M.B. developed, it performed the following functions:

1. The assessment of temporary or permanent flying medical category of flying personnel from Naval Air Stations and Aircraft Carriers at home and overseas.
2. The examination of all new entry personnel for flying, including Air Branch upper yardmen candidates.
3. Medical examinations for Civil 'B' licences.
4. Certain practical aspects of Aviation Medicine for medical officers and sick berth ratings, in conjunction with the Naval Air Medical School, Eastleigh.
5. The conducting of night vision and audiometer tests.
6. To conduct such research investigation as might be directed by the Medical Director-General.
7. Liaison with the interview board.

The total number of Medical Boards of Survey at the C.A.M.B. during the years 1943, 1944 and 1945 averaged 1,000 per year, of which 50 per cent. dealt with neuro-psychiatry cases.

Official examinations of personnel for flying fell from 2,206 in 1943, to 756 in 1945.

In March 1944, the bulk of the instruction of medical officers in Aviation Medicine was transferred from the C.A.M.B. to the Air Medical School at Eastleigh. However, the C.A.M.B. still continued to carry out instruction in the handling and procedure of cases from Carriers and Air Stations, and in particular, great attention was paid to the psychological aspects of flying and its many manifestations. Instruction was also continued in the documentation used in the Naval Air Arm, and a large number of medical officers and sick berth staff obtained a working knowledge of naval aviation medical forms and clerical procedure.

From the beginning, the C.A.M.B. carried out night vision tests on all new entry flying personnel. At first the Hexagon was used, but, in 1944, this was replaced by the A.R.L. Mark IV Adaptometer.

In 1943, an Interview Board was formed at Lee-on-Solent for the purpose of assessing neuro-psychiatric cases referred from the C.A.M.B. At first, the members of this board were fluctuating and temporary. But, in January 1944, a Captain (A) was appointed as permanent President of the Interview Board, and in September 1944, a pilot was appointed as a second permanent member. At each of its meetings the Interview Board co-opted a third member and an officer of the C.A.M.B. attended, not as a member, but in an advisory capacity, so that medical opinion was immediately available.

EXECUTIVE BOARD FOR THE EASTERN THEATRE OF WAR

In March 1945 it was proposed to establish an Executive Board in the Eastern Theatre, for the purpose of dealing with all naval flying personnel in that part of the world who were considered to be incapable of continuing flying duties for psychological or other reasons.

This board consisted of three Executive Officers assisted by the Staff Medical Officer to Flag Officer Air, East Indies, as medical adviser. Its duties were:

(*a*) To advise Their Lordships on any case which, in the opinion of the board, should have his commission terminated, or, if a petty officer, should be transferred to non-flying duties.

(*b*) To advise Flag Officer Air, East Indies on
any change of duties or appointment considered necessary; all cases requiring refresher courses or further training;
any case which had been reported as being permanently unfit for flying duties.

Alongside this Executive Board was established a Central Air Medical Board in H.M.S. *Bherunda*, Ceylon. This board consisted of the Staff Medical Officer to Flag Officer Air, East Indies, the Senior Medical Officer of H.M.S. *Bherunda*, a specialist most appropriate to the case, the Senior Medical Officer of the Air Station, Carrier or Squadron concerned, and a medical officer expert in aviation medicine.

In general, the aim of both the Executive and Medical Boards was to prevent the wastage of air crew personnel by finding suitable appointments for suitable men, to return to the United Kingdom officers whose commissions should be terminated, and to absorb for general duties locally as many ratings as possible whose unfitness concerned only flying duties.

MOBILE NAVAL AIR BASES

In 1944, it was understood that a total of nine Mobile Naval Air Bases would be formed, chiefly for service in the campaigns against Japan; the Medical Department, Admiralty, was warned that two medical officers would be required for each and that arrangements should be made for them to receive a course of aviation medicine at Eastleigh. It was also considered essential that the Senior Medical Officer of each should himself be capable of giving efficient instruction, particularly in tropical hygiene, to the 450 officers and men comprising his unit.

The preliminary organisation of these Mobile Air Bases involved intricate preparation to meet fully their medical requirements. Each needed a mobile dispensary, two ambulances and one jeep. As each was intended to operate far from civilisation, it was also essential to supply sufficient surgical equipment, accessories and tent accommodation to provide for a small hospital unit under canvas for the treatment of routine sick, and casualties from both accidents and enemy action.

Much thought was also given to the aspect of preventive medicine, particularly with regard to the provision of adequate protective clothing for use while working on scrub and jungle clearance.

AIR AMBULANCES

The question of the evacuation of casualties by air was one which received close consideration at a relatively early stage in the development of the Naval Air Arm, and the available records show that this was a subject in which the Medical Director-General showed a great personal interest as the war progressed. The matter was studied as a possible means of effecting economies in shipping and medical man-power at a time when the adequate provision of hospital ships was giving rise to some embarrassment. The Medical Director-General went so far as to suggest to the Board of Admiralty that an air ambulance was the ideal method of moving wounded, which would enable patients to receive the advantages of a fully equipped base hospital, out of the range of operations, within a few hours of becoming wounded. It was pointed out that organised air evacuation would save the maintenance and staff required for many small medical establishments in forward areas, and that its use would result in an obvious saving of shipping necessary for the transport of casualties by sea. Figures showed the normal hospital ship carrier to have a lift of 300 cases, who could not be transported a distance of 1,500 miles by sea in less than five days. Allowing two days for refuelling and turning around, and five days for the return journey, it was possible to demonstrate that the average hospital ship carrier could only evacuate casualties a distance of 1,500 miles at the rate of 300 cases per fortnight. On the other hand, an air ambulance fitted to carry 30 cot cases, could evacuate 30 patients the same distance every two days, or at the rate of 210 cases per fortnight. It was estimated that two air ambulances could perform the work of one hospital carrier. In addition, study of man-power suggested that two air ambulances required no medical officers of necessity, and probably no more than four nursing staff, whereas a hospital carrier required something in the region of 6 medical officers and 80 nursing staff. It was also suggested that the disparity in the size of the ship's company and the working crew of the aircraft was equally striking, as was the cost of conversion and maintenance of a hospital ship compared with that of two aircraft. It was well realised that 'holding hospitals' and staff would be necessary at the air fields on each stage of a long journey. Nevertheless, it was claimed that air evacuation would be the most rapid, the most healthy and comfortable means of transport for the vast majority of naval patients, and might prove to be the most economical in cash and medical man-power.

It was strongly urged that the implications of air ambulance transport should be investigated and studied by experiment during the war,

particularly when units of the Fleet might be based in areas remote from civilisation.

As has already been described earlier in this History, a small number of the nursing staff of R.N.A.H., Sydney, was trained for, and took part in the activities of an Air Evacuation Unit operating in the Pacific. But in practice, the Royal Navy, while realising the serious implications of the suggestions of the Medical Director-General, did little towards implementing any organised scheme for transporting naval casualties by air. Here and there throughout the world local organisation did permit the air transport of sick naval personnel, and an excellent liaison existed with the Royal Air Force for this purpose. But on the whole, naval policy inclined more towards availing itself of the ready assistance of the other Services whose experience of the air evacuation of casualties was amply proved.

Also, towards the close of the war, it was possible, in the light of experience, to refute to some extent the claims made in favour of this form of transport. It appeared that, in forward areas, the hospital ship, far from being ousted by the air ambulance, might well prove to be more necessary than ever before as a 'holding' air reception station for patients carried by the latter. Again, as regards the Hague Convention, any scheme which envisaged a national fleet of air ambulances painted white with Red Cross markings, could but be a Utopian conception in relation to expenditure and aircraft production. It was obvious that aircraft used for the transport of sick would have to perform other general service functions as well.

Finally, the experiences of the Army and Royal Air Force in North West Europe and Burma, from which countries many thousands of casualties were evacuated by air, showed that the clinical disadvantages were not as non-existent as had been claimed earlier. For example, it was found that the high altitudes flown by long-range aircraft, capable of carrying a number of casualties, brought about a capillary dilatation in some cases. This effect was particularly serious where patients were suffering from limb wounds covered with plaster. It was found that the wounds tended to discharge, the limbs becoming swollen and painful and plasters had to be split. Similar disadvantages were noted in relation to colostomy cases. There were also certain criticisms which could be levelled against the transport of psychiatric cases by air, though it was amply proved that high altitudes tended to exert a sedative effect on such patients.

CONCLUSIONS

This chapter has done no more than give a broad outline of some of the chief developments of the medical organisation of the Naval Air Arm. It will be seen that attention has been paid solely to matters concerned with naval flying, apart from flying as a whole, for it is considered

that the Official Medical History of the Royal Air Force will have fully covered the general problems of aviation medicine. The reader will doubtless appreciate that when the Navy established an Air Arm manned by its own personnel, associated medical requirements necessitated the training of a new type of naval doctor and sick berth rating. Nevertheless, it is again emphasised that medical officers and nursing staff whose duties involved long periods of service with the Naval Air Arm were constantly reminded of their general Service obligations, and that the policy of the Medical Branch of the Navy insists upon versatility in order that its numbers may not become too unwieldy or uneconomical. Therefore, although a number of medical officers specialised in aviation medicine, and although there were great advances in meeting the medical requirements of flying personnel, at no time was it ever suggested that the Naval Air Arm should possess a separate and permanent group of medical officers of its own.

CHAPTER 14

MEDICAL ESTABLISHMENTS IN THE UNITED KINGDOM

INTRODUCTION

THIS chapter of the Naval Medical History of the War covers in broad outline the development of the Hospital Services, and includes an account of the more important naval hospitals, auxiliary hospitals, naval sick quarters, and the small number of Combined Services hospitals in which naval and military medical resources were pooled.

Peace-time naval hospital accommodation in the United Kingdom was provided chiefly by the Royal Hospitals at Haslar, Plymouth and Chatham, distribution being founded on the administrative division of the Navy under three Home Commands at Portsmouth, Plymouth, and The Nore. Smaller naval hospitals existed at Portland, and at South Queensferry, the latter serving the Rosyth and Firth of Forth area. In addition, the Royal Naval Hospital at Great Yarmouth was maintained purely for the long term accommodation and treatment of mental diseases.

Subsidiary to the hospitals was a number of sick quarters, each attached to a permanent service shore establishment, with accommodation for emergency and short term surgical and medical cases. These were the Royal Marine Infirmaries at Deal, Chatham, Portsmouth and Plymouth, and the Royal Naval Sick Quarters attached to the Royal Naval College, Dartmouth, and the Boys' Training Establishment, Shotley.

The plans prepared before the war for the accommodation of sick and wounded naval personnel have been described in Chapter 1 and the manner in which they were implemented, in Chapter 2. It will suffice to say again here that the pre-arranged schemes justified themselves and worked efficiently throughout the war.

The increased momentum of war in its final phase, followed by the medical aftermath of post-war reconstruction, increased the commitments of the Royal Navy during 1945, and many burdens were borne by naval hospitals which continued to be borne well into the year 1946 and even later.

ROYAL NAVAL HOSPITALS

ROYAL NAVAL HOSPITAL, HASLAR

The Royal Naval Hospital, Haslar, was first planned in the year 1741, its construction was officially approved in 1745, and its first patients

were received in 1754. In the course of years, with necessary additional expansion, the hospital has come to consist of a large number of buildings occupying extensive grounds overlooking Spithead and the Isle of Wight. The hospital itself covers 7 out of a total of 95 acres, 46 of which are enclosed by a mile long wall.*

The peace-time function of the hospital was to provide general hospital facilities for naval personnel in establishments ashore and afloat in the area controlled by the Commander-in-Chief, Portsmouth. In the years immediately preceding the war, hospital facilities were also extended to personnel of the other Services in the Portsmouth area.

In addition to its function as a general hospital for Service personnel, the hospital undertook the instruction of sick berth staff, and in particular, the preliminary training of newly entered medical officers to the Royal Naval Medical Service.

In the expansion from peace to war much re-organisation of existing arrangements was involved, and the question of the potential function of the hospital in relation to its situation received close attention.

The Royal Naval Hospital, Haslar, occupies a large area of sea border on the Gosport side of Portsmouth Harbour. It is an obvious landmark to ships approaching Spithead from the Solent or the open sea. From the upper floors of the hospital there are attractive views of the surrounding district, over Portsmouth Harbour and the Naval Dockyard to the Portsdown Hills beyond.

The peace-time access to the hospital was complex. The short journey by boat allowed patients to be brought from Portsmouth and from ships afloat to a hospital jetty on the edge of Haslar Creek, an inlet of Portsmouth Harbour. Road access to Gosport was by a toll bridge over Haslar Creek, or by main road, a distance of 2½ miles. Access to Portsmouth by road involved a journey of some nine miles through Fareham, and around the northern edge of Portsmouth Harbour. It will be seen, therefore, that the outbreak of war found the main naval hospital of the premier naval port in the Kingdom situated in the centre of a number of important military targets, and approachable only by sea, bridge, or road routes which could be easily interrupted. In addition, the hospital itself was far from modern in construction. Its vulnerability to attack by air or sea bombardment, as well as sea-borne invasion, was only too obvious, and the debit side of the scale was so heavily weighed by disadvantages that it seemed doubtful at first whether the hospital could be maintained at all in time of war. At the same time, the very age and outmoded layout of the hospital was something to its credit. Its buildings were largely separated, consisting of several hospitals inside one main hospital, and therefore it was unlikely that all would be put out of action at the same time.

* The reader is referred to Tait's *History of the Royal Naval Hospital, Haslar*, and to *The Hospital at Haselord Poynte*. (S. E. Barrington, Esq. 1952.)

The hospital also had the advantage of solid structure, with a vast network of arched cellars of great strength beneath the entire original building. It was therefore assumed that the hospital would be unlikely to perform its general function at the outset, but steps were taken to ensure that, as a casualty clearing station and emergency centre, it should perform a useful purpose. This proved to be the case, and though at times reduced by the heavy impact of enemy air activity, there was in general no impairment of the hospital's efficiency, and during the war it received and cared for 83,446 patients from the Fighting Services.

The nominal war complement of beds was approximately one thousand, but this figure was subjected to constant review from the beginning owing to the repeated encroachment of staff accommodation into the hospital itself.

The peace-time complement of medical officers totalled 15, under the command of a Surgeon Rear Admiral as Medical Officer-in-Charge. The figure included two surgeon captains, as Professors of Medicine and Surgery respectively, who were responsible for the preliminary instruction of newly joined surgeon lieutenants, R.N. The war complement represented fluctuating increases relative to the commitments of the hospital at various periods, and the numbers borne were

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,, 1941 . . .	35
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,, 1943 . . .	25
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The figures included the Consultants in Surgery and Medicine, each holding the rank of Temporary Surgeon Rear Admiral, and accommodated inside the hospital.

The pre-war female nursing staff consisted of 21 members of Queen Alexandra's Royal Naval Nursing Service, including the Matron-in-Chief of the Navy, who, at that time, was accommodated in the establishment. By the end of September 1939 the number had increased to 52, and by November 1944 the peak figure of 110 nursing sisters was reached, including a Principal Matron and Matron. This section of the nursing staff was augmented by male sick berth staff and V.A.D. nursing members. From an original total of 27 in 1939, the latter increased to a peak of 700 in 1943 under a V.A.D. commandant.

The original increases here recorded were those which had been expected during the phase of preparation before September 1939. This fact was of some importance, as these were the figures on which the provision of extra accommodation had been based. But, within a few hours of the outbreak of war, reserve medical officers and nursing

staff began to arrive, unheralded, and many without uniform, for whom accommodation had not been allowed and in some cases could not be provided. In a few days the hospital found itself some 80 medical officers above complement, and the figures of the nursing staff were little better. Most of the newcomers had no experience at all of the Service, and it seemed that they must be accommodated, equipped and trained. In some cases newly joined medical officers had abandoned their civil practices, shut up their homes, and had brought their families with them. Such enthusiasm was laudable, but could not fail to add to the temporary confusion which was bound to result in a large establishment, no matter how apt the authorities proved themselves to be in exercising the Navy's gift for improvisation. This period continued for about three weeks, by the end of which the situation had been resolved into something approaching good order. The families of permanent medical officers resident inside the hospital were evacuated, and their residences converted into dormitory accommodation for medical officers and nursing staff. Certain unused hospital wards were likewise employed.

It had not been expected that the training of medical officers in time of war would remain a commitment of R.N. Hospital, Haslar, and the professors had been appointed elsewhere. But within a few days training was recommenced, and proceeded with continuity under the direction of a single medical officer assisted by other members of the permanent staff of the hospital. This training continued for the first six months of the war, after which it became a commitment of each Royal Naval Barracks.

The problem of accommodation was further aided by taking over a large private residence in Alverstoke, a short distance from the hospital, in which V.A.Ds. were housed on the outbreak of war. Two other houses were also commandeered in Alverstoke in August 1944, in which were housed sixty-one V.A.Ds.

Not only did the increased staff affect the question of accommodation, but it necessitated an expansion of the Cash Office and Supply Department in order to deal with the extra commitments involved.

A survey of the clinical work of the hospital during the war must of necessity be limited, as, in accordance with the general policy, the establishment had to perform the function of a clearing station for long periods, rather than that of a busy therapeutic centre. Its early commitments were to hold beds ready to receive surgical emergencies from the port, and casualties from operations in the English Channel and enemy air raids in the vicinity. All other cases were evacuated to other Service or E.M.S. hospitals. By June 1944 surgery predominated, and, apart from a small number of zymotic beds and out-patient consultations, the purely medical section of the hospital had almost ceased to exist. As the trend of war changed from the defensive to

offensive the hospital slowly returned to normality, fewer cases were evacuated, and, by January 1945, the surgical section had been reduced, and seventeen medical wards were occupied. In the closing stages of the war a greater demand was made on the medical than the surgical section, accommodation being required not only for personnel of the Portsmouth Command, but for large numbers of naval medical casualties invalided from the Eastern Theatre.

In January 1944, a Blood Transfusion Unit was established in the hospital. It consisted of the following personnel:

Blood Bank Officer (Medical Officer-in-Charge of laboratory).
Three additional medical officers.
One transfusion nursing sister.
One laboratory assistant.
Eight V.A.D. members.
One specially trained sick berth rating.

The blood bank officer was responsible for maintaining an adequate supply of transfusion fluids and apparatus, while the three additional medical officers would assist on occasions when blood was collected, or form other transfusion teams if warranted by an emergency. The laboratory assistant's principal duties were blood-grouping and serological testing of donors.

A by no means subsidiary function of the hospital throughout the war was the supply of medical stores and equipment to service afloat. The Medical Stores Department began the war with the disadvantage of restricted peace-time stocks, totally inadequate to meet the expected avalanche of demands. Revolutionary changes were therefore clearly indicated, to supplement this meagre reserve.

In the early part of 1938, stocks of medical passive defence materials had to be built up, as the establishment was responsible for supplying the whole of the Portsmouth Command. Three kinds of first-aid units were prepared:

A medical mobile unit which could be sent at a moment's notice to wherever the need for medical attention was most urgent.
Equipment for main static A.R.P. stations.
Equipment for first-aid posts staffed only by sick berth attendants.

A scale of medical stores was compiled for each station, and eventually 36 major and 144 minor units were assembled and distributed throughout the port before the outbreak of war. During the period September 1939 to the end of 1941, 239 complete major units, 2,720 complete minor units and 6,570 supplementary replenishments were distributed.

The staff of pharmacists and storekeepers was always very limited, and sick berth reservists had to be employed in the stores, with the result that when the majority of key men were appointed elsewhere, a pitifully small staff had to bear the brunt until sufficient staff could be trained.

The Superintending Pharmacist, in addition to holding the position of Medical Store Officer, was also the Central Store Officer and responsible for every article necessary to equip and maintain a large hospital, a task further complicated by the newly created depots and auxiliary naval hospitals served by Haslar.

Towards the end of 1939, many inquiries were received concerning medical stores available to the numerous small craft coming into commission. There was in fact no suitable medical chest, but two chests were devised. Samples sent to the Medical Director-General were promptly approved, and soon became widely popular, and within eight months 1,000 were issued, this figure increasing to 7,000 at the end of 1941. Eventually, they were included in the official scale of medicines for H.M. Ships.

With the fall of France, Poland, Holland, Belgium and Norway, and the subsequent arrival of the naval vessels of these countries, it devolved upon this department to supply their medical requirements, a far from easy matter when languages differed.

The first large demand received in December 1939—destination 'West Africa'—consisted of:

8 complete double No. 1 sets of medical stores.
14 complete No. 3 sets of medical stores and hundreds of additional articles.

The demand was successfully accomplished within the 21 days specified.

Next came the equipping of Expeditionary Forces to Iceland, and to Narvik and other Norwegian ports. Very comprehensive lists were given, just a few of the items being:

Portable X-ray room including dark room and developing room.
Operating theatre.
Field laboratory.
Beds, bedding and usual equipment.
Cooking stoves, butchers' outfits, etc.
Marquees, tents and poles.
Tables, chairs, etc.
Complete medical outfit of drugs and dressings, etc.

'Operation Primrose' Mobile Naval Base Defence Organisation (M.N.B.D.O.) was another large-scale venture taking a long time, for over 100,000 items had to be invoiced.

The evacuation of the British Expeditionary Force from France in 1940, threw considerable strain on the department, as it was deputed to produce immediately medical requisites for all the small craft hastily gathered along the coast.

During 1940 several minor aerial attacks had taken place which caused anxiety about the safety of stores that were dangerously concentrated. Great difficulty was experienced in finding suitable storeroom, but provisionally, the open spaces in the colonnades under the wards were utilised.

On March 10, 1941, four of the equipment stores were set on fire by incendiary bombs. Unfortunately the fires got beyond control, and everything in the stores was burnt, at a cost of £6,000.

After this loss, strong representations were made to procure additional storerooms for housing other valuable medical goods. The Admiralty quickly agreed to the suggested erection of four double size Nissen huts, but before delivery, another heavy air attack was experienced on April 27, 1941, resulting in the destruction by fire of the new large medical store. Again everything was reduced to ashes, amounting to a loss of £80,000.

This was a most serious disaster, as all that remained was one assembly store, one reception and one despatch store. No help was forthcoming from other naval medical store depots as they had been similarly subjected to enemy action. Altogether 80 per cent. of the Supply Services' effectives were gone and consequently the whole organisation had to be rebuilt.

Towards the end of 1941 the department had grown considerably, and it was estimated that approximately 500 large warships, several hundreds of small craft and 36 establishments, auxiliary hospitals and camps were supplied by Haslar with medical stores and equipment.

The peak period in supplies came in 1944, with the year's issues reaching nearly 10,000 in number. In the midsummer quarter, which included D-day, the issues numbered 3,495, representing twelve times a normal peace-time rate.

Two large casualty reception stations were fitted out early in the war. They were situated one on each side of the hospital, on the ground floor, each formed by the bricking-in of the arches of a colonnade, and both in close proximity to the corresponding underground theatres. They were steam-heated, maintained at a temperature of 80° F., and were kept fully equipped. Each reception station was large enough to hold at least forty stretcher cases besides a similar number of sitting cases at one time. Sanitary annexes, pantries, and complete equipment for dressings were installed. One station was always in a state of readiness with a small skeleton nursing staff.

Frequent batches of casualties were received from local air raids, varying from a few to as many as 80 on one occasion. In August 1942, 286 casualties were received from the Dieppe landing.

In the early spring of 1944 the first information was received regarding naval medical arrangements in connexion with forthcoming operations in the West. An understanding had previously been reached with the Army Authorities that Haslar would reserve 500 surgical beds for military personnel so seriously wounded that they could not be transferred further inland, and it was believed that the first casualties might be expected to arrive about twenty-four hours after the expedition started. A week or so before it was thought the attack would occur, all

possible patients were evacuated to the North of Scotland, thereafter only emergencies being admitted. Acting on the assumption that continuous batches of casualties would be landed from L.S.Ts., and the operation would be a protracted one, a system of watches for the staff had to be evolved. The solution was that only one casualty reception station should function, staffed with two watches of twelve hours each. Eight operation teams would be provided, each consisting of a surgeon, an anaesthetist and a theatre sister.

Similar arrangements were subsequently made with the U.S. and Canadian medical authorities whereby serious cases were admitted to Haslar and evacuated to their own organisation as soon as they were well enough to leave.

With previous casualty receptions the note-taking and supervision of wards had been the difficulty, as all the surgical staff tended to gravitate to the operating theatres, and any of the medical staff were liable to return to their own department as soon as the admissions were over. It was therefore decided that each pair of medical officers in an operating team should be in the theatre for 8 hours, and in the two wards allotted to them for another 8 hours, making a total of 16 hours on duty out of 24. In order to get the maximum supervision in the wards, their hours of duty were staggered.

By this method of employing eight teams it was only possible to provide for the use of three tables for 16 hours, and two for the remaining 8 hours out of 24. In addition to the two main operating theatres underground, the old hospital theatre was used for cases of burns, which were treated in an adjacent ward, specially equipped, under the charge of two experienced sisters.

Before long two resuscitation wards were prepared. They were situated on the ground floor, one in each half of the hospital, and adjacent to the corresponding operating theatre and reception station. Manning by the four members of the resuscitation unit allowed each ward one medical officer in twelve-hour watches. Arrangements were also made for each resuscitation ward to have the necessary laboratory staff and equipment to carry out any investigations required. Oxygen was laid on to each bed, enough nurses were employed for allotting one to every two patients, and, in addition, it was arranged to have a portable X-ray machine in each ward to carry out all urgent X-ray examinations at the time of admission. One obstacle emerging from the provision of eight operating teams was that of obtaining eight skilled anaesthetists, but this was overcome by those who were available training other medical officers. A basic staff of 38 medical officers was required for the unit, but unfortunately adjustments became necessary as the staff of medical officers fluctuated.

At this time, supplies of penicillin were very limited and available only to the Forces. Haslar was the place where the naval supply was

then being stored, and it was strictly limited to scientifically controlled use.

The first Normandy casualties actually arrived early on the morning of June 7, 1944, thereafter very severe casualties arriving in batches at fairly steady intervals for 72 hours. An eight-hourly bed-state was reported to the A.D.M.S. (Evacuation) who arranged the necessary transport for transferring patients.

The use of the hospital in connexion with the Normandy landing ceased at the end of August 1944, after a period of almost three months, and the total number of casualties received in that period was 1,347.*

W.R.N.S. personnel needing hospital treatment in the Portsmouth area, in general, were accommodated in local E.M.S. hospitals. Out-patient facilities only were offered at Haslar, though during periods of enemy air activity a small number of W.R.N.S. casualties was admitted as emergency in-patients. In December 1944 the policy was reviewed, and on January 1, 1945, W.R.N.S. patients were admitted to the hospital as a routine procedure, 20 medical and 20 surgical beds being set aside for their reception.

Passive Defence in the hospital was organised on standard methods with local modifications. Besides the usual means of warning by siren, a Group Control Headquarters was established in a section of the cellars for the purpose of receiving messages direct from Portsmouth Command. There also an internal loudspeaker system could be operated and further instructions could be relayed to all parts of the hospital in that way. Strict blackout regulations were observed and a general drill carried out at a prescribed hour ensured that all lighting was obscured. The water tower, which commanded a view of the whole hospital, was used as an elevated observation post.

The cellars running under the main buildings afforded excellent air-raid shelter for all patients in the hospital. They were equipped with bunks and with electric table fans to keep the air in circulation. The larger compartments forming the end cellars were converted into capacious operating theatres and were situated conveniently near the main lifts. Thus two underground theatres fitted with an air conditioning plant and a gas filtration unit were made available, and each had a large annexe attached for resuscitation.

The ground floor wards throughout the establishment were rendered blast proof and splinter proof on the exposed sides by the erection of buttressed and traversed brick walls and revetments 10 ft. long, 14 in. thick, placed 5 ft. clear of the building. The inner sides facing the areas were reinforced by sandbagging the lower halves of all windows, and anti-shatter materials were used to prevent injury through flying

* These casualties were merely a fraction of the 17,556 Normandy casualties received and distributed by the port organisation directed by the P.M.O., R.N. Barracks, Portsmouth. A full account of this organisation is given in Chapter 5 of the Operational Volume.

glass. Unimportant windows that could remain permanently blacked out were covered with opaque boarding, those necessary for lighting being pasted over with prepared muslin and fitted with framed wire mesh guards. Internal glass partitions were similarly treated, or as convenient, replaced by Essex board or asbestos.

In the event of air activity, wards on the upper floors were considered unsafe, entailing evacuation of patients to the basement whenever enemy attack was signalled as imminent. When continuous and intensive nightly air raids were occurring, patients were regularly evacuated to the cellars at 2030 hours and remained under cover until 0630 hours; other patients in outlying pavilions, where there were no cellars, were moved as necessary to trench shelters in the grounds.

Fortunately the victualling store was situated in a fairly protected part of an inner limb of the main building, and the only precaution thought necessary was in strengthening the windows with anti-shatter material and wire mesh. Food was safeguarded by dispersing selected articles to emergency dumps sealed in certain parts of the cellars, and galleys and ward kitchens were permitted to keep limited stocks in reserve. Only conservative demands, sufficient for the working purposes of the hospital, were made upon the victualling yard. Special care was taken to indent, as far as possible, for preserves and canned goods in sealed metal containers of convenient size.

Damage to water mains had also to be reckoned with and safety measures applied. Owing to the poor pressure in the Gosport Mains, the water supply to the hospital had to be raised by booster pump to 62,000-gallon gravity tanks in the tower. A well supplied the laundry, and if necessary its yield could be diverted through a chlorinating plant for drinking purposes. In the later war years a new artesian well was sunk, which was capable of producing enough pure water to give the establishment an independent supply. A roofed-in emergency drinking water dam (25,000 gallons) was built in the basement of the large instrument store, demolished by bombs in 1941.

The systems employed in the hospital for sterilising instruments were:

General steam system, to which an air-conditioning plant was connected.

Electricity.

Primus and spirit stoves.

For lighting, auxiliary Diesel dynamos were employed.

In the event of steam failure, the steam bowl and instrument sterilisers were so constructed at a special height from the deck to allow Primus stoves to be placed under them. If the main circuit failed, two automatic auxiliary dynamos on the same wiring came into operation in two or three seconds, and these operated the theatre lights, the two operating theatre lifts and the emergency wards.

There was also an emergency 'Keepalite' battery set outside the theatres. This circuit, however, only produced a very dim light and was not sufficient for operating. If all other means of lighting failed, accumulators and dry batteries were kept in the theatres for use with portable headlamps.

Heavy air raids occurred frequently in 1940 and 1941, but apart from complete destruction of the hospital museum and library, involving no loss of life, and damage to some of the residences, the actual hospital received only minor damage. The surgical officers' block was put out of action, but alternative accommodation for surgical officer patients was constructed in the main surgical building.

After 1941, no major incident fraught with any damage to life or property occurred in the Haslar area; nevertheless, air raid warnings were heard many times, and large-scale evacuation to cellars and refuges was a frequent evolution.

After the introduction of the flying bomb, there were frequent alarms of attack with these weapons. Some broken windows and other minor damage to buildings resulted when a few fell into the sea nearby.

One of the lessons learned from air raid experience, was that of foresight and determination in making preparations to keep abreast of current developments, by digesting the latest expert opinions and authoritative teaching. While the adaption of the cellars for protected refuges was a striking success, to start with the establishment was deficient as regards fire-fighting staff and appliances. Quick action by those in charge of supplies, and works proposals to approve and fulfil reasonable demands avoided many mishaps after the earlier experiences.

In the later years there was a highly trained resident 'fire party' consisting of stokers and seamen under the charge of an executive officer. These expert fire fighters were in constant touch with those of the neighbouring establishments and with the National Fire Service, so that mutual assistance could be rendered where necessary.

Arrangements were made with the local authorities, under the 'Mutual Aid Scheme', to render every assistance to other hospitals in the area. Operating theatre equipment was prepared for use in certain circumstances by Alverstoke E.M.S. Hospital, and it was undertaken that this equipment, accompanied by an operating theatre assistant, would be delivered within one hour.

From 1939 until January 1945, a form of diversional therapy was available for surgical patients only, undertaken on behalf of the British Red Cross Society by the Commandant of the Gosport Detachment. In 1945 this form of treatment was extended to medical patients.

In peace-time, every effort had been made to provide recreation and amenities on a large scale, both for the staff and patients of R.N. Hospital, Haslar. A large sports ground was available in the vicinity, and inside the hospital grounds were recreation rooms, tennis courts,

and a large hall suitable for stage and cinema entertainments and dances. The hospital had its own post office, and separate canteens for patients and staff. In the early years of the war it was only natural that such matters fell into abeyance to a great extent, but in the later years, as the hospital returned to its normal functions, recreation facilities were revived and augmented by the educational and vocational training measures instituted throughout the Service.

The Instructional Section was maintained at R.N. Hospital, Haslar, during the whole war period. The greatest number of probationary sick berth attendants trained in any one year was 827 in 1941, and the total number trained during the war was 3,248.

ROYAL NAVAL HOSPITAL, PLYMOUTH

The Royal Naval Hospital, Plymouth, was built in 1758, since when it has provided general hospital facilities for naval personnel serving in His Majesty's Ships afloat and Shore Establishments in the area directed by the Commander-in-Chief, Plymouth. Though expanded and modernised to some degree since its original completion, the site of the hospital has remained unchanged, so that a building, once reasonably isolated, in the course of years had become involved in local development, and, in 1939, the hospital formed part of the densely populated area of Stonehouse, between Plymouth and Devonport.

By virtue of its position in a major naval port its vulnerability in a European war was obvious, nevertheless, it was rightly expected that it would remain tenable at the outset and need not be reduced to the category of a casualty clearing station for at least some months. In placing the hospital on a war footing this policy was adopted, but this does not mean that precautions for its defence were neglected, or that provision was not made for its relief in time of stress. It will be seen that in both respects ample foresight was displayed, with the result that, when the time arrived, the Royal Naval Hospital, Plymouth, proved capable of adapting itself to circumstances of hardship which can never have been inflicted to such an extent before on a medical establishment in time of war.

The medical staff of the hospital during the war years consisted of twenty-four medical officers, one dental officer, and seven warrant wardmasters under the command of a Surgeon Rear Admiral. The number of medical officers varied but slightly from year to year, and, on the whole, it may be said that the hospital was comfortably manned in this respect, and although each medical officer was fully employed, none was overworked to the extent that any patient suffered from lack of medical attention.

The war complement of female nursing staff consisted of thirty-two nursing sisters, at first under a Matron, and later a Principal Matron

and Matron. In addition, 102 V.A.Ds. were employed under a V.A.D. commandant. This number of nursing sisters was at times augmented when the hospital fulfilled the function of a drafting centre, from which nursing staff was sent to other medical establishments at home and oversea. In the same way the nominal complement of V.A.D. members was augmented from 1943 onwards, when the hospital became a training and drafting depot for V.A.D. nursing members. Under this system V.A.Ds. received three months training under an instructional sister, and additional practical instruction in ward duties. A certain number also received special training as assistants in the laboratory, operating rooms, X-ray and dental departments.

The war complement of sick berth staff was 334, to which may be added probationary staff under training at certain periods. Despite the nominal figure given, it would be more accurate to say that during the war years the hospital suffered considerably from alternate periods of overstaffing and understaffing, due mostly to man-power requirements and repeated short-term operational demands for sick berth staff for brief periods.

On the outbreak of war it was found necessary to make certain increases in the civilian administrative and labouring staff in order to put the hospital on a war footing. Gaps also had to be filled which were brought about by the call-up of those of the civilian staff who were reservists.

The immediate increases were in the clerical staff, and two W.R.N.S. typists and one V.A.D. clerk were employed for the Secretary's office, and the office of the supply department.

A further temporary clerk was added later to deal with the work in connexion with food rationing.

As regards labourers, domestics and kitchen staffs, the numbers were elastic, increases and reductions being made from time to time when the situation demanded. Where possible, members of the W.R.N.S. were employed in the following capacities:

3 telephone operators.
2 typists.
2 clerks.
5 cooks.
3 stewards.

The latter were employed for officer patients and V.A.Ds.' quarters. Later in the war it was necessary to employ W.R.N.S. in a domestic capacity in the medical officers' mess and sisters' quarters, in order to replace civilian domestics conscripted for National Service.

As the war progressed, it became increasingly difficult to obtain civilian labour, the average age of labourers being well over 60 years. To meet this difficulty, an appeal was made to the local Executive Authority with the result that a permanent working party of twenty

seamen was lent to the hospital from the Royal Naval Barracks, Devonport, for general duties.

Later shortages arising in the various administrative offices of the hospital were met by employing a number of V.A.D. clerks.

The peace-time accommodation of medical and nursing personnel in the hospital itself left little room for expansion to meet the needs of the increased complement in time of war. As an immediate measure, extra accommodation for six medical officers was provided by constructing partitioned cabins over the X-ray department. Later the residence of the medical specialist was taken over as an annexe to the medical officers' mess.

Early in 1939 arrangements were made to take over, in the event of emergency, the Cornwall Female Orphanage in Plymouth. This building was capable of accommodating 46 persons. It was eventually taken over on September 9, 1939, and was occupied by 15 reserve nursing sisters and 28 V.A.Ds. But on March 21, 1941, the building was completely destroyed by fire during an air raid, and alternative accommodation for the extra nursing staff was found in a vacant hospital ward. This arrangement continued until August, 1941, when V.A.Ds. were transferred to a private house in Plymouth. At the same time the extra reserve sisters were transferred to the chaplain's residence, inside the hospital itself.

Later in the war two extra houses in Plymouth were requisitioned for the accommodation of V.A.Ds., making three private houses in all, and a small flat was also furnished locally to accommodate four V.A.Ds. This arrangement was never wholly satisfactory, because it meant that a large number of V.A.Ds. lived two miles away from the hospital. This necessitated special transport arrangement at the start and end of each day, and also at meal times, with a consequent loss of time during which these nurses were available for duty in the hospital. Towards the end of the war all V.A.Ds. were accommodated in a private house about one mile from the hospital, but although some time was saved, the fact that such a large proportion of the female nursing staff was accommodated outside the hospital was always a disadvantage.

As regards sick berth staff, the excellent permanent quarters established inside the hospital in peace-time fully justified their existence during the war, and their amenities were of great importance in maintaining morale. The quarters were expanded by the use of double-decker beds, but at no time was it necessary to resort to overcrowding. Large numbers of probationers under training at various periods were accommodated in the upper wards of the hospital. Here there was occasional overcrowding, and eventually a single block of the hospital was taken over entirely for the accommodation of probationers.

In peace-time the R.N. Hospital provided accommodation for 350 patients. On the outbreak of war the bed strength was increased to

728. This standard of accommodation was maintained until 1941, by which time the experience of severe air raids showed the necessity to reduce the hospital, for the time being, to the status of a casualty clearing station. The maximum accommodation for patients was now fixed at 150, this figure being dictated by the number of buildings remaining in which patients could be afforded adequate protection. Early in 1943 a proportion of protected accommodation became available in second floor wards, and the bed strength was increased to between 250 and 300. This level was maintained by the regular evacuation of patients to the auxiliary hospitals at Maristoe, Newton Abbot and Barrow Gurney.

In the autumn of 1944 the likelihood of enemy air activity decreased, and it was possible gradually to increase the number of patients accommodated. At the beginning of 1945 the hospital resumed its function as a Base hospital, though on a somewhat reduced scale owing to the loss of two complete blocks by air raid damage.

The total number of patients admitted to R.N. Hospital, Plymouth, during the war was:

1939	1,490
1940	9,473
1941	8,164
1942	9,120
1943	11,205
1944	10,825
1945	10,005
	60,282

With the growth of the local naval population, in addition to in-patients, the call for out-patient consultations rose enormously as the war progressed, and during the whole war period an average of 30,000 out-patients attended the hospital each year. The surgical work of the hospital fluctuated throughout the war in proportion to the severity of enemy air activity against the port, and during the period of reduction to a clearing station, was confined to emergency procedures.

The first months of war did not result in much air activity or in naval actions in the vicinity of the port or in the Western Approaches to the Channel. The hospital did, however, hold itself in readiness for the landing of casualties from ships involved in action, and it was expected that these would arrive after some hours' warning, permitting of the preparation of wards and the massing of equipment and personnel. Such an organisation required only an expansion of pre-existing arrangements for dealing with the routine accidents of dockyard and port.

A change occurred in June 1940. Dunkirk had its repercussions in Plymouth as elsewhere. The Sound became full of ships returning

from France, and the occupation of the Northern and Western Coasts of Europe laid the South-west of England open to air attack which might at any time attain alarming proportions. Invasion, too, was a possibility to be reckoned with, and the activities of both surface and submarine craft were inevitably brought closer.

It was obvious that Plymouth must prepare for emergencies of all kinds and that these could be expected as follows:

Reception of casualties from ships using Plymouth as a base where wounded might be landed.

Reception of air raid casualties.

Reception of casualties arising from actions in repelling an invading force.

A casualty reception centre was therefore evolved in which provision was made for resuscitation and preliminary examinations, and included an operating theatres unit which accommodated four tables comfortably in two theatres connected by a plaster room. Casualty reception exercises were performed frequently, and had a valuable place in training until such time as the unit was tested by practical use.

The major incidents affecting the hospital were:

June 18, 1940.

110 casualties from S.S. *Lancastria*, bombed and sunk off St. Nazaire.

November 29, 1940.

8 casualties from H.M.S. *Javelin* following an action with enemy destroyers.

March 20 to 22, 1941.

68 casualties following air attacks on Plymouth.

April 22 *to* 24, 1941 *and April* 28 *and* 29, 1941.

226 casualties following enemy air attacks on Plymouth, the maximum number of casualties admitted at one time being 78.

March 29, 1942.

31 casualties following the attack at St. Nazaire.

October 1943.

82 casualties following the loss of H.M.S. *Charybdis* and H.M.S. *Limbourne* in an action with enemy E-boats.

September 20, 1944.

24 German casualties from the Hospital Ship *Rostock*.

As regards special departments of the hospital, it is of interest to record that early in 1943 an orthoptic department was added to the ophthalmic department of the hospital, and was staffed by two qualified W.R.N.S. officers from the ophthalmic department of the Gunnery School in H.M.S. *Excellent*. At the same time the work of the ophthalmic department itself was greatly aided by the appointment of a qualified optical dispenser, who served as sick berth petty officer.

The purely medical work of the hospital, as opposed to surgical, showed little of outstanding interest during the whole period of the war, the majority of long term cases being evacuated to other hospitals.

The initial passive defence measures of the hospital were on the general lines for all such establishments on the outbreak of war, though with certain modifications on the assumption that the port would not be subjected to air attack in the early stages. To start with, no special shelters were constructed. The ground floor windows of all the main hospital blocks were protected by steel sheets ten inches apart, filled in with sandbags or loose sand. Similar protection was afforded the operating theatre and administrative offices.

In course of time, as the sandbags weathered, these were reinforced by an outer covering of brick and concrete. Eventually, the experience of heavy air attacks proved the advisability of providing further protection to ground floor wards, and the need for an improved secondary lighting system. It was also necessary to brick in all the glass of the operating theatres, and in the main theatre an inner concrete roof was constructed underneath the original glass roof. All roof glass in the laundry, kitchens and working spaces was reinforced with wire netting where still intact, and where damaged, was replaced by rubberoid roofing. A limited number of surface shelters was also constructed.

The passive defence scheme included fire fighting and anti-gas measures. Early in 1943 the fire fighting force was increased, and a Royal Marine officer was added to the hospital complement as a passive defence and firefighting officer. The creation of this separate force was a great relief to the medical staff of the hospital, who had previously been burdened with passive defence duties in addition to their normal functions in the hospital.

The commitments of the service afloat medical store and dispensary were very heavy during the whole war period. The difficulty in obtaining sufficient labouring staff resulted in much extra manual work being borne by the pharmaceutical staff. The staff itself suffered constant changes, and the volume of dispensing was enormously increased. The cumulative effect of these difficulties was that, for some months, great difficulty was experienced in dealing promptly with demands for medical stores from H.M. Ships and Establishments. Further impediments were caused by air raid damage in 1941, after which medical stores were distributed at various points in the hospital. Warehouses were also requisitioned at a distance from the hospital itself for the storage of medical equipment.

On the whole the essential services of the hospital were adequately maintained throughout the war, though at times strained almost to breaking point.

The victualling of patients and staff became progressively difficult, not only owing to periodic shortage of supplies, but owing to the additional clerical work with which the victualling department was burdened. Nevertheless, it was always possible to provide an adequate

dietary for patients. Cooking facilities were badly interrupted in 1941 by the disruption of gas mains by air raids, but the provision of mobile kitchens and the use of a single oil fuelled galley met the situation without any great difficulty.

The hospital laundry survived the war undamaged, but was embarrassed by shortage of mechanical staff which was eventually solved by the employment of engine room ratings lent by the Royal Naval Barracks.

A constant problem under the heading of essential services was that of the handling of mails of patients and staff. Considering the enormous volume of correspondence, both official and private, which passed through the hospital, the number of complaints regarding non-delivery was surprisingly small.

The transport section of the hospital was considerably enlarged at the outbreak of war and during its course. Three additional 'bus ambulances were added to the medical transport of the Port which was directed from R.N. Hospital. The total number of vehicles available in the Port was as follows:

	Four Stretchers	*Ten Stretchers*	*Total Capacity*
North Yard	4	1	26
South Yard	2		8
R.N. Barracks	3		12
R.M. Barracks	1	1	14
R.N. Hospital	4		16
Bull Point	1		4
Impregnable	1		4
Raleigh	2	1	18
		Total	102

Before D-day the Superintending Naval Store Officer had available within the Port an additional ten ambulances of the four stretcher type, with drivers. These were held in the North Yard and Morice Yard and raised the total ambulance capacity to 142 stretcher cases. Working parties of probationary sick berth attendants were utilised throughout the war as stretcher bearers for cases coming into hospital and for those transferred to other hospitals.

The addition of a rail coach ambulance for the transfer of small numbers of cot and non-cot cases to other R.N. auxiliary hospitals, was a convenience available from 1942. This coach was a converted G.W.R. dining car which provided accommodation for eight cot and twelve non-cot cases, and their baggage. The kitchen was retained and used for serving meals to patients en route. A sanitary annexe was fitted. It was under the control of the medical transport officer at Bristol, and was used regularly each week for transport of patients to Newton Abbot and Barrow Gurney, and occasionally for transfers to Sherborne. Its use effected a considerable saving in petrol during a period when petrol supplies were short.

Air transport was used very little as the local aerodrome was situated just below the cloud belt, and no reliance could be placed on it being available when it was required.

The department functioned smoothly without any untoward incident. The naval type Morris ambulance again proved its usefulness and was undoubtedly the most comfortable type of ambulance, particularly for long journeys. A staff car (10-h.p. Austin) was added to the transport equipment early in 1944 as it became desirable to have adequate transport for the Surgeon Rear Admiral and other officers, in connexion with the preparations for the assault on Normandy as they affected this Port.

During the war years enemy air activity in the vicinity of Plymouth occurred on 602 occasions between June 30, 1940, and April 24, 1944. As regards the Royal Naval Hospital the main disadvantages revealed were:

Inadequate communications, telephone lines being few and vulnerable.

The need for a planned passive defence headquarters underground, with a sound reproduction equipment.

The difficulty of extracting from medical personnel the teams necessary for passive defence in addition to their normal duties.

Above all, the very unsuitable situation of the hospital in a congested neighbourhood, with a poor approach and only one entrance suitable for the passage of large vehicles.

During the first quarter of 1941 air attacks on Plymouth were frequent, and were particularly serious on March 20 and 21. Ten high explosive bombs fell inside the hospital, and many incendiary bombs. Material damage was sustained in the mental block, officers' block, medical officers' mess and chaplain's residence. Casualties were few considering the extent of the damage. Considerable damage to the water supplies in the vicinity was caused.

On April 22, 23, 24, 29 and 30 and May 6, heavy air attacks again occurred. Many high explosive and incendiary bombs fell inside the hospital causing much material damage. Casualties among staff and patients were two killed and two injured. One ward block and the plaster room were destroyed, and serious damage was caused to the victualling store, dispensary store, ambulance garage and residential quarters. The water supply to the hospital was again seriously affected, and on April 22, the telephone system of the hospital broke down as a result of two bombs which fell in the vicinity of the telephone exchange. This breakdown occurred early in the raid, and the hospital was therefore without means of communication for a period of four hours, during which time many large fires were burning. At the same time, the hospital passive defence organisation was called upon to deal with damage and fires sustained in civilian buildings in the surrounding area.

It is recorded that the medical and nursing staffs were all subjected to severe prolonged strain around this time, but that they withstood

their ordeal in a most satisfactory manner, and that much further material damage to the hospital was prevented by personal initiative and effort.

As a result of experience gained in the 1941 raids, when the fire hydrants frequently failed to supply sufficient water owing to heavy demands on them throughout the city, and when at the time the water was required it happened that the tide in Stonehouse Creek was low and it was impossible to obtain water therefrom, the following steps were taken to provide more water for ready use in emergency in the hospital and the vicinity:

Two 500 gallon tanks were erected in the hospital, one facing the centre gateway, and the other between 'D' block and officer patients' block.

The tanks at the top of the water-tower, which had not been used for over 20 years, were repaired for use and filled with water. These tanks contained 9,000 gallons.

In order to provide water for fire-fighting in civilian areas in the vicinity of the hospital, the civil fire authorities were given permission to make an entrance gate in the southern wall of the hospital, and to build a large tank on the open ground between the staff football ground and tennis courts. This tank contained 283,000 gallons, and could be utilised by the hospital if required.

Before and during the heavy raids of March to May 1941, it was only possible to use the water in Stonehouse Creek between half and full tides. The civil authorities built a dam at the Stonehouse Jetty, and water could be obtained from the creek at the hospital jetty at any state of the tide. This work was completed in December 1941.

On two occasions the whole gas supply to the City of Plymouth was cut off. On the first occasion on January 13, 1941, the Plymouth gas works were severely damaged, and due to subsequent breakdowns, no gas was available from this source for some months. This situation was dealt with in the hospital in the following manner:

By employing the sick berth staff quarters oil fuel galley for all patients' cooking which had normally been done on the gas cookers in the main kitchen.

By installing portable coal-burning cooking stoves, of Army pattern, in the following places:

Officer patients' kitchen.
Medical officers' mess.

These were installed within twenty-four hours of the dislocation of gas supplies.

The nursing sisters' quarters utilised primus lamps and oil stoves.

Owing to the length of time for which it was expected that the gas supply would remain cut off, it was decided to connect up to the Devonport supply, which passes within 200 yards of the hospital wall, and was not then (January 1941) affected. An above-ground supply pipe was connected up to this supply, and run through

the hospital just inside the eastern boundary wall. This work was completed, and full gas services restored to the hospital by the first week in April.

On April 28, the Devonport gas supply was cut off, and remained off for a period of four weeks, but the above arrangements for cooking without gas were brought into operation, and worked satisfactorily.

The main supply of electricity for both lighting and power was furnished from the local Corporation.

In addition to this, there were the following alternative means of supply:

Supply from the dockyard generating plant.

A Diesel generating plant, which had been installed in the hospital, and was completed in March 1941. This machine came into force automatically immediately there was a breakdown in the main supply to the hospital. It did not supply power and light to all parts of the hospital, but only to essential services, such as operating theatres, casualty wards, etc.

Operating theatres were also provided with independent battery lighting.

All wards and offices, etc., were provided with electric torches, and with one electric lantern (miners' type), as well as candle lamps, for use in emergency.

On February 13, 1943, two H.E. bombs were dropped inside the hospital at 2145 hours by a small force of enemy aircraft. This was the first raid for about eighteen months. The bombs were of 500-kilo calibre, designed to produce maximum blast effect. Eight members of the sick berth staff were injured, but none seriously. Damage to the hospital was considerable, however. Practically all the windows and doors in the hospital blocks and living quarters were blown out. All ceilings and roofs were shattered. The huts for treating tuberculous patients were demolished.

The effect was that the medical and surgical work of the hospital was seriously hampered for a period of five days, and all patients were evacuated to auxiliary hospitals at once. Immediate repairs were undertaken, and continued by day and night, with the result that normal admissions of patients were resumed on February 18.

Shortly after midnight on June 14, 1943, several bombs were dropped immediately outside the hospital. There was no damage to the hospital itself, but the outside quarters of V.A.Ds. was partially destroyed.

Early in the morning of November 16, 1943, some flares fell in the hospital grounds, and V.A.D. outside quarters were again badly damaged.

The instructional section was maintained at R.N. Hospital during the whole war period, and presented a constant problem, particularly as regards accommodation. The greatest number of probationary sick berth attendants under training at any one time was 357, and the total number trained during the war was 3,389.

Arrangements were made with the medical superintendents of the local civilian hospitals for assistance to be rendered to them by surgical teams from R.N. Hospital when necessary. The mobile surgical unit was kept manned and in readiness for despatch to any area requiring assistance for casualties due to enemy action. Provision was made for the supply from hospital stores of blankets, stretchers and other equipment. From time to time assistance was rendered to the local civil hospitals by providing a medical officer to act as a relief on sickness, etc. Medical officers also assisted private practitioners during a mild influenzal epidemic in the winter of 1944–5.

In the event of casualties to civilians during air raids, or other action occurring near the hospital, directions were given for the civilians to be admitted to R.N. Hospital. Many cases were admitted in this way.

Relief of beds by transfer to E.M.S. Hospitals was rarely resorted to, as the R.N. Auxiliary Hospitals were available. Only immediately before D-day was it necessary to use a special hospital train for the evacuation of patients to other than naval establishments. Cases for specialised treatment were sent to E.M.S. centres only when such facilities were not available at naval hospitals.

In the later stages of the war, the welfare of patients and morale of the staff were increased by the provision of diversionary activities ranging from occupational therapy to educational and vocational training. These activities did much to replace the more active forms of physical sport and recreation which could be continued only with difficulty.

The R.N. Auxiliary Hospital, Maristow, the residence of Lord Roborough, was taken over by the Admiralty in 1942. It was originally intended that it should be used as a neuro-psychiatric centre, but this plan was not pursued when it was discovered that an aerodrome was being prepared within two or three miles of the hospital. When this plan was abandoned, it was decided that the hospital should be used as additional wards for the Royal Naval Hospital. It was used for the treatment of convalescent minor medical and surgical cases transferred from the main hospital. It was especially useful for cases requiring from seven to fourteen days' hospitalisation, whom it was undesirable to retain at Plymouth owing to air attack and whose transfer to other auxiliary hospitals would have entailed unnecessary travelling. Accommodation was available for 100 patients and the staff necessary for the running of the establishment. No patients were admitted direct or discharged direct to their ships, but all passed through R. N. Hospital. All administrative control and records were retained at Plymouth.

Personnel consisted of two medical officers, a warrant or commissioned wardmaster and four nursing sisters, who all used a common mess. The hospital was originally manned by sick berth ratings and six V.A.Ds. but it became desirable in early 1943 to man the hospital entirely by V.A.D. members for nursing duties, and to use it as a

pool for accommodating V.A.Ds. for overseas draft. Members of the W.R.N.S. were used for cooking and domestic work. A small victualling staff was maintained for the issue of provisions, and civilian labourers were employed, when available, for maintenance of grounds. One handyman-electrician-carpenter was retained throughout the whole period under review.

Three large rooms were used as surgical wards and six of the smaller rooms as medical wards. This provided accommodation for one hundred patients without undue overcrowding. Later, when female patients were accommodated in R.N. Hospital, one medical ward of twelve beds was set aside as accommodation for females.

A small physiotherapy department and a small dispensary were maintained. The hospital was dependent upon R.N. Hospital for laboratory and X-ray requirements, and there was no operating theatre.

A telephone with a manual exchange was linked direct with the G.P.O. and dockyard exchanges. This was manned by W.R.N.S. operators and proved adequate for requirements.

Transport of patients from R.N. Hospital was by means of a large, single-decker bus ambulance supplemented by smaller ambulances as requisite.

The water supply to the hospital was from a private reservoir, and was barely sufficient for the needs of a hundred bedded hospital, and at times gave rise to considerable anxiety. In very dry spells it was necessary on more than one occasion to restrict admissions because of this difficulty.

The hospital was provided with its own electric and storage plant, consisting of an oil engine, dynamo and storage batteries. This was an old plant and hardly adequate for the calls made upon it, so that it was necessary early in 1944 to instal a diesel-driven motor engine as an addition.

ROYAL NAVAL HOSPITAL, CHATHAM

The present Royal Naval Hospital, Chatham, was opened in the year 1905. It is situated on high ground in Gillingham, Kent, from where it commands an imposing vista of the Medway Towns and the country-side beyond. The original planning of the establishment aimed at the avoidance of isolated buildings spread over a large area, a feature which had, in the course of years, become identified with naval hospitals. Instead, a single building was planned in which all the necessary special departments could function with easy access to nearby wards. The basis of construction was therefore a main hospital building built around and over a wide central corridor, so that, with the exception of the isolation accommodation, all sections of the establishment could be approached within a single building. Set apart were the hospital church, medical officers' residences, and quarters for the male and female

nursing staffs. The layout of these buildings was designed to surround a wide expanse of lawn and gardens, the whole representing an attractive oasis in the middle of a busy, populated district. The visitor, passing from the streets outside cannot fail to be impressed by the view which greets him, and by the prevailing atmosphere of peace inside this sanctuary for the sick.

By virtue of its modern construction, its situation, and its ease of access by road, this hospital possessed peace-time advantages in offering facilities to sick Service personnel in the Nore Command which were not possessed by its sister establishments at Haslar and Plymouth. But in planning for a major war, it was uncertain whether these advantages might not become disadvantages. Its situation in a prominent position not more than a mile from a busy naval dockyard, and in the direct line of flight between the Continent and London and the Thames Estuary made it a most vulnerable target. Added to this was the fact that the scheme of centralising all departments inside a single building militated against that dispersal of resources which would have been possible in the case of separate buildings, all of which would have been unlikely to suffer individual damage from a single attack. A further disadvantage was the vast quantity of glass which had deliberately been included in the hospital's design in order to provide a well-lit building.

Therefore, in the phase of preparation for war, a policy was adopted consistent with the presumed vulnerability of the Chatham Area as a whole, and it was considered that, on the outbreak of war, the hospital might be untenable, and that it might become necessary to evacuate it altogether. With this possibility in view, no expansion of the hospital itself was undertaken beyond a small increase in the available number of beds.

The peace-time accommodation in this hospital was:

Medical	10 officers	117 men	}	Total: 744
Surgical	14 „	426 „		
Infectious	10 „	140 „		
Mental	— „	27 „		

On the outbreak of war the number of beds was increased to:

Medical	23 officers	254 men	}	Total: 850
Surgical	33 „	306 „		
Infectious	12 „	146 „		
Mental	— „	38 „		
Female	6 „	32 ratings		

The accommodation of the hospital was never particularly strained at any time because of the desirability of transferring patients from the immediate area, and of keeping available a constant number of beds to receive 300–400 casualties at any given time.

To achieve this aim, arrangements had been made as early as 1938 for the London County Council Southern Hospital at Dartford to take large numbers of naval cases from Chatham. During the war years this arrangement worked extremely well, and a Naval Wing was established

at Dartford under the charge of a surgeon captain, R.N.V.R., and staffed by naval sick berth ratings, in which accommodation was provided for 536 patients. At a distance of 19 miles only from Chatham, a routine of rapid admission was quickly established at Dartford, and these facilities afforded by the local authorities played a great part in easing the accommodation of Service patients from the Chatham Area.

In 1942 further accommodation was provided when the Port of London Isolation Hospital at Denton, Gravesend, was taken over by the Navy for the accommodation of Service personnel from the Chatham Area suffering from venereal disease and other contagious disorders. In addition to these local measures, routine evacuations were organised during the war of batches of 100 to 150 patients at a time from R.N. Hospital, Chatham, to various E.M.S. Hospitals. These evacuations were mainly effected by hospital trains.

On the outbreak of war the total number of medical officers was increased from 13 to 26, under the command of a Surgeon Rear Admiral. These numbers included civil consultants holding temporary naval rank who were available for duty whenever their services were required in the hospital itself or elsewhere in the Nore Command. Their experience and practical assistance proved invaluable as the war progressed.

The peace-time complement of naval nursing sisters was 19, which was increased to a maximum of 62 under the direction of a Matron, and later a Principal Matron. Apart from meeting the needs of the hospital itself, they also formed part of a reserve pool for drafting to duty elsewhere as necessary.

The female nursing staff was augmented by V.A.Ds., the highest number employed at any one time being 80.

The total peace-time complement of sick berth staff was approximately 200, including probationers under training. During the war the figure was greatly increased, but was never stabilised, being subjected to rapid fluctuations in accordance with training and drafting requirements. The greatest number borne at any one time was 400.

As in the case of all other establishments, the increases in medical and nursing staffs presented problems of accommodation which had to be solved rapidly. The supply officer's residence was utilised as an overflow for the medical officers' mess. Residential arrangements for certain specialist medical officers were modified, thus providing extra space for nursing sisters in addition to the double bunking which was necessary in the official sisters' quarters.

The residence of the surgical specialist was utilised for V.A.Ds.; 12 others were housed in a garage converted for the purpose, and 38 V.A.Ds. were temporarily accommodated in a separate part of the sick berth staff quarters. Later, 19 V.A.Ds. were housed in a private residence requisitioned in a street near the hospital.

In the sick berth staff quarters the recreation room and gymnasium were converted into sleeping quarters in addition to extra bed space in existing dormitories. Further sleeping accommodation was provided in the basement spaces of the hospital. In spite of these measures there was always gross overcrowding of the sick berth staff quarters, which continued for practically the whole of the war.

Naturally, staff increases were not confined to the medical and nursing requirements of the hospital, but were also extended to include the various subsidiary services necessary to maintain and to meet the extra commitments of a large medical establishment in time of war.

The existing peace-time clerical staff was supplemented by additional civilian entrants, both male and female, in order to cope with the vastly increased accounting duties.

Throughout the whole war considerable difficulty was experienced in procuring the services of sufficient pharmacists, and additional staff had to be engaged to compete with the demands made on the medical stores department. In general, the manual work involved in this respect had to be carried out by men of advancing years, frequently unskilled, which at times proved a great handicap in effecting rapid handling and despatch of stores. In the second half of the war the provision of medical depots elsewhere in the country eased this situation, and the hospital was required to concentrate on the assembly of smaller units, albeit in very large numbers.

On the outbreak of war the broad policy adopted was that the R.N. Hospital, Chatham, should not be expanded, that all medical cases likely to require long term treatment should be evacuated elsewhere, that 300 to 400 beds should be constantly available for the reception of casualties, and that surgical procedures should be restricted to emergencies. This broad policy was subjected to modification from time to time, depending upon the impact on the Chatham Area of the trend of war elsewhere. There were periods when the establishment might be said to have reverted almost to its function of providing general hospital facilities, and this was indeed the case as the war in Europe drew to a close. There were other times when the policy of meeting minimum requirements only was obviously largely theoretical, and in practice a vast amount of work was performed. For instance, although the year 1940 covers a period in which the hospital was ostensibly to be required to deal only with emergency work, in reality 1,415 surgical operations for all purposes were carried out, the majority of which were of a routine nature. Likewise in the medical section of the hospital a research unit was established in July 1940 to investigate cases of gastric ulcer syndrome and dietetics, by which many valuable results were achieved.

During the war years 86,205 patients passed through the hospital, this total exceeding by approximately 3,000 the number recorded by

any other naval hospital. The figure is the more remarkable in view of the fact that the hospital was never called upon to deal with more than twenty-five fresh casualties at any one time. It was, therefore, never possible to test to full capacity the elaborate system which had been built up for the reception and resuscitation of casualties in large numbers.

As regards passive defence of the hospital, the first essential was to ensure efficient darkening, a formidable task involving 8,000 windows in wards, special departments and residences, in addition to a further 2,700 panes of glass in the main corridor.

Four well constructed underground steel shelters, each to hold fifty persons, were built to provide shelter for patients, staff and civilian employees who might be in the grounds when an alarm was given.

An underground air raid defence headquarters was built in the grounds to the west of the administrative block, and an alternative headquarters in the basement under the butler's store. In addition a three-sided recess, near the centre of the administrative block, was converted into a blast and splinter-proof shelter for the personnel employed in this block.

A blast and splinter proof surface shelter was found necessary for the use of female employees of the hospital. Most of these women were employed in the laundry and it was, therefore, built near the roadway facing the laundry building. The basements under the sick berth staff quarters were strengthened, emergency exits built, ventilation improved, and bunks provided for the sick berth staff using those quarters. Three above ground brick shelters, fitted with bunks for about seventy persons, were built in the rear of certain residences, for V.A.Ds. and nursing sisters. In the residences with cellars the entrances were protected and bunks were provided. In the non-cellar residences ground floor spaces were protected by building blast walls.

Four observation kiosks, built of reinforced concrete, were erected at various points along the boundary wall for protection of police sentries, and the police gate at the main entrance of the hospital was protected by the erection of blast walls.

Arrangements were made to provide blast and splinter-proof protection for the two operating theatres, and alterations consisting of bricking up windows and providing protective roofing were completed in No. 2 theatre by September 1939. It was then proposed to provide deep underground protected operating theatres. Plans were drawn up and estimates obtained, but having regard to the length of time it would take and the cost involved, it was decided as an alternative, to convert the existing basements into protected, gas proof, air conditioned operating theatres. Four operating theatres, anaesthetic rooms and recovery rooms were completed in this way.

Adhesive paper and cellophane were used on all the windows as a precaution against flying glass, but in the spring of 1940 the windows

of main corridors, certain stairways, landings and wards were painted with a proprietary preparation called 'gavinol'. This left a thin adhesive coat which, although it clouded the windows, cut out very little light. This substance was found to deteriorate in time, and in January 1941 all the windows of departments, offices and wards were protected with textile netting fabric which was fixed to the windows by size, and varnished. Overhead windows were covered by corrugated metal sheeting. The windows of ground floor wards were protected with brick built blast walls up to a height of 6 ft., and brick blast screens were built at the outside entrances to the wards.

The more seriously ill patients, and those whom it was not advisable to move, were accommodated in the ground floor wards. Those patients who could be moved from the wards were taken to the basement by electric lifts and accommodated on three-tier bunks. The walls of these basements had to be strengthened in places to provide against damage from blast.

In the zymotic hospital the same protection to windows was provided, but as there were no basements to the wards, two above ground shelters were erected. The basements under two surgical wards were made suitable for the accommodation of patients after operative treatment.

The hospital had a normal six months' supply of food, which was kept in the basement. As far as possible galvanised iron bins with well-fitting lids were provided.

The water supply was directly from the town mains, and to provide against possible lack of supply, four 100-ton underground tanks were built at different positions in the grounds, and a large number of 100-gallon tanks were placed on the landings of the hospital wards. The supply of drinking water was ensured by special precautions being taken to prevent contamination of one of the 100-ton tanks, specially kept under constant supervision.

Elaborate decontamination measures were also instituted as well as an organisation to deal with gas casualties. First aid, fire fighting, rescue and repair parties were organised and trained. The rescue and repair parties were composed of members of the civil engineers' department of the hospital. Two parties of six men each were available day and night, and any extra assistance which might be required was available from Chatham Dockyard nearby.

The fire arrangements of the hospital were considerably extended after the outbreak of war. Before 1939 the equipment for dealing with fires consisted of the hydrants, hoses, some fire buckets kept at the main gates, a Bailey's fire escape, and a reciprocating pump at the boiler house for boosting up the water pressure in the fire mains.

In October 1939 a heavy mobile fire engine was supplied consisting of a Morris chassis with a Leyland pumping unit capable of pumping 1,000 gallons per minute, and with a suction lift of 21 ft. It was also equipped with a foam extinguisher of 50 gallons, and an extending

ladder that would reach to the windows of the highest ward. Therefore the hospital was equipped with a machine capable of dealing with a fire of any intensity in any part of the hospital. Two trailer pumps were also provided. The wards, outbuildings and residences were equipped with first-aid fire fighting material, and round the wards and residences were 34 one-man manual pumps which could throw a jet of water 20 to 30 ft.

The police and foreman of labourers provided the main fire party until December 1939, when a stokers' fire party took over. This party first consisted of 13 men with a chief stoker in charge; later the numbers were increased to 24. In September 1941 they came within the National Fire Service zoning scheme.

Although bombs fell in the immediate vicinity the hospital itself never suffered any damage.

At all times during the war at least one mobile operating team consisting of a surgeon, anaesthetist, theatre sister and V.A.D. or sick berth staff was available with instruments and dressings sterilised and packed ready for immediate transport by motor car or ambulance to any place within forty or fifty miles where help was needed.

As to the Civil Casualty Service, after enemy air activity it was quite understood that the whole casualty reception organisation of the hospital would be available to cope with an air raid incident in the neighbourhood.

By arrangement, the hospital was always able to transfer cases, either by ambulance, convoy or hospital train, to various E.M.S. Hospitals, such as Mount Vernon, Stoke Mandeville, Park Prewett, Horton, or even further afield. This was essential in order to keep a number of beds always available for fresh casualties. Cases requiring specialised treatment, such as brain injuries, plastic surgery or chest surgery, could always be transferred to the special units for these cases at E.M.S. Hospitals, Mount Vernon, Horton and East Grinstead. On one occasion a case of suppurative pericarditis was dealt with by a mobile chest unit operating team from Epsom.

An occupational therapy department was instituted in this hospital in May 1942. Money was provided from a local Services fund to obtain materials and a full-time civilian occupational therapist was employed. All articles made by the patients were sold, and by October 1944, the occupational therapy fund was self-supporting, money advanced from the local Services fund having been repaid. From that period, all material purchased and all money received from sales of articles were credited to naval funds.

In 1943 the civilian occupational therapist left, and a nursing sister, who had been given special instruction in this work, was employed on these duties, and later still when the nursing sister was appointed away, a V.A.D. with knowledge of these duties was placed in charge of this

department. During the period May 1945–May 1946 approximately 2,000 patients received occupational therapy, and £506 10s. was received as payment for articles sold.

From June 1944 frequent lectures, discussions and 'quizzes', usually on current affairs, were organised by the education officer for the staff.

A library for the use of patients and staff was reorganised by Red Cross workers. In June 1943 a permanent building was erected to house the library, and in August 1944 the library administration was taken over by the education officer. The library contained about 3,500 volumes, of which 2,500 were fiction.

From June 1944 there was also an E.V.T. reference library for the staff. Films were also displayed and instructional courses arranged in accordance with educational and vocational training requirements.

Very little outdoor recreation could be provided for patients during the war years, as unfortunately it was found necessary to utilise the only suitable ground available for the erection of additional store buildings and the construction of air raid shelters. Indoor recreations included billiards and table-tennis. A 35-mm. film show was given once weekly in the men's day room for officers and rating patients. The films and operators were loaned by the canteen cinema, R.N. Barracks, Chatham. In addition, a weekly 16-mm. show was provided for the patients in the tuberculosis wards by the cinema school, R.N. Barracks, Chatham. From May 1941 E.N.S.A. concerts were held once every two weeks.

Although during the war there was no sports ground available for the hospital staff, football and cricket teams were maintained.

SMALLER ROYAL NAVAL HOSPITALS

The space available in this History does not permit a detailed account to be included of the subsidiary Royal Naval Hospitals in the United Kingdom. But this does not mean that valuable work was not performed by each of them.

On the outbreak of war the staff of the Royal Naval Hospital, Portland, was increased to 7 medical officers, 4 nursing sisters, 1 warrant wardmaster, 1 senior pharmacist, and 19 sick berth ratings. Additional nursing staff was provided by 25 V.A.D. nursing members. Further miscellaneous increases included 16 members of the W.R.N.S. for domestic, clerical and communication duties.

As in all other establishments, an elaborate system was built up for the Passive Defence of the hospital and the reception of casualties.

The hospital was badly damaged by enemy air raids in July 1940, and in March and June 1942. Fortunately, there was no fatal casualty among patients or staff.

After July 1940 it was considered desirable to move as many patients as possible to a less vulnerable site, and Minterne House, about 25

miles inland, was requisitioned as a casualty hospital. In March 1941 the Royal Naval Auxiliary Hospital, Minterne Magna, was ready for full use, and the Royal Naval Hospital, Portland, then became a casualty clearing and emergency hospital only, though out-patient facilities were still provided for personnel in the Portland Area. In spite of its reduction in status the hospital received 5,222 in-patients during the war period.

During the war years the Royal Naval Hospital, Port Edgar, continued to provide facilities for Service personnel in the Firth of Forth area, but was always handicapped by lack of accommodation for patients in any great number, and space for expansion was severely limited. Nevertheless, the hospital received altogether 15,680 in-patients, the majority of which were transferred by routine evacuation to the Royal Naval Auxiliary Hospital, Kingseat, and E.M.S. Hospitals in other parts of Scotland.

The Royal Naval Hospital, Great Yarmouth, employed in peace-time for the reception and care of long-term mental cases, was transferred to Lancaster during the war. Here its peace-time function was continued, and was developed to embrace the various branches of neuro-psychiatric medicine.

ROYAL NAVAL AUXILIARY HOSPITALS

As outlined in the preliminary remarks at the commencement of this section of the Naval Medical History of the War, in addition to the established Royal Naval Hospitals, a number of Royal Naval Auxiliary Hospitals was planned in various parts of the United Kingdom. As the war progressed, the original plans were implemented and were later augmented consistently with the increased medical commitments which arose. It is impossible to give a complete record of each of the Royal Naval Auxiliary Hospitals, but the following account gives such details as are considered to be relevant to this History, to which may be added the information that during the war the Royal Naval Auxiliary Hospitals in the United Kingdom received and treated 150,593 patients.

ROYAL NAVAL AUXILIARY HOSPITAL, BARROW GURNEY

In March 1939, arrangements were made by the Admiralty with the Ministry of Health for the Barrow Gurney Mental Hospital to be taken over and equipped for naval purposes in an emergency. It was taken over at the end of August 1939, and by October 30, 1939, had the necessary staff, equipment and stores to accommodate 500 patients. At an early date an organisation was built up for the reception, resuscitation and treatment of casualties in large numbers, but during the war years the opportunity of testing out this system never arose.

The Hospital. The hospital was situated on a secondary road about five miles from Bristol and could be approached from Bristol either by the main road to Bridgwater or Weston-super-Mare.

The various hospital blocks and 'villas' were widely separated and the grounds were extensive and densely wooded. Clearings were cultivated as flower and kitchen gardens, the latter providing fresh vegetables for the patients. The 'security' fencing around the grounds consisted only of two strands of barbed wire.

The Hospital Staff. The average complement of medical officers serving in the hospital during the war years was about 25 under the command of a Surgeon Rear Admiral. This number included consultants in neurology, neuro-surgery and psychological medicine, who were based on and accommodated in the hospital.

Medical officers were accommodated in a separate mess served by an adjacent galley and in single quarters in nearby buildings. Certain cottages were allocated as married quarters.

The female nursing staff consisted of a Matron, 2 senior sisters, and from 35 to 45 nursing sisters. During part of the war and immediate post-war period a small number of trained mental staff was borne. Accommodation was provided in the nurses' home, the Matron having a separate flat, senior sisters separate rooms, and nursing sisters sharing rooms.

V.A.D. nursing members, clerks and cooks were borne with a V.A.D. commandant. No definite complement was laid down and the numbers fluctuated, being 30 in 1940 gradually increasing to 85 in 1943. Accommodation for V.A.Ds. was provided in the nurses' home.

For the first year of the war the sick berth staff were all pensioners or reservists. As the war progressed these were mostly replaced by 'hostilities only' (H.O.) ratings. The first draft of these arrived in September 1939. By 1941 the complement was stabilised and remained so until early in 1945 with the exception of an increase in mental nurses in 1942, and the replacement of five sick berth attendants by V.A.D. clerks and six sick berth attendants by W.R.N.S.

The following table gives the number of sick berth staff borne in the years 1941–6:

	1941	1945	Early 1946	July 1946
Sick berth chief petty officers	16	15	3	5
Sick berth petty officers	24	23	18	14
Leading sick berth attendants	41	36	26	17
Sick berth attendants	84	65	56	134
Mental nurses	21	32	18	8
Operating room assistants	9	10	6	7
Physiotherapists, male	6	2	1	1
Physiotherapists, female	—	2	1	—
X-ray assistants	4	4	1	2
Dental assistants	1	1	1	1
Laboratory assistants	4	5	3	3

The complement of 1941 was reduced early in 1945 to meet commitments arising out of the Normandy operations.

With the release programme following the end of the German, and later the Japanese war, the number of sick berth staff diminished. A replacement of up to 25 per cent. by non-sick berth staff ratings was ordered, but replacements did not keep pace with releases. The main difficulty experienced during the release period was the progressive diminution in the numbers of senior ratings in spite of all available sick berth petty officers being employed and paid as sick berth chief petty officers. Leading sick berth attendants and sick berth attendants were of necessity employed in duties which would normally have been carried out by sick berth petty officers and leading sick berth attendants. Another difficulty experienced was that of getting replacements for specialist ratings. This was general to all departments, but was particularly felt in this hospital as regards trained mental nursing staff. Practically all trained mental staff were H.O. ratings and no replacements were available. To overcome this dearth of trained mental staff a short course of six weeks' training in mental nursing was commenced for sick berth ratings drafted from depot for this purpose.

The first W.R.N.S. to commence duties in the hospital were two immobile telephone switchboard operators. These started duty in September 1939. During the next two years mobile W.R.N.S. were drafted in the categories of stewards, switchboard operators, M.T. drivers, laundrymaids, cinema operators, quarters assistants, messengers, writers and supply assistants. By the end of 1941 the total number was approximately 30 with a C.P.O. W.R.N.S. in charge.

In 1942 the numbers rose to 50 and an officer W.R.N.S. was appointed in charge. During 1943–4 the numbers rose to 120, but later in 1945 civilian maids replaced W.R.N.S. in the nurses' home and the training division was shut down, thereby reducing the complement of W.R.N.S. to 83.

Initially the W.R.N.S. were accommodated in the nurses' home and some of the cottages. By March 1945 special W.R.N.S. quarters were completed. These consisted of six Nissen huts for sleeping, each hut having seven double-tier beds, and one single bed in a small cubicle for the Leading W.R.N.S. Bathrooms and sanitary annexes were provided separately. A roomy, separate building provided a kitchen, dining-hall, and sitting room. Two cottages were also retained for W.R.N.S., one to accommodate senior W.R.N.S., and the other to provide accommodation and administrative offices for the W.R.N.S. officer.

In September 1939, the Bristol Mental Hospital employees consisting of 24 men and 8 women were taken over with the hospital. In ensuing years further additional civilian staff were engaged, and by 1946 this class of employee had increased to 70. With certain exceptions, civilians lived outside the hospital.

The total numbers of patients admitted to R.N. Auxiliary Hospital, Barrow Gurney, during the war were:

1939	728
1940	3,246
1941	4,036
1942	4,286
1943	4,066
1944	4,312
1945	3,973
1946	1,747
	26,394

*The Medical Division.** The total accommodation of the medical division of the hospital was 324 beds.

The fact that the hospital was originally designed as a mental hospital under the Bristol City Council, with spacious ground for recreation made it convenient for the reception of Service patients suffering from psychoses and allied illnesses. Medical officers with experience of psychiatry in civil life were appointed as specialists in neuro-psychiatry, and the naval consultant in psychological medicine was, for a period, accommodated within the hospital. Qualified male mental nurses from civilian mental hospitals joining the sick berth staff were employed in the wards set aside for those mentally ill; a few nursing sisters with mental nursing qualifications also were entered and employed in charge of these wards.

Throughout the time that the hospital was in the hands of the Royal Navy, a considerable number of medical officers was trained in psychiatric methods, and large numbers of the sick berth staff were trained in the theory and practice of mental nursing, many to the extent of passing examinations under the Royal Medical Psychological Association. All forms of treatment were carried out in the hospital by the neuro-psychiatrists including extensive psychotherapy, narco-analysis and physical methods of treatment such as electro-convulsive therapy and insulin therapy. A medical officer, nursing sister and members of the sick berth staff were specially trained in this last form of treatment at Crichton Royal, Dumfries, and returned to train others, and in time treatment of suitable cases of schizophrenia by insulin became one of the most important activities of the hospital.

The neuro-psychiatric section of the hospital was organised in two parts, one block of wards being reserved for patients suffering from psychoses, with closed and open wards, and another block for the treatment of the psychoneuroses and allied conditions.

Naturally, much greater freedom could be allowed in the latter situation. An adequate enclosed area of ground was available for exercise for those patients who were too ill to enjoy general freedom. Every effort was made to employ fully, in suitable working parties,

* Plate X illustrates a typical medical ward.

those patients who would benefit thereby as a method of therapy. The very limited cabin accommodation, and the absolute proximity of these cabins to wards where ratings were being nursed, rendered the hospital unsuitable, in general, for the treatment of officer patients suffering from psychotic illnesses, and at no time can it be said that a satisfactory solution to their accommodation was achieved. The accommodation of officers suffering from neuropsychoses and other illnesses not requiring, in any sense, the supervision of closed wards was solved by the opening of the R.N. Auxiliary Hospital, Wraxall Court, where 35 beds were available. The approximate accommodation in the hospital proper was 85 beds for the accommodation of psychotics and 45 for psychoneurotics.

In addition to those suffering from true psychoses and psychoneuroses, large numbers of individuals of constitutionally inferior type, psychopathic personalities, etc., many of whom had been charged with repeated offences, were received in the hospital for observation or sent in consultation for advice as to disposal.

At the hospital's zenith, the combination of experienced neuropsychiatrists, fully trained and experienced mental nursing staff, a fully qualified occupational therapist, and the presence of an instructor in physical training, resulted in the establishment and maintenance of a unit which, in its organisation and results, is considered to have compared favourably with any establishment in the country.

A general medical section existed in the hospital from the beginning, and a medical specialist was appointed. Comparatively few patients suffering from acute medical illnesses were treated, the large number being of a chronic nature, frequently transferred from other hospitals. There were 123 beds available for ratings, and 20 beds for officers suffering from general medical diseases in a special ward with adjacent cabins.

The naval consultant in neurology was accommodated in the hospital, and a ward of 31 beds was reserved as a special neurological section. All naval medical establishments in the United Kingdom transferred their neurological patients to this hospital for investigation, treatment and disposal. The convenient nearness of the Burden Neurological Institute and the co-operation of its staff made it possible for electroencephalographic examinations to be carried out in all suitable cases.

Forty beds in a conveniently isolated villa with a suitable balcony were reserved for the treatment of pulmonary tuberculosis.

The laboratory was situated in the surgical section, and was adequate for normal requirements. Use was made of the R.N. Medical School at Clevedon. As there was no gas main supply to the hospital, gas cylinders were used for bunsen burners. The laboratory existed when the hospital was taken over, but nearly all the apparatus was supplied from naval sources.

The Surgical Division. When Barrow Gurney was established as a Royal Naval Auxiliary Hospital, it was decided that the surgical division would be situated in what was the sick hospital of the civilian mental hospital. This sick hospital was a self-contained building on one floor; the accommodation for patients was 182 beds. All wards had easy access to the grounds and to any other part of the division along wide corridors and enclosed passage ways. The four main wards were designed for the maximum light and air supply, in that each jutted off into its own grounds from a main connecting corridor.

To allow for damage, a second operating theatre was fitted out in the surgical division at as great a distance as possible from the main theatre.

These two operating theatres were almost entirely dependent on electricity for sterilisation of instruments, light and heating. One secondary steriliser, which was worked by steam heating, was available, but the final emergency sterilisation depended on primus stoves or other similar methods and chemical disinfection.

A shadow theatre with reserve operating table, instruments and dressings kept ready for erection or transport as necessary, was installed in the medical section, approximately 400 yards away from the main theatres in case the surgical block was demolished. This shadow theatre was never required.

A gas decontamination centre for the injured was prepared near the sub-operating theatre where, from an infected outside entrance, the patients passed the decontamination process and emerged ready for surgical or other necessary treatment opposite the sub-operating theatre.

A resuscitation centre was fitted out with all necessary apparatus for transfusions and treatment, and at all times was in a state of readiness.

An additional annexe was built and fitted as a burns centre.

The surgical division was so designed that there was small chance of it being entirely demolished, but additional protection was afforded by the erection of blast walls in front of all windows and doors, while the operating theatres had iron shutters over the vulnerable areas. The building was practically fire-proof, having the minimum amount of wood used in its construction.

The surgical division included the following specialist departments:

Physiotherapy Department. This department was at first adjacent to the X-ray room, at a considerable distance from the surgical section. During 1942 the department was removed to a small ward in the surgical section, and contained, in addition to the usual faradic, galvanic, and sinusoidal currents, U.V.R., radiant heat, infra red elements, a Kromayer lamp, and suitably screened short-wave diathermy.

X-ray Department. This department was situated in the administrative block. A Victor apparatus was supplied by the Service to supplant the old apparatus used by the Bristol Mental Hospital, and the electric

supply changed from D.C. to A.C. A portable and a dental machine were also supplied, the former being fitted with a rotary convertor for use in the wards, all of which were on D.C. supply.

E.N.T. A single room in the surgical section was fitted for use by the E.N.T. specialist.

Ophthalmic Department. This department was situated in the administrative block.

Dental Department. A very well fitted dental department was under the charge of a dental officer and catered for the hospital only. On January 31, 1945, however, reduced dental commitments in the Bristol area justified the employment of one dental officer only in the Bristol area, and the hospital dental surgeon did the work for R.N. Auxiliary Hospital, Durdham Down, W.R.N.S. Sick Quarters, Apsley Road, and Bristol Dental Centre.

Supply Department. The Supply Department of the hospital was directed by a captain (S) assisted by a lieutenant (S), and was composed of a pay office, a canteen, baggage store, victualling store, galleys and laundry.

The victualling store staff consisted of five W.R.N.S., two civilian labourers, and a civilian butcher. The store was well fitted out with store-rooms, issuing room, butchery and an electrically operated cold-storage room. Supplies were obtained from the victualling stores office at Devonport, and by local contract. Fresh vegetables were supplied in part from the hospital gardens.

Works Department. The Works department of the hospital was in charge of a chief engineer, who, with a deputy engineer and a maintenance fitter, was taken over with the building and was responsible for the maintenance of water, heat, light and electrical services. Stokers for the main boilers were civilians and Service ratings. The Admiralty Civil Engineering Department, Devonport, was responsible for the hospital among other naval establishments in the area, most of the work necessary being carried out by local contractors. The entire equipment of Barrow Gurney Hospital was taken over by the naval authorities, but considerable increases were necessary from Service sources. The need for dispersing stores to minimise loss by enemy action was obvious and necessitated the building of additional stores in parts of the hospital grounds and in the basement beneath the victualling stores room which was served by an elevator.

Medical Stores. The staff of the medical stores department comprised the senior pharmacist, one pharmacist for dispensing duties, and three ledger clerks. A storehouseman and two labourers were also employed in the medical store. With the progress of the war the staff was increased to 12 and, owing to the calling up of the civilians into the Forces, consisted mainly of uniformed personnel. The essential services of the

hospital such as the water supply, central heating, power and lighting, laundry, disinfectors, etc., were up-to-date and satisfactory.

Medical Transport. For most of the war years medical transport was provided by two Service ambulances, four converted 'bus ambulances, three vans and a staff car all based on the hospital. Three civilian drivers were obtained from the Bristol Bus Company and taken on as Admiralty civilian drivers. They were supplemented by emergency drivers and W.R.N.S.

Passive Defence. In this respect owing to its isolated position, the hospital was left very much to its own resources.

The existing corridors of the hospital were utilised as air raid shelters for the patients and staff from adjacent wards. Two-tier metal stretchers were hinged to the walls for bed patients who were fit to be moved, and up-patients were accommodated on stretchers placed on the floors. Brick blast walls were erected in front of windows and doors, and sandbag barricades erected outside the more open, non-corridor side of the wards. The corridors provided adequate protection against incendiary bombs and large bomb or shell fragments. The roof was of concrete, 5½ in. thick. These corridors were also fireproof.

One surface shelter was erected for the use of fire and rescue parties. Staff who were off duty took shelter in selected ground floor rooms of the staff quarters, also protected by blast walls and sandbags. No trenches were constructed.

The operating theatres were built with electrically operated sliding steel shutters which covered the large windows. Brick walls were also erected.

Water protection measures were not necessary, as the existing storage tank in the water tower was completely covered.

A reserve supply of tinned food was always retained for use in emergency. Other foodstuffs were kept in separate rooms in the victualling store, and protected by tarpaulins and specially made canvas covers.

A trained party of sick berth ratings under the hospital engineer was formed to deal with immediate repair work.

As the hospital was about three miles from the outskirts of Bristol, it was in consequence involved in all the alerts and warnings in the Bristol area. But on one occasion only were high explosive bombs dropped in the hospital grounds. On this occasion, January 3–4, 1941, in a severe and prolonged dusk to dawn attack on Bristol, eleven 500-lb. bombs were dropped in the grounds. Ten of these exploded, and the unexploded bomb was removed a few days later by a bomb disposal squad from Avonmouth.

Two bombs fell close to the surgical wards.

One bomb about 12 yards from the pay office.

Three bombs (one unexploded) about 20 yards from the sick berth staff quarters.

Two bombs in woods near the engineering department.

Three bombs in woods near the staff quarters villa.

An outstanding feature was the very minor nature of the damage, considering the nearness of the bomb craters to the buildings. This was attributed to the heavy clay subsoil permitting the bombs to penetrate and thereby masking lateral blast. No casualties were sustained.

Scattered incendiary bombs fell in the grounds on several occasions and were promptly dealt with. There was no major fire as the result of enemy action, for which credit is due to the high state of efficiency of the hospital fire-fighting and fire-watching organisation.

A mobile surgical unit was kept available at all times and consisted of operating surgeon, anaesthetist, sister, operating room assistant and sick berth attendant. Unit stores were kept packed in five suitcases divided as to instruments, dressings, anaesthetic apparatus, resuscitation apparatus and nursing comforts. Hospital transport ambulance was provided. The duty of this unit was primarily to attend areas in the immediate district where excessive bombing had occurred, but it was also intended to assist and relieve overworked surgical teams in other hospitals, Service or civilian.

Wards were set aside for the reception of civil casualties occurring in the immediate neighbourhood. These wards were never used for this purpose nor were the services of the surgical unit called for.

Organisation. As part of the accepted policy there was constant collaboration between R.N. Auxiliary Hospital, Barrow Gurney, and other naval hospitals and civil hospitals under the E.M.S. scheme. In addition to the general acceptance of neuro-psychiatric and neurological patients from all naval establishments, a regular quota, to relieve congestion of patients suffering from general medical diseases, was accepted from the R.N. Hospital, Plymouth.

Advantage was taken of the nearness of the E.M.S. Hospital, Kewstoke, to transfer there patients requiring surgical treatment for injuries to and diseases of the lungs. The Military Hospital for Head Injuries, Oxford, the Burden Neurological Institute and the R.N. Auxiliary Hospital, Sherborne, accepted cases requiring neuro-surgery. Help in treatment, when required, was given by the medical staff of the Bristol Royal Infirmary and the Bristol General Hospital, particularly in the case of patients requiring X-ray therapy, and those requiring gastroscopic examinations.

A specialist in neuro-surgery was appointed in 1939, and, using the hospital as a centre, visited R.N. Hospitals and E.M.S. Hospitals as requested by them, advising and operating as required.

Liaison was established with E.M.S. Hospitals in the surrounding counties and with R.N. Auxiliary Hospital, Sherborne, for evacuation

of patients, but only two occasions arose when patients in large numbers were evacuated, i.e. (1) to E.M.S. Hospital, Evesham, April 1941, when 250 patients were sent to clear the hospital for acceptance of patients from Plymouth, and (2) to E.M.S. Hospital, Whittingham, near Preston, March 1944, when 105 surgical patients were evacuated to prepare for Normandy casualties. Otherwise, transfers were of routine nature.

The matter of evacuating the hospital on invasion was given consideration in 1940, and it was decided by Commander-in-Chief, Western Approaches that, as (*a*) invasion would be, in all probability from East to West and (*b*) the hospital was not situated in the Coastal Zone, the hospital would not be evacuated, but would provide 100 beds, additional to the existing 500, to accommodate patients from the invasion area. Beds and equipment to effect this were ordered, but the exact disposition of the 100 extra beds was not detailed.

With a large number of mentally ill persons constantly in the hospital, the importance of the institution of an occupational therapy department was manifest; this was effected at an early date, and a qualified occupational therapist was employed. The skilled supervision and the co-operation of the occupational therapist with medical officers with a view to advising suitable occupation to inspire initiative and interest in patients no doubt were a potent factor in the hastening of cure, and in producing a state of social adaptability in those who had to be invalided and returned to civil life.

Certain mental nurses took advantage of the opportunity to be trained, and to pass examination in occupational therapy.

Lectures and discussions were arranged daily for patients and, whenever possible, for staff. Educational and vocational training classes were held for the benefit of the staff.

Groups of patients were taken by the schoolmaster every morning in a recreation hut for a lecture or discussion on current affairs. Outside lectures were occasionally given by speakers from the Bristol Regional Committee for Adult Education in H.M. Forces. As an alternative to current affairs, talks on music illustrated by records were often given.

E.V.T. classes for the staff were held in leatherwork, tapestry, dressmaking and soft toy making. Each subject occupied two hours per week in voluntary time.

A Nissen hut was taken over from the training division and adapted for use as an information room.

An E.V.T. library, consisting of books on history, political theory, current affairs and economics was at the disposal of patients and staff. In addition, text-books were available to students who wished to read specific subjects. The R.N. loan library provided any books required for educational purposes. The principal daily papers were displayed in the information room. Educational films were also shown.

Staff facilities for outdoor recreation throughout most of the war period were limited, and consisted of one football pitch marked out in a meadow in the hospital grounds, and two hard tennis courts. Football matches were organised. Late in 1944, recreation was put on a more organised basis. A hockey ground was constructed, and a basket-ball pitch was marked out. Sports gear was generously supplied by the Sports Amenities Board. Further football teams and a mixed hockey side were raised. No cricket pitch could be made in the hospital grounds, but a team was raised, and played and practised on the Flax Bourton Cricket Club ground, whose members generously accorded this privilege. Badminton was played in the recreation hut. Staff dances were held at frequent intervals. Cinema performances were held twice weekly.

A recreation hut for patients providing the usual amenities for billiards, darts and wireless was situated in the hospital grounds. Two cinema shows were given each week, and an average of two stage shows a week were given by visiting theatrical companies. A well stocked fiction library was provided for the use of patients and staff.

In 1942 the hospital undertook the training of new entries to the sick berth staff, and an instructional department was formed. These trainees were accommodated in Nissen huts, which, with lecture halls, dining-rooms, recreation room, kitchen and washing facilities altogether formed a self-contained camp in the grounds of the hospital. The camp was designed to accommodate 200 trainees, but, in order to meet emergency demands, it was found necessary to increase the number to a maximum of 230. The first class of trainees was received in July 1942, and training continued without interruption until February 1945.

During that period 1,119 probationers passed through the camp, and of that number 833 completed the course of training and qualified by examination as sick berth attendants. The final class qualified on February 23, 1945.

In November 1945, a modified course of training was instituted, and the camp was re-opened.

During the period from November 9, 1945, until July 26, 1946, when the camp finally closed, a total of 476 probationers received training, 365 of these qualifying by examination.

The numbers covering both periods were:

Received for training . .	1,595
Qualified by examination .	1,198

Wraxall Court, a country house between Bristol and Clevedon, was opened on May 27, 1944, as an annexe to Barrow Gurney for the treatment of officers suffering from mild psychiatric disorders, or convalescent from medical and surgical illnesses.

The house accommodated a maximum of 33 patients, and provided a combined common-room, dining room and billiard room. Occupational

therapy was carried out in a large hut in the grounds. The gardens and green-houses provided fruit and vegetables for both Wraxall Court and Barrow Gurney Hospital.

The staff comprised two medical officers, a warrant wardmaster, 23 sick berth staff, two V.A.Ds., two W.R.N.S., and 14 civilians, a total of 44.

Wraxall Court closed down on April 18, 1946, after treating 870 patients.

R.N. AUXILIARY HOSPITAL, KINGSEAT

In accordance with the preliminary planning, whereby certain buildings in the United Kingdom were to be taken over as auxiliary naval hospitals, on the outbreak of war the mental institution at Kingseat, Newmachar, was transferred to the use of the Navy.

This modern mental hospital, composed of a number of isolated villas, was situated 500 ft. above sea level, and approximately 12 miles north-west of the city of Aberdeen, occupying an isolated position in the heart of an agricultural countryside. The grounds of the hospital lay on a slope facing westwards, and covered 100 acres, including five miles of roads. The boundaries were formed not by walls, but by a belt of conifers and larch trees.

A Surgeon Rear Admiral was appointed to the hospital on September 1, 1939, and was supported by the standard medical staff of 2 surgeon captains, R.N., and a team of medical officers for the various recognised specialist duties, most of whom were R.N.V.R. The nursing staff consisted of a Principal Matron, 2 superintending sisters, and 29 nursing sisters of Queen Alexandra's Royal Naval Nursing Service. Between 60–100 V.A.Ds. were borne, the number fluctuating according to hospital commitments and drafting requirements elsewhere in Scotland. Ancillary to the medical and nursing staffs was a captain (S) R.N., a commissioned writer, a staff of pharmacists, a varying number of W.R.N.S. employed as clerks, stewards, cooks and telephone operators. A retired lieutenant commander (E) R.N. was employed to superintend the machinery which maintained light and water supply, and a certain number of the peace-time civil staff of the hospital was retained to continue work as gardeners, carpenters and on other employment concerned with the maintenance of the essential services of the establishment.

At the time of the outbreak of war the hospital was occupied by 800 mental defectives. These had been evacuated by September 14, on which date the hospital was prepared to receive 250 Service patients, including 50 officers.

During the first six months of its existence many structural alterations had to be effected in order to convert the establishment from a mental institution into a general hospital. These alterations included the

replacement of some hundreds of self-locking doors by ordinary fittings, the provision of more than 400 wooden seats in water closets, and the change from key to dolly switches in electric light controls.

The problem of living and sleeping accommodation for the staff was acute from the outset, though the consequent loss of accommodation for patients was to some extent balanced by crowding in the villas set aside for staff.

A serious defect was the lack of storage space for hospital equipment, and this was not overcome until March 1941 when new storerooms were completed. A surgical unit including two modern operating theatres was constructed as an annexe to the villa employed for surgical work, and a modern X-ray department was built on to the main hospital block in February 1940. It is a tribute to persons responsible for these additions and alterations in construction that they were effected under the adverse conditions of the severe winter of 1939–40, during which the establishment was on several occasions completely isolated from the outside world by snow drifts for days on end.

In planning the naval medical war administration, R.N.A.H. Kingseat had been carefully selected with a view to providing a large medical establishment remote enough from populated areas to be safe from enemy attack, while near enough to the Fleet to receive from the latter a large number of patients needing long term treatment. Broadly speaking, R.N.A.H. Kingseat was the main base hospital for the Home Fleet Anchorage in Scapa Flow. The hospital functioned in conjunction with a carrier service by hospital ship between Scapa Flow and Aberdeen. In effect, at regular intervals throughout the war, regular journeys were made by hospital ships carrying long term cases who were discharged at Aberdeen and transferred to R.N.A.H. Kingseat by road. There were long periods when this function fell into abeyance owing to a low rate of sickness in the Fleet, and was replaced by the function of receiving patients transferred from hospitals further south, e.g. R.N. Hospital Port Edgar, and R.N.A.H. Kilmacolm. It can therefore be claimed that R.N.A.H. Kingseat also acted as base hospital to the Firth of Forth and Clyde Areas, and even the Tyne and Mersey Areas when, as around the period of the Normandy invasion, it was necessary to evacuate a large number of hospitals in England. Be this as it may, it must always be remembered that the primary purpose of R.N.A.H. Kingseat was to meet the Scapa Flow commitment, part of which was the potential reception of large numbers of casualties from any major clash which might occur between the Home Fleet and the German High Seas Fleet, to which extent the existence of Kingseat had to be regarded as a necessary factor of insurance inside the framework of naval medical policy.

It was therefore necessary at all times to maintain sufficient staff and accommodation to work the emergency organisation for the reception

of a sudden large influx of casualties from the Fleet. This organisation was never fully extended, but always might have been. But during the Norwegian campaign, following the loss of H.M.S. *Glorious*, and following the *Scharnhorst* action, casualties were received which demanded the implementing of the emergency organisation to a limited degree.

Although remote from any populated area, the hospital was situated not only within five miles of a busy R.A.F. Station, but also within two miles of a 'dummy' air station erected as a deliberate decoy to enemy aircraft. An elaborate passive defence scheme was therefore necessary in the hospital, and although never brought into play, even when the city of Aberdeen was bombed in April 1943, training was maintained at a consistently high level and proved of value to members of the staff who were able to make full use of the knowledge acquired when drafted elsewhere.

For the greater part of the war the male nursing staff consisted of pensioners recalled for service. But in 1943 an instructional department was instituted, and the training of large numbers of probationary sick berth staff was undertaken. This had the effect of introducing a younger element into the establishment to some advantage.

Although situated only 12 miles from Aberdeen, transport facilities for staff and patients were never lavish during the first half of the war. Conditions improved later, but it was always necessary, particularly during the winter months, for the hospital to be self-supporting as regards its own recreations and amusements. Organised games included cricket, football, hockey, tennis, bowls and badminton.

A large theatre, with seating for 500, was provided, with modern stage lighting and equipment. Here cinema shows were held twice weekly, and in addition to amateur parties and E.N.S.A. entertainments, a weekly matinée was given gratuitously by whatever company happened to be playing in the Tivoli theatre, Aberdeen. A weekly dance was also held.

Occupational therapy was developed on a large scale throughout the hospital, and the activities of the educational and vocational training department did much to ease any monotony felt by the patients and staff.

A friendly and valuable liaison was established between the hospital and the staff of Aberdeen Medical College and teaching hospitals, and mutual aid was constantly forthcoming as requested.

R.N.A.H. Kingseat received and treated altogether 37,238 Service patients.

R.N. AUXILIARY HOSPITAL, NEWTON ABBOT

Shortly before the outbreak of hostilities, it was decided by the Admiralty to put into effect an agreement previously reached with the

Devon County Council Authorities to take over the Newton Abbot Public Institution, as a Royal Naval Auxiliary Hospital.

Accordingly, on September 3, 1939, preliminary personnel joined the Institution to complete the transfer and commence the work of organising and converting the buildings into a naval medical establishment.

The Institution, solidly built of faced stone, consisted of a number of scattered buildings standing in grounds which comprised some five acres.

It was originally intended that the buildings should accommodate 600 Service patients, but it was apparent from the initial survey of the space available that this figure had been over-estimated, and that a maximum of 400 beds was all that could be provided for without much overcrowding. Arrangements were therefore put in hand for ward accommodation for 400 patients and quarters for 150 hospital staff.

Steps were also taken to engage civilian labour comprising kitchen staff, telephone operators, boiler house stokers, artisans and labourers.

The hospital engineer was retained in the establishment by arrangement with the Devon County Authorities.

Senior medical officers, surgical and medical divisions, joined on September 21, 1939. Other personnel joined at intervals, and by the end of October the following staff were accommodated:

Medical officers	9
Store officer	1
Cashier	1
Wardmaster officers	2
Sick berth ratings	80
Matron	1
Nursing sisters	3

The entry of civilian staff proceeded satisfactorily, and little difficulty was experienced in obtaining suitable workpeople. The laundrymaids and cleaners were mainly those who had been employed in the Institution under the Devon County Council. A short article regarding the opening of the hospital appeared in the local press and a number of applications for employment was received as a result.

No operating theatre existed in the Institution, but the Devon County Council had consented to the erection by the Admiralty of a two-roomed operating theatre, designed on the usual standard lines, on the hard tennis court site within the Institution. The building of the theatre was taken up with H.M. Dockyard, Devonport, and by October 5, 1939, a contract had been given to a local firm and construction was proceeding in a satisfactory manner. The work was subsequently delayed by the non-arrival of various fittings, e.g. sinks, basins, sterilisers, but except for these, the operating theatre was completed by November 7, 1939. Delay in the arrival of stores was experienced for

some time, and not until March 12, 1940 could it be reported that the theatre was in full working order and use.

A secondary theatre was improvised on November 7, 1939 for use in emergency. Emergency operating theatres were also constructed in the male shelter and in the plaster room.

Receiving room, baggage room, and central medical store were constructed and in full use by the early part of 1940, and an X-ray unit was installed.

It had been the original intention to ask for the construction of a laboratory. In the interests of economy, however, this was not possible, and other means had to be adopted. Accordingly, a small ward was utilised as an improvised laboratory, involving a decrease of four beds in the hospital accommodation for patients. By early in 1940 the laboratory was in full use.

To augment the items turned over from the Devon County Council, a certain quantity of stores was received from Plymouth early in October 1939. Demands for extra surgical instruments, laboratory stores, massage and physiotherapy equipment, were prepared and forwarded into office. By December 1939, drugs and instruments were arriving gradually, but some time elapsed before the demands were satisfied.

In the early stages, four Diesel oil omnibuses belonging to the Devon General Motor Company were converted into coach ambulances and held at the disposal of this hospital in the company's depot at Torquay. This number was subsequently reduced to two, and these ambulances were eventually purchased by the Admiralty. No garage accommodation existed in the hospital for vehicles of this size, and arrangements were made for facilities to continue to be provided by the omnibus company at Torquay.

Two four-cot ambulances arrived in November 1939, followed by a 12-cwt. Bedford van and a 30-cwt. Fordson truck. These four vehicles were retained in the hospital and a shed was adapted as a garage. Three drivers for the motor transport were entered locally.

Some 800–900 windows were blacked out during the preliminary stages, and in addition to arranging for the blackout of the rest of the hospital, immediate steps were taken to form a passive defence organisation, and a medical officer was detailed to act as the Passive Defence Officer. At that time the district was not a vulnerable area, and as in nearly every case the ground floor wards were protected against blast by walls and other buildings within 50 feet, no special protection was considered necessary. The progress of hostilities called for a change of this opinion.

The Passive Defence Officer, Plymouth Command, visited the hospital during October 1939, and his advice was obtained on certain measures.

Proposals were made for improvements in the existing water supply. Underground static water tanks in various parts of the establishment contained some 82,000 gallons available for use with trailer pumps.

Liaison was effected with the local Civil Passive Defence Authorities, with Devon Constabulary, and with the Superintendent of the Newton Abbot Fire Brigade. Joint fire-fighting exercises were arranged with the latter. Passive defence exercises within the hospital were also carried out at frequent intervals.

Proposals were put forward for the construction of brick shelters, tunnels or lean-to refuges, complete with sleeping bunks, steam heating and permanent electric lighting. These shelters were completed, and accommodated 282 persons. Additional protected sleeping accommodation for a further 150 received Admiralty approval on November 1, 1941.

On August 20, 1940, Newton Abbot was subjected to enemy air attack. The attack took place in broad daylight, and was mainly directed against the railway station. Warning sirens were not operated in the town. Damage was done to railway rolling stock, the railway station, and to private property.

The passive defence organisation in the hospital was put into operation and the arrangements worked well. Assistance in the form of the mobile unit and two ambulances was despatched to the railway station, and co-operation with the Civil Authorities was maintained until all the casualties had been dealt with.

Casualties numbered 67 (16 fatal), and included 2 naval ratings who were slightly wounded. Five civilians were also admitted to this hospital and these, after a few days, were transferred to the Newton Abbot hospital. Letters of appreciation for the assistance rendered were received from the local authorities and from civilian patients.

Bombs were dropped in the close vicinity of the town on several occasions but without causing any casualties.

Bed accommodation was available for 167 medical and 233 surgical cases, a total of 400, which included special isolation cubicles for 12 cases, but this number was only reached after some months of effort. Delay in the completion of demands for medical stores, bedding and clothing was experienced, but by the beginning of December 1939, accommodation was ready for some 200 patients. It was not possible to arrange accommodation for officer patients, mental or venereal cases.

Early in May 1941, following the heavy enemy air attacks on Plymouth, the Royal Naval Hospital, Plymouth, ceased to function as a Base hospital, and from that time was considered a casualty clearing hospital only. Cases were subsequently received in convoys from Plymouth and the Royal Marine Depots, Lympstone and Dalditch at frequent intervals, and occasionally from Liverpool and Glasgow, patients from the latter port being mainly foreign invalids.

Generally speaking, patients were naval ratings, but Royal Air Force, Army, and Allied personnel were also received.

R.N. Auxiliary Hospital, Newton Abbot, closed down on March 7, 1946. During the war years 19,877 patients were received.

R.N. AUXILIARY HOSPITAL, SHERBORNE, DORSET

This establishment was erected between July 1941 and February 1942 under the direction of the Ministry of Works to the plans and specifications of the Ministry of Health.

The question of manning presented great difficulties which, so far as male personnel were concerned, were aggravated by the then state of the war with particular emphasis on the immediate requirements in the Far East.

In October 1941 four officers were appointed to 'stand by' during the construction period and to organise the opening of the establishment as an auxiliary naval hospital at the earliest possible moment. In late November 1941 an advance party of 20 sick berth ratings was obtained. These men were used principally for clearing and storing wards and departments as each was completed by the builders. When it became apparent that the establishment would be predominately 'woman' manned, necessary alterations to staff quarters were effected, and a last minute need for more W.R.N.S'. accommodation did, in fact, delay the full opening of the hospital for about three weeks.

Finally, accommodation was effected for:

Surgeon Rear Admiral	
Medical officers	16
Sick berth staff	99
Matron and sisters	27
Commandant, Asst. Comdt. and V.A.Ds.	127
W.R.N.S.	109

The establishment was well served in the matter of special departments. An operating theatre, X-ray department, laboratory, dispensary, saline baths unit, physiotherapy department and a gymnasium, were provided for in the plans.

The electricity supply by Wessex Electric Grid was at first, owing to the extra load from this establishment, far from satisfactory, and became somewhat uncertain with the introduction of more electric appliances into the hospital. These defects were eventually remedied by the installation of a transformer (booster) station in open country about three-quarters of a mile beyond the northern boundary of the establishment.

The Sherborne water supply fell short of being satisfactory, and from the beginning it was known that the local authorities would be put to some trouble to produce an adequate supply. The pumps then existing were old and lacked the power to push the water to the gravity tank which was specially built at a point higher than the hospital. The public

reservoirs had insufficient head to supply the establishment, and as a temporary measure a boosting arrangement was put in hand whereby the water was passed into an open tank from which it was pumped into the hospital main by using a fire-fighting trailer pump, supplied by the Ministry of Works, and a canvas hose. After a breakdown, a second trailer pump was called into service to be used alternately or as a standby. The water supplied by this method was considered to be unfit for drinking and the necessary precautions were issued and taken.

The local council eventually secured a Government grant to enable them to start a new bore in low-lying land, and a priority order for the supply of new pumping machinery.

On March 20, 1942, it was reported by the Medical Officer-in-Charge that the water supply was adequate for the staff and 80 patients. Thereafter the supply soon increased and remained adequate.

Twenty-three surface shelters were constructed of brick reinforced with steel wire. Walls were 14½ in. thick, roof concrete 6 in. thick and floor of concrete. Slatted benches placed against each long wall provided seating accommodation for 22 or 44 persons according to the class of shelter of which there were 15 single and 8 double.

A bucket lavatory was curtained off at one end and the shelter was faintly heated by means of electric tubular fires. They were erected between the wards and near to living quarters. No cot or stretcher case could be carried into these shelters which had a narrow doorway further protected by a blast wall.

There were no protected offices for staff with the exception of (*a*) the passive defence office used as Area Headquarters, protected by an outside blast wall and opening on to an inside corridor, and (*b*) the telephone switchboard room also protected by an outside blast wall and opening on to an inside corridor.

No protected operating theatres were provided, nor could permission be obtained to build or convert the existing ones at that stage of the war.

No ward offered real protection, but during the building of the establishment the plans were altered to permit of the walls of the wards, below bed frame height, being constructed of double thickness, thus affording some measure of protection to patients who were bedridden. During periods of alerts, bed patients who could be moved were laid on the deck on their mattresses, others in frames and in plaster beds were, when possible, covered with a protecting screen of mattresses specially stacked in the centre of the wards for that purpose.

Apart from one sharp, but heavy daylight raid by enemy fighter-bombers in the late summer of 1940, before the hospital was built, the town of Sherborne, which suffered considerable damage on that occasion, was not again directly attacked.

Nearby places such as Yeovil, Wincanton, Templecombe, and the outskirts of Stowell and Charlton Horethorne, were bombed

occasionally, and during one night raid when bombers were passing over to the Midlands, two large bombs were dropped in Sherborne Park near the railway, opposite the hospital at a distance of about 1,000 yards. Occasionally, shell splinters from a heavy A.A. battery about five miles away fell around the buildings, but no damage was sustained.

Civilian hospitals in this area were small and could hardly have dealt with a large civilian casualty list. In this connexion liaison was established with the Medical and Civil Defence Services to render assistance as required, both with accommodation at this establishment, and with mobile medical units and surgical teams.

Two surgical teams were formed and were sent out on the following occasions:

To Templecombe (distance 9 miles) to deal with civilian air raid casualties.
To Wincanton (distance 10 miles) ditto.
To R.N. Hospital, Portland, for three days, to assist with surgical cases among survivors from men-of-war.

These teams were equipped with medical and surgical stores, food and medical comforts. They were also used on numerous occasions for serious road accidents involving military convoys within a radius of 15 miles. Their work was effective. Casualties were later brought to R.N.A.H. Sherborne.

Recreational facilities were almost negligible for a period of twelve months. The grounds of the hospital were left by the builders in a very bad state, and a big drive was started to clear the ground of rubble. Every one, including patients, worked with a will, and for some months other forms of recreation were subordinated to the effort to make the grounds respectable. A football ground, under full size, was made by the staff under the direction of the head gardener. This supplied a much needed want for both patients and staff.

Indoor games for both staff and patients were pursued within the limits afforded by the sitting rooms attached to each mess and the physiotherapy departments for patients. Dances and table-tennis, with inter-departmental and inter-mess competitions were organised. The erection of a large recreation hut in 1944 opened up considerable indoor recreational facilities, and full advantage of the building was taken by patients and staff.

In the spring of 1945 the Sherborne Women's Section of Toc H opened a 'club' principally for the benefit of patients and staff of this hospital. It was also open in the evenings to the ships' companies of the Naval Air Stations at Henstridge and Charlton Horethorne. The building was leased from the Army authorities who had it on requisition. The service there was voluntary and the amenities comprised canteen, lounges, gymnasium, reading and writing rooms, and a ladies' room. The club was also open to the relatives of members of the Services,

which proved a boon to patients, whose relatives often visited them from great distances. Unfortunately, after six months this club was wound up owing to the property being de-requisitioned by the Army authorities, and no alternative building could be found.

Motor coach outings were a feature of the entertainment effort for patients, including visits to places of interest at reasonable distances from Sherborne, e.g. Wells, Glastonbury, Bristol, Cheddar, Wookey Hole Caves, Malmesbury, Salisbury, Weymouth and Bournemouth.

Wireless sets for all wards and messes were gradually obtained as gifts, by local hire, and from welfare sources. A master set was purchased from private funds. All wards were fitted with loud-speakers and 12 sets of headphones allocated to each ward.

The establishment was opened as a general hospital in April 1942, providing 14 wards for ratings divided equally between the medical and surgical divisions. The officers' ward with four cabins and 20 beds was primarily for surgical patients.

After the hospital had been open for about three months, the Admiralty decided that it would be advisable to turn Sherborne into a mainly orthopaedic hospital. The medical division was reduced to three wards. Of the remainder, one was reserved for general surgical, one for neuro-surgical, and one for W.R.N.S. patients. In the first place the one reserved for W.R.N.S. was primarily orthopaedic, but soon became very general. The remaining wards, including officers', were used for orthopaedic cases only. These wards soon filled up and remained full until the autumn of 1945, when two of the orthopaedic wards were given back to the medical division.

With the arrival of numerous long term orthopaedic cases, it became necessary to formulate some sort of policy for the treatment of these patients in general. The Medical Officer-in-Charge decided that, as long as there was no great pressure of beds, every case should be treated for as long as it was felt that in-patient treatment would be of benefit, irrespective of whether he was likely to return to duty or be finally invalided. This policy was continued for the remainder of the war and after, under the Admiralty long term treatment scheme.

The neuro-surgical unit was transferred from R.N. Auxiliary Hospital, Barrow Gurney, in 1942.

The R.N. Auxiliary Hospital, Sherborne, continued to function until 1948, when it was finally closed down. During the war years it received and treated 15,947 patients.

R.N.A.H. SEAFORTH AND R.N.A.H. WOOLTON

Up to February 1941, there existed at Liverpool a Royal Naval Sick Quarters in St. Paul's Ophthalmic Hospital, containing approximately 70 beds, under the charge of the Base Medical Officer, a surgeon captain (retired). A further sick quarters for 150 beds had been requisitioned at

Seaforth, which was an old building used as a mental home before the war and belonging to the Corporation of Liverpool. The whole ground in which it stood had recently been leased to the Mersey Harbour Board. When the Command of the Western Approaches was transferred to Liverpool there was urgent need for naval hospital accommodation.

R.N. Auxiliary Hospital, Seaforth, was opened as such in July 1941, after many delays. The south wing was not included in the original requisition, and was used as a Service club by a civilian organisation. It speedily became clear that this would be required as well, to provide further bed accommodation, so that by mid-1942 this wing was requisitioned. The Corporation Convalescent Home at Woolton, with accommodation for 220 beds, was also acquired after prolonged negotiation.

These two establishments were opened for use in January 1943, and, together with the original requisition at Seaforth, they formed R.N. Auxiliary Hospital, Seaforth, with its annexe at Woolton. The south wing became an administrative block, together with sick berth staff quarters, recreation room, offices and pulmograph section of the hospital. Woolton was extremely valuable because it could also accommodate officers in fair numbers. It had a small operating theatre for emergencies, and excellent grounds and surrounding amenities. The original 150 beds at Seaforth were clearly insufficient, and by double banking of certain wards 200 beds were introduced. The consequent overcrowding had to be accepted for the time being.

In its completed form, Seaforth had a central administrative block and two wings, North and South. The patients were housed in the north wing on four floors. There was an officers' block at the top of the central administrative block and an officers' mess below this and above the offices and receiving room. The basement contained galleys and store rooms. The south wing, part of which required structural alterations, contained a newly built genito-urinary ward and disinfector, a recreation room and chapel, various departmental offices, a pulmograph unit, and a spacious sick berth staff quarters. A bad feature was the inadequacy of the scattered store rooms, making custody and muster of stores very difficult. The surgeon captain and his secretary had offices in the lodge at the main gate, and this also housed the supply officer and his staff. The grounds were of poor soil and the yield of flowers and vegetables was disappointing. Nevertheless, cultivation was vigorously proceeded with and not without success. There was a good garage in the grounds. The back of the hospital had a good seaward view over the mouth of the harbour and across the Mersey Channel to the North Wales coast, but it was too near the Gladstone Dock for comfort during air raids. The front presented a commonplace view over Seaforth and Litherland.

At this time the ophthalmic department was housed in the R.N. Sick Quarters, Liverpool.

R.N. Auxiliary Hospital, Woolton, was a light and airy building set on high ground in its own beautiful gardens. It was on the south-eastern outskirts of Liverpool. Two hundred-odd patients could be housed on three floors in the wings. In the centre court were a dining hall, galleys, and above these a good recreation hall and chapel. The main offices were near to the entrance which was at the end of the main corridor. This corridor had several good rooms, suitable for officers' cabins, except that they all opened directly on to this public thoroughfare. There was a good W.R.N.S. quarters and a small sick berth staff quarters at the back centre. In a small yard below these the ambulances were housed. At the top of the female wing were two valuable cubicle wards, one for officers and the other for cases under observation. There was a small operating theatre, without anaesthetic room, opening out of the corridor to the male wing. There was also a small X-ray department, laboratory, physiotherapy department and dispensary. These sent their more elaborate work to Seaforth. There were no P.M. rooms or animal houses attached to the small clinical laboratory.

The distance between Seaforth and Woolton was 11 miles by road.

There were two operating theatres in Seaforth on the ground floor at the end of the surgical corridor, one for clean and the other for septic cases. There was an attached sterilising room and surgeons' room, and nearby was the instrument room. The clean theatre was small, and access was not too easy. The artificial lighting and temperature regulation were satisfactory. Few theatres can have been harder worked, not only in general surgery and emergencies, but also in ear, nose and throat cases.

The theatre at Woolton was used for emergency cases, gynaecological cases, tonsillectomy and certain orthopaedic procedures.

The ear, nose and throat department was housed in the basement of the north wing at Seaforth and contained a general clean ward of 22 beds, and a ward for infective throats of six beds. There was also a large out-patient department.

The X-ray department was housed in the central block on the same floor as the administrative department. The physiotherapy department was placed in the basement. Room was allotted for the pulmograph unit in the southern wing.

The laboratory, which was cramped for space, was also on the administrative floor. It contained a main laboratory and a Senior Medical Officer's room. There was an auxiliary clinical laboratory at Woolton. Special investigations were carried out at Liverpool University. A mortuary and post-mortem room were improvised in the south wing.

Medical transport was organised for the whole Command by R.N. Sick Quarters. The hospitals of Seaforth and Woolton each had their own ambulances and utilicon; Seaforth three ambulances, Woolton two. In addition there was a small car at Seaforth.

The united hospitals of Seaforth and Woolton were not really completed and in running order until mid-1943. In September 1943 there were 53 sick berth ratings and 32 V.A.Ds. in the two hospitals. The Admiralty approved the substitution of 33 sick berth ratings by 30 V.A.Ds. and 5 W.R.N.S. as stewards and clerks. This resulted in a total of 20 sick berth staff and 62 V.A.Ds. between the two hospitals.

When Seaforth opened there were six medical officers, including the Surgeon Captain. By September 1943 one more medical officer had been appointed. Accommodation for medical officers at Seaforth was either in the mess or in private houses, which were very difficult to come by. At Woolton there was only room for the officer on duty. The rest had to find outside lodgings. In each hospital the sisters were quartered in large requisitioned houses at some distance from the hospital. The same applied to the V.A.Ds., whose quarters, however, were not occupied until early in 1944. Motor buses carried the Sisters and V.A.Ds. to and from their hostels.

That the number examined and treated was constantly rising at this period is shown by a comparison between the figures of 1942 and 1943:

	1942	1943
Total medical admissions . . .	993	1,762
Total surgical admissions . . .	955	1,603
General and spinal anaesthetics . .	471	713
Operations	893	1,276
E.N.T. operations	355	644
Laboratory investigations . . .	16,877	24,859

The out-patient traffic at both hospitals was greatly increased in 1943.

The administrative departments were all housed at Seaforth, including the Senior Accountant Officer's offices. All female patients were housed at Woolton, except certain special categories who came to Seaforth in the first instance, but were transferred to Woolton after investigation and operation. Gynaecology was practised exclusively at Woolton. All skin cases were also dealt with at that hospital.

Woolton had its own operating theatre, a small laboratory suitable for clinical work, a small, but very efficient X-ray plant and a physiotherapy department. There was also a pharmacist for storekeeping and dispensary duties. All these departments were in the hands of staff, either sick berth staff or V.A.Ds., and under the supervision of the medical officers of Seaforth. The medical and surgical specialists of that hospital, as well as the anaesthetists and X-ray officer, visited Woolton regularly. The Principal Medical Officer visited Woolton twice weekly.

Serious air raids occurred over Liverpool in the latter part of 1940 and the first half of 1941. In May 1941 there was a very serious continuous raid lasting over a week, which all but paralysed the dock

area. Bootle, a borough near R.N. Auxiliary Hospital, Seaforth, was very badly damaged and the proximity of the Gladstone Dock to R.N.A.H. was an attraction for bombers. Actually, although all the glass in the hospital was blown out, only one bomb exploded in the grounds. There were no serious casualties among patients or staff. After May 1941, there were only scattered and ill-sustained raids, but the passive defence organisation had to be kept going throughout. In the crowded state of the wards in 1942, where beds were double-banked and the blackout curtains closed, the conditions were very far from perfect, either as regards health or comfort.

Eventually there were at Seaforth a Principal Medical Officer, a Deputy Principal Medical Officer and eight medical officers. A woman doctor (surgeon lieutenant) was appointed to W.R.N.S. Sick Quarters at Gledhill and for the W.R.N.S. Sick Quarters at Derby House (C.-in-C.'s Offices) and at Blundellsands (the W.R.N.S. Holding Depot). At Woolton were a Senior Medical Officer (surgeon lieutenant commander and gynaecologist) and three medical officers. A chaplain, a paymaster and a naval schoolmaster formed an essential part of the organisation, as did the warrant officer for the two hospitals. The specialists, except the gynaecologist, were at Seaforth.

In February 1944 a Surgeon Rear Admiral was appointed to this Command owing to the marked increase in the personnel of Western Approaches.

A large number of cases were admitted as a result of enemy action, some from ships, some from hospital ships, and some from E.M.S. Hospitals in Northern England and Southern Scotland. Out-patient surgical clinics became a feature, and a good liaison was founded between R.N.A.H. and the E.M.S. Hospitals. The Liverpool Radium Institute became of the utmost help, not only in malignant cases, but in deep X-ray therapy for skin cases. The Merseyside Blood Transfusion Service provided adequate supplies of blood.

In the first quarter of 1945 the Surgeon Rear Admiral reported: 'The work has been very heavy, both Seaforth and Woolton being practically full continuously, vacancies being made possible only through transfers to other establishments and by discharge to sick leave'.

The volume of correspondence was immense, and the administrative staff had to work overtime to cope with this flood of written material.

In February 1946 the Liverpool establishments came under the immediate command of Commander-in-Chief, Plymouth. Moreover, after February 1946 there was a definite easing of all activities, except when ships returned from the Near and Far East with invalids, ex-prisoners-of-war, and quarantined personnel. By this time the number of patients in the combined R.N. Hospitals of Seaforth and Woolton was 460. In June 1946 these figures had come down to 300, and by the end of August to 200. In August 1946 it was decided to close the two

tuberculosis establishments at Southport and Rainhill, to use Rainhill for general purposes in conjunction with Seaforth, and finally to close Seaforth and keep Rainhill as the final hospital in the area.

The R.N. Auxiliary Hospitals Seaforth and Woolton, between them received and treated altogether 15,471 Service patients.

R.N.A.H. SOUTHPORT AND R.N.A.H. RAINHILL

The R.N. Auxiliary Hospital, Southport, was opened in 1943 for the reception of service cases of pulmonary tuberculosis, pending vacancies in the overcrowded sanatoria of the country. For this purpose the Victoria Hotel, Southport, which had been requisitioned since the beginning of hostilities by the Ministry of Works, was taken over for conversion by the Navy early in 1943; necessary alterations were put in hand, and the first patients admitted on October 14, 1943.

Alterations included a considerable amount of redecorating, fitting out of an operating theatre, dispensary and X-ray room, laying of linoleum in the whole establishment, fitting of blackout frames to 400 windows, and installation of 10 bed-pan sluices, a sputum cup washer and disinfector. The blackout frames were made on 'hopper' lines to allow as much air to enter the rooms as possible during the night.

The establishment was built in the shape of a large letter 'L', the limbs of which opened direct upon two of the principal streets of a popular seaside resort. It comprised ground floor, large basement, three upper floors and a tower. Accommodation was provided for approximately 210 patients. Three wards on the ground floor were constructed by conversion of the ball-room, dining room and smoking room, accommodating some 65 patients. The rest were housed on the first floor which contained the officers' and women's blocks, and the second floor.

Each of these floors offered nothing larger than approximately 20 bedrooms, each accommodating three or four patients. Offices, telephone exchange, library, occupational therapy rooms and chapel were housed on the first floor. Medical officers' mess, cabins, wardroom and nursing sisters' mess were situated on the second floor, and on the third floor one wing was used as cabins for the female nursing staff, and the other for the sick berth staff. In the basement the hotel kitchens made an admirable galley without alteration. Baggage store, canteens, storerooms and sick berth staff mess were also on this floor.

The staff consisted of:

- 4 medical officers.
- 1 dental surgeon.
- 1 accountant officer.
- 1 commissioned wardmaster.
- 1 matron.
- 8 nursing sisters.
- 1 pharmacist.
- 35 V.A.Ds.
- 35 sick berth staff.
- 1 second officer.
- 60 W.R.N.S.

Specialist departments consisted of an X-ray room, containing tomograph and ordinary X-ray unit, and a small operating theatre for induction and refilling of artificial pneumothoraces and phrenic crushes.

Bath water and central heating plants were most satisfactory and constant hot water was a most comforting feature. Bathroom and lavatory accommodation was adequate. Cooking was done by coal ovens. The standard of catering was high, abundant in quantity, exceptional in quality, a generous supply of eggs, milk and butter being included. The W.R.N.S. cooks carried out their duties with commendable efficiency, and the food was always appetising and hot owing to the use of elecric food trolleys.

Enemy attacks on this county were more or less over by the time that R.N.A.H. Southport was opened, and no raids occurred at all. The air raid shelter was the basement. The hospital staff was exercised in passive defence in conjunction with weekly fire-drill, and a gas cleansing station was fitted out in the back entrance to the hotel.

There were ten main fire hydrants inside the hospital, and arrangements were made for co-operation with the local National Fire Service and Civil Defence organisations in case of need. Fire buckets, pyrene and foam extinguishers were distributed throughout the several floors, and outside fire escapes were accessible from all floors. A sick berth chief petty officer was put in charge of fire fighting arrangements.

R.N. Auxiliary Hospital, Rainhill, was taken over as a subsidiary to R.N.A.H. Southport in 1943. It accommodated 150 cases, was situated about 25 miles distant, and was visited weekly by the Medical Officer-in-Charge, Southport. Both hospitals received a monthly visit from surgical and medical consultants. The former had a full operating day on cases of thoracic surgery, the latter advised on lines of treatment generally, diagnosis, progress and prognosis. Cases of pulmonary tuberculosis were notified as diagnosed to the Ministry of Health, which in turn notified the appropriate County Medical Officer, who, after calling for clinical data, put the case on the waiting list for the sanatorium nearest to the patient's own home.

Some cases with a satisfactory A.P. were discharged to their own homes to await admission to a sanatorium under dispensary supervision. A few minimal cases were discharged to duty. A wide liaison was established, on the one hand with the Royal Naval and Auxiliary Hospitals, which discharged their cases to Southport, on the other with all County Medical Officers and Medical Superintendents of the various sanatoria, including private establishments, with regard to the reception of patients. Transport to sanatoria was done by train, ambulance and air, with the appropriate escort of sick berth staff, V.A.Ds., nursing sisters or medical officer. General surgical and medical cases from the staff and patients were discharged to R.N.A.H. Seaforth.

Occupational therapy played a prominent part in the work of the hospital, and a fully qualified occupational therapist was employed. All the patients participated happily, and considerable skill and ingenuity were shown in leather-work, toymaking and embroidery.

A schoolmaster, who was appointed to the Liverpool area, visited three days a week, and arranged lectures on current affairs to both patients and staff. Educational as well as non-documentary films were shown daily. Brains trusts and 'quizzes' were popular. An excellent library was maintained by the Lancashire Branch of the British Red Cross. Services were held by the chaplain in the largest ward. Wireless was supplied in all wards. Special courses were arranged for members of the staff. Physical recreational facilities were practically non-existent for the patients, owing to a complete lack of airing ground. A small yard at the front was made into a solarium, the glass awning being painted black to keep off the direct rays of the sun. Carriage drives and car trips were allowed to selected cases, and a few were allowed afternoon leave. V.A.Ds., sick berth staff and W.R.N.S. had facilities for tennis, cricket, football, swimming, sailing, dancing, cinemas, and the other amenities of a popular seaside resort.

On September 4, 1946, the establishment ceased to be a naval hospital, and all patients were evacuated to the L.C.C. Hospital, Dartford.

During its existence, R.N.A.H. Southport, received and treated 2,234 patients, and its subsidiary establishment at Rainhill 3,037 patients.

R.N. AUXILIARY HOSPITAL, LONDONDERRY

R.N. Auxiliary Hospital, Londonderry, opened on September 14, 1944. At that time the work of the port had reached a peak from which there was a subsequent gradual decline. Between May 1942 and August 1944 the U.S. Naval Hospital, Creevagh, provided all hospital facilities for the Base.

The original building on the site was a military camp consisting of sixteen huts with galley, dining hall and sanitary annexes. This camp was completed in 1939 as a supplement to the adjacent military barracks. In 1940 the camp was converted into a hospital, and was used as such by the R.A.M.C. and U.S.A.M.C. The huts were connected by a substantial brick corridor, and a brick extension on the east side provided an operating theatre and X-ray department. Offices were built on the south side. Each hut provided a ward. The hut, 60 ft. long, consisted of corrugated zinc sides and roof lined with Baltic sheeting. It had doors at each end and ten large windows. In all but three, a small galley with electric hot plate was built up at the corridor end.

Heating was provided by hot water radiators throughout the buildings from four low pressure boilers. A further small boiler was installed in one boiler house for high pressure steam to the theatre block when the

conversion to a hospital took place. As a result of building the corridors, two of the low pressure boilers became rather isolated from their full supply, and by their situation were considered to increase the fire risk in the hospital.

The original medical staff appointed comprised:

1 Surgeon Commander R.N.—Acting Surgeon Captain, R.N., Medical Officer-in-Charge.
1 Surgeon Lieutenant Commander R.N.V.R.—Medical Specialist.
1 Surgeon Lieutenant Commander R.N.V.R.—Surgical Specialist.
1 Surgeon Lieutenant R.N.V.R.

In addition, one surgeon lieutenant, R.N.V.R., appointed to the Base as N.P. specialist, Northern Ireland, had a ward in the hospital, and another medical ward was supervised by a surgeon lieutenant appointed to H.M.S. *Ferret*.

The nursing staff comprised:

1 Senior Sister Q.A.R.N.N.S. active service—Acting Matron.
7 Sisters Q.A.R.N.N.S. reserve.
50 V.A.D. nursing members.

The sick berth staff averaged 21 of all ranks.

No accommodation was available for the staff in the hospital grounds. The medical and sick berth staff were accommodated in the adjacent R.N. Barracks. The Matron and sisters lived in what had been in peacetime a major's quarters five minutes walk from the hospital. The V.A.D. nursing members were accommodated in eight military families' quarters even further away. This entailed a walk of 15 minutes from quarters when going on and off duty, and in very wet weather was a serious drawback.

Before the opening of R.N. Auxiliary Hospital, all hospital cases were sent to the U.S. Naval Hospital at Creevagh, seven miles away on the North side of the river Foyle. This hospital closed down in August 1944, and a large part of its equipment was transferred to R.N. Auxiliary Hospital. The equipment included beds of a type new to naval hospitals, and presented the advantage that by turning two handles at the foot of the bed, the mattress folded up under the knees and the head end was raised. This was of great assistance to the nursing staff.

The operating theatre accommodated one operating table and steam sterilising equipment. The adjacent anaesthetic room, sink room, surgeon's changing room and sisters' store room were well planned. The majority of the equipment was American and of good design. The X-ray department was placed next to the operating theatre with a communicating door between. In size, ventilation and protection, it was well within the standards laid down by the British X-ray and Radium Protection Committee. The equipment was entirely American, the main unit being a Victor R.39 with tilting table.

The physiotherapy department was situated in one of the huts. Equipment of American origin was available, including infra-red and ultra-violet lamps and diathermy. As the majority of the equipment was designed for 100-volt supply, a rather cumbersome transformer was provided to operate it. This had also to be taken round the wards to operate the portable X-ray machine.

Water was supplied from the City mains, and was soft upland water of good quality. Electricity was obtained from the Corporation supply provided by the power station in Londonderry. A small emergency motor dynamo unit was built just outside the operating theatre to provide an emergency supply. Drainage was connected to the local main water carriage system, discharging into the River Foyle. This river is tidal for several miles upstream from Londonderry.

It was not considered practicable to appoint a supply officer for hospital duties only, and the duties of supply officer, R.N.A.H., were allocated to an officer on the staff of Base Supply Officer, Londonderry, on a part-time basis. Three W.R.N.S. ratings worked in the hospital under his supervision. The accountant and stores officer duties fell to the Medical Officer-in-Charge personally, and the warrant wardmaster.

No hospital laundry was provided, and all work for hospital and nursing staff was done by local firms.

An R.N. Medical Depot under the charge of a pharmacist was already operating in Londonderry when the hospital opened, and continued to issue Service afloat stores.

The accommodation always allowed of fifty beds being immediately available for casualties. Reception of such a number would have thrown a heavy strain on the nursing and medical staff which could not readily be reinforced. In fact, very few casualties were received.

Ample supplies of plasma, serum and glucose saline were kept in stock. A list of available blood donors was kept up to date in the adjacent R.N. Barracks, and the liaison maintained enabled a transfusion to be available at half an hour's notice.

During the process of conversion of the camp to a hospital, blast walls were erected round the administration offices, and sand bag screens round the operating theatre and wards.

The provision of central heating reduced the fire risk in this hospital considerably. A further excellent point was that speedy evacuation of any ward or department was a simple matter, all the buildings being single storey. Each ward had a large door at each end through which a bed could easily be wheeled, and below each outside door a well-built sloping concrete ramp provided an easy gradient to the ground.

The sergeant of Admiralty civil police was in charge of fire fighting personnel, and additional assistance was available from the R.N. Barracks, fire parties in the adjacent main barracks and the National Fire Service. No call was made on fire fighting services.

The civil hospitals in Londonderry comprised the following:

City and County Hospital . . .	100 beds.
Waterside Hospital	120 „
Eye and Ear Hospital	30 „

During hostilities these were administered under the Emergency Medical Service Scheme. As R.N. Auxiliary Hospital could only muster one surgical team, no outside assistance could be arranged.

Two military hospitals functioned in Northern Ireland at this time:

Military Hospital, Belfast . . .	600 beds.
Military Hospital, Bangor . . .	600 „

These were nearly 100 miles from Londonderry. They accommodated sick from the Naval Base, Belfast, who could not be dealt with in R.N. Sick Quarters, and from the Naval Air Stations in County Antrim and County Down. Patients were sent from Londonderry for consultation with the ophthalmic, E.N.T. and skin specialists.

Occupational therapy for patients was organised from the time the hospital opened, and achieved a high standard. It was supervised by the Joint War Organisation representative in Londonderry with the aid of experienced and skilled local civilian volunteers. Ample supplies were obtainable from J.W.O. sources, and the personality and zeal of the voluntary workers made all but the very short term cases take up this work.

In addition, concerts and other entertainments were organised, and walking patients taken on outings where they were the guests of British Legion organisations in nearby towns and villages. Other civilian volunteer workers ran the patients' library service. An excellent selection of books was maintained.

A medical officer on the staff was appointed as liaison educational officer for co-operation with the instructor lieutenant who organised educational facilities in the base. No separate lectures were organised in the hospital as ample facilities existed in the adjacent barracks.

A pleasant feature in winter was the weekly music circle where programmes were played from records on a radiogram.

Members of the staff had, in addition, the opportunity of borrowing books from the patients' library, and attending the weekly cinema and concerts organised mainly for the patients.

Courses of instruction in nursing were organised and lectures given by a sister Q.A.R.N.N.S.(R) who showed an aptitude for this type of work.

During its existence R.N. Auxiliary Hospital, Londonderry, received and treated 1,559 Service patients.

R.N. ORTHOPAEDIC REHABILITATION CENTRE, BROMLEY

Oakley House, Bromley Common, Kent, was taken over and started up as a rehabilitation centre for naval ratings and Marine other ranks in 1944.

Although the house, out-buildings, sleeping huts and gymnasium were still in the hands of the workmen, it was possible to take in the first patients on March 27, 16 in all. These were accommodated in the one sleeping hut available. By June 15 the numbers had risen to 43, a second sleeping hut having been opened. Unfortunately, at 0400 hours on June 16, during the first concentrated attack by the enemy with flying bombs, a near miss caused such damage that the place was made uninhabitable. The patients and the greater part of the physical and recreational training staff were transferred to R.N. Hospital, Chatham, where a ward was turned over to their use, and rehabilitation work recommenced after only a few days interruption and continued at the hospital for the next five weeks.

During this time, the Medical Department had asked for and obtained the use of St. Felix School, Southwold, Suffolk, already requisitioned by the Admiralty, and recently vacated by Force L. Accordingly, on July 27, the centre moved out of R.N. Hospital, Chatham, and up to Southwold. Work continued without further interruption for some months and the number of patients rose to 140, the maximum that could be accommodated and treated without increase in floor space and instructional staff. In May 1945, instructions were received that the centre was to move back to Bromley, as St. Felix School was to be derequisitioned. This necessitated the discharge of all patients until the period of transfer was over. By May 28, all patients had been discharged and remedial work had finished for the time being.

Oakley House, Bromley Common. This country house, together with about nine acres of ground and a walled-in kitchen garden, was requisitioned early in 1944. To this nucleus were added, or were in the process of being added, four prefabricated sleeping huts for patients, each accommodating about 30 patients in double tiered beds, a N.A.A.F.I. canteen, a gymnasium 108 ft. × 60 ft., together with washing and lavatory facilities for patients, a small physiotherapy room and various offices.

When the first patients were received on March 27, the gymnasium block and N.A.A.F.I. were still unfinished and therefore not available. Work on these two buildings was nearing completion when the bomb damage occurred.

Of the four sleeping huts, two were eventually used by patients, the third was in use as the contractor's store and office, and the fourth was used as a gymnasium. With the small number of patients and the assistance of fine summer weather, it was possible to carry on useful work, most of which was done out of doors with patients stripped to the waist.

The staff of 22 W.R.N.S. and 18 ratings was accommodated in the house itself. Accommodation was cramped and washing facilities poor.

The W.R.N.S. had one bath for 22, and the ratings, including 22 petty officers, had to share two showers with the patients.

The officers were also accommodated in the house itself. There being no separate galley, staff, patients and officers were all on general messing. The food was good and well cooked.

The seven acres of field in front of the house had been untouched for several years, but with the help of a local farmer and the Bromley Borough Council, enough work was done on it to provide a smooth mown area large enough to play basket-ball and football. An area at the back of the house, the size of two tennis courts, was made into a rough but playable bowling green, which was in constant use.

The walled-in kitchen garden of about one acre contained six hot-houses with grape vines, peaches and nectarines. The garden was overgrown with the weed of three years uninterrupted growth, and a horse and plough had to be hired to start preparing the soil for seeds. Most of the early work in the garden was done by the petty officers and ratings of the staff. When the patients were admitted, they were put into the garden for a period each day as part of their rehabilitation. Later, a civilian gardener was added to the complement. To encourage industry, the petty officers, ratings and W.R.N.S. were each given a small allotment, the produce from which they were allowed to use.

At Bromley, all patients were received from R.N. Hospital, Chatham. The cases were all orthopaedic in type, the majority being fractures or knee injuries.

Patients' clothing consisted of blue football shorts with elastic top, a coloured football shirt, a brown overall suit and a pair of gym. shoes. The shirts were of different colours, the colouring differing according to the remedial class in which the patient was placed. Gym. shoes were worn for remedial work and games only, in order to conserve stocks, as the war-time issue did not wear well. Patients were encouraged to strip to the waist in good weather.

Patients slept in double tiered bunks with coir mattresses, one or two pillows each, and three blankets. Patients seemed to experience no difficulty in getting on or off the top bed of a double tiered bunk in spite of their injuries. Each patient had half a double kit locker for his uniform, gear, etc., and towels were hung from two lines stretching the length of each hut. The huts were well ventilated.

One of the reasons why no more than 40-odd patients could be accommodated was that the washing and lavatory facilities in the gymnasium block were never completed. As a result, 43 patients and the male staff of 18, including 12 petty officers, had to share the single outside wash place and two showers. The patients had two W.Cs. and a urinal to themselves.

In order to save time and labour, the cafeteria system was adopted for meals. Serving was rapid and the food was always hot. A rota of

patients helped the cooks with the serving, and the stewards with the washing up after meals.

It was decided at the outset that patients at a rehabilitation centre would need plenty of food. They were men taking more physical exercise than they would normally take in the course of their duties; they were in the open air as much as weather would allow, and they were building up muscle. In fact their requirements were similar to those of a healthy schoolboy. In addition, good food and plenty of it produced a feeling of pleasurable contentment, and a contented patient was usually industrious and co-operative in his remedial work.

Fortunately, the patients were entitled to extra rations of butter and, what was especially useful, 3½ pints of fresh milk a week. With these extra rations, and by taking a daily list of libertymen who would be ashore for supper, the supply officer was able to produce a menu which satisfied all requirements as regards calories and contentment. A special point was made of giving the patients a much later supper than they would normally have had in Barracks or H.M. Ships. Soup was usually served at night in addition to a main dish with vegetables, sweet, and cocoa or coffee. The feeding was a pronounced success and the standard remained consistently high.

Patients were responsible for the cleaning of the sleeping huts, recreation rooms, wash places and heads as well as pathways and the surroundings of huts and house generally. They were put into four watches. The non-duty watches were granted shore leave from 1700 hours Friday to 1200 hours Monday. Patients wore uniform for shore leave without any distinguishing marks, and were allowed to go where they pleased. The chief amenity was the situation of Bromley, a town of 40,000 inhabitants, only a 2d. bus ride away, with buses passing the main entrance to Oakley House every few minutes.

The two main cinemas each made reduced prices for patients. The R.N. Old Comrades Association granted honorary membership to all patients, and their club-room contained a bar. Free tickets or tickets at reduced prices for dances were always being received. Patients were invited to entertainments given by the local organisations.

Darts, shove ha'penny, table tennis, playing cards, and a piano were supplied by War Amenities and the Red Cross. The Red Cross supplied, in addition to 25 bicycles for medical purposes, arm chairs, cushions, sofas, coconut fibre carpets and other items of furniture and decorations. War Amenities donated a sound reproduction equipment with 20 loudspeakers and a microphone for announcement. Loudspeakers were installed, two in each sleeping hut, in the carpenter's shop, galley, staff mess rooms, and N.A.A.F.I.

Fresh patients were admitted once a week, coming up in an ambulance coach from Chatham and arriving just before noon. Bed tickets and

X-rays came with the patients. Patients for discharge were taken back in the same ambulance in the afternoon.

Each patient was examined on admission and full notes of the history and examination were entered on a special record card. Each patient was thereafter examined at weekly intervals, when further progress notes were added and any change in class or activities was recorded. A copy of all these notes was made into the bed ticket, so that on discharge there was available in the bed ticket returned to hospital a full record of the man's disability from start to finish. Patients were discharged direct to duty, except for a few returned to hospital for further treatment or reassessment, but were all seen as orthopaedic out-patients on the afternoon of discharge. A 'follow up' card was given to each patient on discharge, with the date on which he should return it. If he failed to return it, a second card went to his home address.

The class instructor (P. & R.T.I.) attended each consultation of the patients in his class, so that his opinion on patient's progress could be given, and any queries explained by the medical officer.

Treatment consisted essentially of remedial exercises done in classes, each class under its own instructor. Patients were put into classes according to the site of their injury and degree of recovery. The classes were as follows:

A Class consisted of patients in leg plasters, patients with knee injuries, and all those on crutches. The object of treatment in this class was to develop quadriceps tone and, in addition, in the plaster cases, to prevent clawing of the toes.

B Class consisted of patients with ankle injuries or ankle weakness. It included fractures of the shaft of the tibia and fibula, as well as all fractures and injuries around the ankle and foot. The object of treatment was here to develop the calf and foot muscles, and at the same time to re-educate in walking.

C Class consisted of patients from both A and B who had progressed to a stage where much more activity and strenuous work could be done to develop all the muscles of the leg. At the same time these patients were taught to co-ordinate their movements so as to be able to balance, jump and run.

D Class consisted of patients in the early stages of recovery from injuries to the shoulder, elbow and wrist.

E Class consisted of patients who were well advanced in their stage of recovery from arm injuries and could quite safely do more strenuous work. Suitable cases of hand injuries from this class were sent to the workshop for carpentry, in order to develop the grip of the hand.

F Class consisted of patients with fractured vertebrae, both in or out of plaster. The object was to correct posture, develop abdominal and back muscles, and to restore flexion of the spine.

G Class was a final class for the spines and legs. In this class patients underwent a fairly strenuous P.T. programme which included hopping, running, jumping and some ground work and agility.

Remedial exercises were designed with three objects in view:

To develop muscle power.

To regain mobility of stiffened joints.

To co-ordinate muscle and joint action, so that the patient might again be able to run and jump and play games.

The whole emphasis was placed on the first aim of developing muscle power, and this depended on the patient's own efforts to work his wasted muscles to the maximum of which they were capable, and on the personality and class-taking ability of the instructor, who gave the patient the necessary impetus and encouragement to make these efforts.

It was obvious that a patient could not spend the whole day doing remedial exercises, however varied they were and however good the abilities of the instructor. Tedium was inevitable. Therefore periods of remedial exercises were interspaced with other activities such as games, gardening, cycling, window cleaning, carpentry and wood-cutting.

Three main games were played according to the stage of recovery of the patient. For those on crutches, bowls combined pleasure with a certain amount of exercise. For those in the early stages of recovery from any type of injury, volley ball was found to be a most useful game. For the advanced cases basket-ball provided plenty of running and jumping. All three games produced in the excitement of the moment involuntary movements of which the patient thought he was incapable.

Physiotherapy was found to play very little part in the remedial programme, apart from the occasional use of an infra-red lamp.

The staff consisted of two medical officers, a supply officer, a boatswain P. & R.T., and a P. & R.T. officer who worked at both Lewestone Manor and Oakley House and divided his time equally between the two centres. Six P. & R.T. instructors, all 'hostilities only' petty officers, and two sick berth petty officers carried out the remedial programme. W.R.N.S. were employed as cooks, stewards, writers, supply, stores and motor transport ratings.

The second medical officer, the P. & R.T. officer, and the boatswain and the six P.T.Is. all came from H.M.S. *Bristol*, an establishment which did work resembling that of rehabilitation, namely the training of Grade II (physically) new entries. In addition they had all spent a fortnight at one or other of the R.A.F. Rehabilitation Centres.

Before the first patients were received, an opportunity was taken to visit and see the rehabilitation schemes run by the Army Convalescent Depots at Kingston, the Army Hospital at Orpington, the Albert Dock Hospital, and the Artificial Limb Fitting Centre at Roehampton. All the staff thus had ample opportunity of comparing the work at these

different centres and working out a scheme of treatment to fit the type of case to be sent to Bromley.

On the morning of June 16, 1944, Oakley House was rendered uninhabitable by bomb damage. Of the 43 patients then under treatment, 13 were sent back to full duty, and the remaining 30 were discharged to R.N. Hospital, Chatham, where an empty medical ward was turned over to their use.

St. Felix School, Southwold. On July 22, 1944, the centre transferred to St. Felix School, where work continued without interruption until May 1945. The school consisted of four separate houses, a sanatorium, also separate, and a further block of three houses. Officers occupied the headmistress's house, the staff (W.R.N.S. and ratings) another house, while the patients occupied the greater part of the block of three houses. Of the remaining two houses, one was used as a storehouse for the large quantity of furniture still remaining at St. Felix, while the other remained empty.

The amount of floor space available was one of the main factors governing the number of patients who could be treated at any one time. Although St. Felix was a school taking over 200 pupils in peacetime, floor space for remedial work was limited. There were no large classrooms, and the only rooms large enough for remedial work were the gymnasium 60 ft. × 40 ft., the assembly hall 48 ft. × 27 ft. and the concert practice room 36 ft. × 24 ft. The arts room and domestic science room were both large enough, but were not requisitioned by the Admiralty and were not available.

The gymnasium was the only room where games such as basket-ball and volley ball could be played, the concert practice room being too small and the floor of the assembly hall too weak. In summer, floor space offered no problem except when it was actually raining, but in winter, with cycling, outdoor games and even walking often impossible, indoor space was badly needed. The gymnasium, though small, was most useful, not because of the apparatus it contained, but because it had a sprung floor.

There were excellent grounds at St. Felix and ample space for every sort of outdoor activity. There was a full size hockey pitch, and hockey was played both in summer and winter. A football pitch in good condition was available as well as tennis courts, croquet lawn, and lawns suitable for bowling greens. An outdoor swimming bath was unfortunately not in working order.

All patients were accommodated in the block containing three houses. They slept in double tiered bunks in bedrooms holding any number from 2 to 14. There were 14 bathrooms available for patients. There were 2 large dining rooms, one opening into the other, each of which would take 60 patients. A further small room was used for chief and petty officer patients, who messed separately.

PLATE X. A general medical ward.

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PLATE XI. Rehabilitation at a naval hospital.

PLATE XII. Occupational therapy in a naval hospital.

PLATE XIII. Patients at a rehabilitation centre.

Cooking facilities at St. Felix were not so good as those at Oakley House, where in addition to a coal range and three gas cookers, there were potato cleaning and mixing machines as well as a refrigerator lent by the British Red Cross. The standard of diet, however, remained consistently high.

Patient chief and petty officers were given separate sleeping and messing accommodation from the other patients, Free Gangway, and an extension of shore leave until 2300 hours. In return for these privileges, they were made responsible for the behaviour of patients and supervised the work at cleaning stations, blackout rounds and galley duties. This plan worked with success.

On the transfer of the centre to St. Felix, patients were admitted direct from sick quarters and hospitals, without being first sent to R.N. Hospital, Chatham. The method of transfer was promulgated in A.F.O. 4721/44 paras. 3, 4 and 5, which read:

> 'Requests for transfers from other hospitals, etc., must in the first instance be made by letter to the medical officer-in-charge of the centre, and should include a summary of the case.
>
> 4. The centre will be run on the lines of a training establishment, rather than as a hospital, and patients will receive pay and not hospital allowance. The accountant officer will maintain a ledger, on which all members of the staff will be borne for pay and all patients for victuals only.
>
> 5. H.M. Ships and Establishments which receive information on Form M.22 of transfer to the orthopaedic rehabilitation centre of ratings and marines borne on their books are to forward to the centre a victualling transfer list showing the man's rate of pay. When a man is transferred from this centre the transfer list will be returned to his ship or establishment showing the period victualled at the centre, his disposal and any charges to be made against his account.'

Patients were received from most of the Royal Naval Hospitals and Royal Naval Auxiliary Hospitals in Great Britain as well as from R.N. sick quarters and several E.M.S. Hospitals. Patients were discharged direct to duty. Those who were unsuitable for treatment or who failed to respond to a short trial of treatment (sciaticas and low back pains were examples) were transferred back to the hospital from which they had been sent as soon as it was apparent that further treatment would be a waste of time. A patient who, it was considered, would have to be invalided or needed further surgical treatment was transferred usually to R.N. Hospital, Chatham, for further assessment and/or disposal. Those who needed minor surgical treatment such as tenotomy, were sent into R.N.A.H. East Anglia for a few days, as no facilities existed for operative work at St. Felix.

Each patient discharged to duty took with him a note to the Senior Medical Officer of his ship or establishment which contained a short record of the man's injury and his present capabilities.

Analysis of Cases Treated March 1944 to May 1945

Total number of entries	587
Number of normal discharges	503
Number of accelerated discharges	52
Total number of discharges	555
Number under treatment May 26, 1945	32

Note. Owing to the transfer of the centre to Oakley House, Bromley, numbers were reduced to 32 by accelerating the discharge of 52 patients during the final week at St. Felix School, Southwold. These 52 patients are not included in the analysis of results below. The 32 patients remaining on May 26, 1945, were sent on leave on May 28, 1945, to rejoin at Oakley House, Bromley, after transfer of the centre.

Entries

	Number	Percentage
Leg injuries:		
Joining quadriceps classes on entry	262	45
Joining calf classes on entry	185	31
Joining general leg classes on entry	8	1
	455	77
Arm injuries	52	9
Spine injuries and disabilities	75	13
Non-orthopaedic	5	1
	587	100

Main Injury Groups Treated

Cases have been classified into 47 injury groups. The larger groups are shown below:

Post operative cartilages:	
Entered less than 60 days after operation	60
Entered 60 days—3 years after operation	47
	107
Miscellaneous knee injuries (I.D.K. strain, quads, insufficiency and torn ligaments)	75
Fracture of metatarsal bones	17
Fracture of os calcis	21
Fractures of ankle	90
Fractures of shafts of tibia and fibula	61
Fracture of shaft of tibia only	17
Fracture of shaft of femur	13
Soft tissue of wounds of leg	17
Fracture of arm, wrist and hand bones	36
Other arm and shoulder injuries	28
Fracture of vertebral bodies	49
Miscellaneous back injuries and disabilities	27
Peripheral nerve injuries	14
Other injuries	85
	657

Note: Several cases are included in more than one injury group.

Time of Entry

(Interval between injury and transfer to the Centre.)

	Number	Percentage
Up to 50 days after injury or operation	117	20
51–100 " " " " "	150	25
100–150 " " " " "	87	15
151–200 " " " " "	68	12
201–250 " " " " "	48	8
More than 250 days after injury or operation	102	17
Cases with no definite injury date	15	3
Total	587	100

Cause of Injury

	Number	Percentage
By enemy action	108	18
Otherwise on duty (rough sea, slips, falls, etc. Not organised games)	175	30
Accidents off duty (not including games, etc.)	94	16
Training (P.T., assault courses, shooting accidents, etc., while under instruction)	26	5
Other recreational activities	18	3
Cases with no definite injury or accident	11	2
Football (organised, off duty, or prior to entry)	124	21
Unaccounted for by above (no injury, medical, etc.)	31	5
	587	100

Source of Patients

	Number	Percentage
Prior to July 29, 1944: R.N.H. Chatham	74	51
After July 29, 1944: R.N.H. Chatham	225	
H.M.S. *Europa* and R.N.A.H. E. Anglia	170	29
R.N.A.H. Rainhill	30	12
R.N.A.H. Kingseat	17	
R.N.A.H. Invergordon	10	
H.M.S. *Westcliffe*	11	
29 Other establishments	50	8
	587	100

Up to this date cases were received from R.N.H. Chatham only. After transfer to St. Felix cases were received direct from any Medical Establishment.

Discharges

Figures are given for 503 normal discharges up to May 19, 1945.

Disposal		Number	Percentage
Discharged to duty	Full unrestricted duty	339	67
	Temporary restricted service	41	8
	Permanent restricted service	23	5
		403	80
Discharged to hospital	For further treatment and disposal	32	6
	For re-assessment	29	6
	With recommendation for invaliding	23	5
	Unsuitable for teatment in R.N.O.R.C.	10	2
	Other reasons	6	1
		503	100

Length of Stay in No. 1 R.N.O.R.C.

	Number	Percentage
25 days or less	75	15
26–50 days	151	30
51–75 days	115	23
76–100 days	78	15
101–150 days	60	12
More than 150 days	24	5
	503	100

Average length of stay in Centre of 403 patients discharged to duty . . 66 days
Average period of incapacity of 403 patients discharged to duty . . 195 days

During the week ending May 26, 1945, a further 52 cases were discharged who would normally have been retained for a longer period. Their disposal was as follows:

Full duty:	Category 1	26
	Category 3	1
	Category 6	9
		36
To hospital:	For re-assessment and disposal	8
	For further treatment	6
	With recommendation for invaliding	2
		52

Other smaller Royal Naval Auxiliary Hospitals were established in the United Kingdom at various periods during the war. A number of these, though granted the designation of 'hospital' were little more than centres of accommodation for convalescence and the overflow of minor illnesses from the larger establishments to which they were virtually annexes. A small number were of greater importance, and served either a small naval area or fulfilled a particular purpose.

R.N.A.H. Invergordon, was one of these, as were R.N.A.H. Kilmacolm, which served Clydeside, and R.N.A.H. Durdham Down, which dealt with minor and convalescent cases in the Bristol area. These three hospitals between them cared for 15,498 Service patients.

The R.N.A.Hs. at Cholmondeley Castle, Knowle, and Lancaster were devoted to neuro-psychiatry, and performed a useful function in the assessment, rehabilitation and ultimate disposal of such cases. Between them they received 6,358 patients.

Plates XI, XII, and XIII illustrate Rehabilitation and Occupational Therapy in naval hospitals.

R.N. SICK QUARTERS IN THE UNITED KINGDOM

The space available does not allow a detailed history to be given of the Royal Naval Sick Quarters in the United Kingdom and the work performed by each during the war years. Neither is it justifiable to devote time to more than the nominal and statistical tables which follow.

In the Royal Navy the term 'Royal Naval Sick Quarters' is one which is difficult to define accurately in the absence of any definite standard of established bed strength, or medical and nursing staffs. In general, the term is used as a title to denote a medical establishment, the status of which may be described according to the work it performs, as junior to a general hospital, but senior to a sick bay. But this description is not altogether true in some cases, for it may happen that by virtue of its isolation, a naval base may be served by a so-called sick bay which performs work to an extent which certainly merits the status of sick quarters. Again, isolation and remoteness of situation may involve a so-called sick quarters in responsibilities and commitments approaching those of a general hospital. Conversely, the title designating status may frequently be mis-applied in reverse. This was particularly so during the War of 1939–45, in which a large number of Royal Naval Sick Quarters came into being.

Royal Naval Sick Quarters such as Dartmouth and Shotley existed in peace-time, and continued during the war in the same form, albeit with increased commitments. But during the war other sick quarters arose, sometimes almost overnight, in which commitments varied enormously. For example, the Royal Naval Sick Quarters of H.M.S. *Europa*, Lowestoft, more than merited its title, as did the sick quarters of H.M S. *Royal Arthur* (Corsham), *H.M.S. St. George* (Douglas, Isle of Man), H.M.S. *Collingwood* (Fareham), H.M.S. *Orlando* (Greenock), H.M.S. *Duke* (Malvern), H.M.S. *Glendower* (Pwllheli), and the Royal Naval Sick Quarters, Southend.

On the other hand, some of the establishments which were termed Royal Naval Sick Quarters merited this title less than a number of medical departments of certain naval bases, which continued to exist as mere sick bays.

Patients Treated in R.N. Sick Quarters in the United Kingdom

Establishment	1939	1940	1941	1942	1943	1944	1945	Total
Aberdeen, H.M.S. *Bacchante*	—	406	642	614	1,088	666	338	3,754
Ardrossan, H.M.S. *Fortitude*	84	299	346	265	385	255	206	1,840
Auchengate T. E., H.M.S. *Dundonald*	—	—	—	569	1,221	956	839	3,585
Avonmouth, H.M.S. *Lucifer*	—	—	29	53	67	43	17	209
Barrow-in-Furness, H.M.S. *Clio*	—	97	256	288	54	166	45	906
Belfast, H.M.S. *Caroline*	—	—	—	—	—	397	346	743
Birkenhead, H.M.S. *Eaglet II*	—	—	324	282	171	100	226	1,103
Birkenhead, H.M.S. *Irwell*	—	—	—	276	668	1,007	512	2,463
Blyth, H.M.S. *Elfin*	5	333	276	441	407	391	314	2,167
Brighton and Shoreham, H.M.S. *Lizard*	—	—	—	—	330	555	366	1,251
Brightlingsea, H.M.Ss. *Nemo* and *Helder*	—	110	331	391	725	539	25	2,121
Bristol, H.M.S. *Bristol*	—	—	—	659	—	—	—	659
Campbeltown, H.M.S. *Nimrod*	—	126	611	642	1,119	1,209	863	4,570
Cardiff, H.M.S. *Lucifer*	—	—	—	289	147	142	62	640
Chatham, H.M.S. *Pembroke*	2,454	9,827	11,199	11,961	13,747	14,263	12,059	75,510
Clyde, H.M.S. *Spartiate*	—	130	656	661	1,032	957	596	4,032
Corsham, H.M.S. *Royal Arthur*	1,392	4,177	3,458	3,607	5,316	2,962	1,590	22,502
Creaghdu, H.M.S. *St. Christopher*	—	—	—	111	344	103	—	558
Cullercoats, N. and S. Shields, H.M.S. *Calliope*	—	1,159	2,630	2,374	2,019	1,911	1,134	11,227
Cunningham Camp, H.M.S. *St. George*	395	2,317	1,539	2,097	1,638	1,295	1,024	10,305
Dartmouth, H.M.S. *St. Helier*	—	6	71	48	4	66	30	225
Dartmouth C/F Base, H.M.S. *Cicala*	—	131	737	1,367	1,095	610	393	4,333
Devonport, H.M.S. *Drake*	1,122	7,414	7,678	8,209	10,043	10,468	9,900	54,834
Douglas, H.M.S. *Valkyrie II*	—	—	97	486	460	515	319	1,877
Douglas, H.M.S. *St. George*	332	1,229	1,066	1,832	1,924	1,427	1,268	9,078
Dover, H.M.S. *Lynx*	—	1,192	842	856	608	893	429	4,820
Dover, M.T.B., H.M.S. *Wasp*	—	20	144	143	283	315	—	905
Duncraig, H.M.S. *Trelawney*	—	161	409	348	183	104	60	1,265
Dundee, H.M.S. *Ambrose*	—	109	257	531	493	685	136	2,211
Dunoon, H.M.S. *Osprey*	—	—	463	630	961	780	974	3,808
Doonfoot, H.M.S. *Scotia*	—	—	—	758	1,570	974	443	3,745
Edinburgh, H.M.S. *Ubiquity*	—	—	—	—	—	127	343	470
Empshott	—	—	—	216	246	145	48	655
Falfield Coding School, H.M.S. *Cabbala*	—	—	223	335	316	262	264	1,400

Patients Treated in R.N. Sick Quarters in the United Kingdom (cont.)

Falmouth, H.M.S. *Forte*	7	182	331	374	395	356	156	1,801
Fareham, H.M.S. *Collingwood*	—	2,031	3,201	4,524	5,266	3,145	1,889	20,056
Felixstowe, H.M.S. *Beehive*	—	—	—	314	437	506	351	1,608
Fort William, H.M.S. *St. Christopher*	—	—	234	583	783	282	—	1,882
Gairloch	—	—	—	—	—	116	—	116
Glenshean, H.M.S. *Lochailort*	—	—	—	30	113	39	—	182
Gosport, T.E., H.M.S. *St. Vincent*	26	159	278	305	201	73	45	1,087
Gravesend, H.M.S. *Gordon*	—	—	63	127	40	—	—	330
Great Malvern, T.E., H.M.S. *Duke*	—	—	640	1,985	2,225	1,300	1,905	8,055
Great Yarmouth M/S Force, H.M.S. *Miranda* Great Yarmouth M.T.B. Base, H.M.S. *Midge* Great Yarmouth, H.M.S. *Watchful*	36	596	863	1,173	992	975	437	5,072
Greenock Boom Defence, H.M.S. *Orlando*	—	171	365	897	886	898	1,017	4,234
Greenock, H.M.S. *St. Colombo*	—	—	361	372	325	206	154	1,418
Grimsby, H.M.S. *Beaver I*	—	51	584	648	264	31	—	1,578
Hartlepool, H.M.S. *Paragon*	—	—	—	—	29	81	56	166
Harwich, H.M.S. *Badger*	93	1,045	1,038	903	771	499	619	4,968
Hexham Camp, H.M.S. *Standard*	—	—	—	112	224	126	57	519
Holyhead, H.M.S. *Bee*	—	—	—	—	—	279	65	344
Holyhead, H.M.S. *Torch*	—	—	—	202	236	—	—	438
Houton Bay	—	—	116	480	415	334	68	1,413
Hove, H.M.S. *King Alfred*	35	502	658	613	865	691	211	3,575
Howstrake, H.M.S. *Valkyrie II*	—	—	—	—	417	1,527	197	2,141
Hull, H.M.S. *Beaver II*	—	—	—	225	247	264	149	885
Immingham, H.M.S. *Beaver II*	—	5	190	445	519	513	433	2,105
Invergordon, H.M.S. *Flora*	—	217	136	202	316	302	50	1,223
Kiel (Southend), H.M.S. *Landrail*	—	—	—	106	364	441	320	1,231
Kirkwall, H.M.S. *Pyramus*	119	563	498	541	272	132	41	2,166
Lamlash	—	—	74	147	209	173	387	990
Largs, T.E., H.M.Ss. *Monck* and *Warren*	—	—	—	—	—	214	466	680
Larne, H.M.S. *Racer*	—	—	84	148	117	156	32	537
Lee-on-Solent, H.M.S. *Daedalus*	122	458	674	881	1,292	1,474	1,611	6,512
Leith and Granton, H.M.Ss. *Claverhouse* and *Lochinvar*	61	1,603	2,253	2,617	2,259	1,206	606	10,605
Lerwick, H.M.S. *Fox*	23	128	116	190	354	224	89	1,124
Liverpool, T.E., H.M.S. *Wellesley*	—	195	404	313	469	288	183	1,852
Liverpool, H.M.S. *Eaglet*	—	1,129	1,466	1,743	1,606	1,546	1,234	8,724

Patients Treated in R.N. Sick Quarters in the United Kingdom (cont.)

Establishment	1939	1940	1941	1942	1943	1944	1945	Total
London Area, H.M.Ss. *Shrapnel V*, *President V*, *Victory V*, *Attack* and *Dolphin*	—	—	4	513	1,595	1,512	873	4,497
Londonderry, H.M.S. *Ferrett*	—	—	535	638	1,315	1,044	756	4,288
Lowestoft, H.M.S. *Europa*	—	2,848	4,075	4,390	5,187	4,357	4,427	25,284
Lyness and Northness, H.M.S. *Proserpine*	—	673	998	1,041	899	896	831	5,338
Marlborough	—	—	—	67	445	422	174	1,108
Milford Haven, H.M.S. *Skirmisher*	162	335	642	718	563	640	331	3,391
Newhaven, H.M.S. *Forward*	—	95	261	604	853	635	148	2,596
Oban, H.M.S. *St. Andrew*	—	—	131	488	363	247	81	1,310
Pembroke Dock	—	—	45	201	153	65	66	530
Portland C/F Base, H.M.S. *Attack*	90	572	308	720	927	533	299	3,449
Portland, H.M.S. *Boscawen*	178	513	578	411	369	583	422	3,054
Portsmouth, H.M.S. *Victory*	968	5,529	5,098	8,831	11,036	10,635	8,618	50,715
Pwllheli, H.M.S. *Glendower*	—	288	1,625	1,905	2,034	2,049	1,276	9,177
Ramsgate, H.M.S. *Fervent*	—	100	94	130	196	193	189	902
Rosneath, H.M.Ss. *Rosneath* and *Louisberg*	—	—	—	57	543	—	46	646
Rosyth M.T.E., H.M.S. *Cochrane*	—	610	374	618	957	1,108	883	4,550
Rosyth B/D Depot, H.M.S. *Rooke*	—	302	593	517	823	828	527	3,590
Ryde, I.O.W., H.M.S. *Medina*	13	242	367	477	404	334	79	1,916
St. Budeaux, H.M.S. *Impregnable*	63	507	377	239	213	69	—	1,468
Sheerness, H.M.S. *Wildfire*	139	1,499	1,848	1,992	2,334	1,813	1,054	10,679
Shotley, H.M.S. *Ganges*	15	58	131	105	73	78	—	460
Southend	—	—	—	—	1,311	2,280	1,344	4,935
Southend, H.M.S. *Pembroke IV*	2,454	9,827	11,199	11,961	13,747	14,263	12,059	75,510
Stornoway	—	—	—	384	520	367	—	1,271
Swansea, H.M.S. *Lucifer*	—	481	652	734	623	498	296	3,284
Torpoint, H.M.S. *Raleigh*	—	812	2,131	2,317	2,550	783	640	9,233
Warrington, H.M.S. *Gosling*	—	—	—	724	3,722	2,426	1,269	8,141
Warsash, H.M.S. *Tormentor*	—	40	162	266	367	400	327	1,562
Wetherby, H.M.S. *Cabot*	—	244	809	524	748	274	—	2,599
Weymouth C/F Base, H.M.S. *Bee*	—	—	—	35	148	—	—	183
Wilcox Camp, H.M.S. *Defiance*	150	808	746	775	922	—	—	3,401
Weymouth, H.M.Ss. *Borcawen* and *Grasshopper*	—	—	—	—	40	177	46	263
Total	10,538	64,661	82,694	113,610	120,773	98,723	344,152	835,151

Naturally commitments varied with the trend of war, and there were times when a sick quarters was established barely before the need for it had disappeared. Nevertheless, it must be admitted that a small number of Royal Naval Sick Quarters which came into being during the war ultimately owed their status to the reluctant recognition of a title originally self-applied.

The numbers for H.M.S. *Victory* include sick attendances of naval personnel in:

R.N. Barracks, Portsmouth.
Physical and Recreational Training School, Portsmouth.
Southampton Sick Quarters.
Belmont Park.
Stamshaw Camp.
Soberton Towers Training Establishment.
Stockheath Camp.
Isle of Wight Sick Quarters.
Fort Southwick.
Fort Wellington.
Combined Headquarters.

The figures for the London Area include sick attendances of naval personnel employed in:

Central Admiralty Establishments.
Fulham.
Battersea.
Chelsea.
Earls Court.
Kensington.
Regent Street Polytechnic.
Northampton Polytechnic, E.C.1.
Duchess House, W.
Regent Street.
Swiss Cottage.
Highgate.
Isleworth.
Hampstead.
Camden Town.
Hounslow.
Staines.
Walthamstow.
Stockwell.
Holloway Road.
Wimbledon.

The figures for H.M.S. *Pembroke* include sick attendances of naval personnel employed in:

Nore Command.
Borstal R.N. Barracks.
Chatham R.N. Barracks.
Gravesend.
Cookham Camp.
Tilbury.
Port of London Area.

The figures for H.M.S. *Drake* include sick attendances of naval personnel in:

R.N. Barracks, Devonport.
Glenhalt Camp.
Lyneham Camp.
Beechwood Camp.
A.A. Range Wembury.

CHAPTER 15

MEDICAL ESTABLISHMENTS ABROAD

MEDITERRANEAN AREA

THE peace-time hospital commitments of the Royal Navy in the Mediterranean were met by the Royal Naval Hospital, Malta, supported by the Hospital Ship *Maine*, which performed the dual function of base hospital for the Destroyer and Submarine Flotillas in Malta, and of accompanying the Mediterranean Fleet on periodic cruises. At the eastern end of the Mediterranean, hospital accommodation for naval personnel was arranged by civil hospitals in Egyptian ports, and by the Royal Air Force in the Canal Zone and Palestine. At the western end of the Mediterranean, naval personnel were accommodated by the British Military Hospital, Gibraltar, under an arrangement which had existed since the closing of the official naval medical establishment in Gibraltar some years before.

Naval medical planning in advance frequently gives the impression of non-existence during the actual course of hostilities in a particular area, an impression difficult to correct until after the war, when an overall picture of the trend of events can be viewed in retrospect. Nevertheless, it must always be borne in mind that no matter what foresight may be displayed, or lack of foresight when omissions are later revealed, a great part of naval medical organisation in modern warfare of necessity consists of improvisation and local development to meet situations as they arise. This system must not be interpreted as faulty organisation, but must be accepted as normal procedure in a Service whose marine environment and mobility render its self-reliance unique.

As regards the Mediterranean, the Admiralty was presented with the formidable task of grafting on to the relatively simple peace-time medical organisation, a plan to meet the medical requirements of a large Fleet operating in vast waters bordered by a number of countries whose sympathies varied. No matter what form this plan might take in advance, it was always realised that its ultimate fate was doubtful. The need for this attitude is revealed by the situations which had to be met as time passed. The entry of Italy as a belligerent, the siege of Malta, the fall of Crete and Greece, the alternating picture in the Western Desert, the invasion of North Africa, the invasions of Sicily and Italy, and above all the deployment and depletion of the Fleet itself, each had its effect on naval policy, and consequently on the naval medical organisation.

Fortunately, in 1935 and 1936, the Royal Navy had experienced, under 'cold war' conditions, the possible nature of its medical requirements, as an incident of the Italian Campaign in Abyssinia, which called for the assembling of a large Fleet in Alexandria. With the troubles in Palestine to follow, and the Civil War in Spain, the Navy in the Mediterranean was constantly on the alert until 1938. The Munich crisis had its effect in the Mediterranean, as elsewhere. The result was that, long before the outbreak of the war in September 1939, full consideration had been given to the medical aspect of the initial campaigns in the Mediterranean Area in which the Fleet was likely to become involved.

In September 1935 a large British Fleet was assembled in Alexandria as a precautionary measure incidental to the Italo-Abyssinian War. During the next ten months it became possible to assess the medical requirements of the Navy in such circumstances, and it became obvious that the commitments could not have been met by the single hospital ship which was provided, without the extra accommodation which was afforded by military hospitals ashore. This fact was never lost sight of subsequently, and was confirmed when the evolutions of the Mediterranean Fleet, occasioned by the Munich crisis in September 1938, were reviewed later in that year.

During late 1938 and early 1939 medical organisation in the event of the major war which was now expected, received the closest consideration. Broadly speaking, the immediate outlook was concerned with the provision of adequate hospital accommodation in the main port on which the Fleet was likely to be based, and the ultimate subsidiary considerations were concerned with additional hospital ships, tented hospital units, and improvised sick quarters which would function on the periphery of the area of operations. As regards the provision of a base hospital ashore, this was obviously directly connected with the major strategical policy of the Fleet, and the point at issue was the tenability of Malta as an anchorage should Italy decide to enter the war. This being so, two presumptions arose in the planning phase. The first was that the Fleet would be based at Alexandria, and the second was that the R.N. Hospital, Malta, would be largely liquidated. The first problem to be solved, therefore, was the provision of suitable shore hospital accommodation in the Alexandria area.

The early attention directed towards this matter is evidenced by an inquiry addressed by the Admiralty to the Commander-in-Chief, Mediterranean, on October 26, 1938, stating first that it was desired to ascertain the position regarding hospital accommodation in the Eastern Mediterranean in the event of war with Germany and Italy. The request expressed the opinion that the Hospital Ship *Maine* would not suffice to meet requirements, and that in any event it would be undesirable to retain patients on board her for longer periods than

necessary. Accepting a probable estimate of sick and wounded per year at 10 per cent. of the total personnel, a review of the available shore hospital accommodation in Egypt for naval patients was demanded, particularly in the light of the experience gained in the Munich crisis, it being assumed that the Royal Naval Hospital, Malta, would probably be available for local cases only.

In response to this request the Commander-in-Chief, Mediterranean, reported to Admiralty on December 30, 1938, that the crisis of the previous September had proved that the shore hospital arrangements at Alexandria and in the Canal Zone were not satisfactory. The total accommodation had been 50 beds only, set aside by the Anglo-Swiss Hospital, Alexandria, to be shared by personnel of all the Fighting Services. A further difficulty had been an acute shortage of medical and nursing staffs, and of medical stores and equipment.

With a view to achieving a solution of the problem, conversations had taken place between the Commander-in-Chief, Mediterranean, and the General Officer Commanding, British Troops, Egypt, and for the first time the suggestion was mooted and explored that the Navy and Army in Egypt might pool their resources, and consent to share hospital accommodation on a basis of mutual aid.

This suggestion was viewed favourably by the Admiralty, and a preliminary policy was agreed with the War Office whereby the Army undertook to set apart in its own proposed hospital accommodation 600 beds for naval patients at Alexandria, and 100 in the Canal Zone. Stores and equipment were to be provided by the Army, in return for which the Navy would provide a proportion of medical and nursing and other staffs. Concurrently, it was agreed that the Hospital Ship *Maine* should be brought up to full war-time strength as regards staff and equipment as soon as possible, and that a second hospital ship should be made available in the Mediterranean on the outbreak of war. It was also arranged that the British Hospital at Port Said, which was essentially a seamen's hospital, should be taken over in the event of war as a strictly naval medical establishment, and that the civilian medical officer in charge of it should be granted a temporary commission as a naval medical officer during the period of hostilities.

It will be realised that this policy, which came under active consideration in May 1938 and early 1939, represented a remarkable line of thought which aimed at combining inside one hospital the medical resources of two separate Services. Adverse criticism might have been expected but in fact was largely absent, and though the policy in its infancy contained obvious difficulties which must inevitably arise when theory would be replaced by practice, nevertheless both the Admiralty and the War Office at this stage displayed admirable restraint. While foreseeing the difficulties, neither allowed the policy to be influenced by what had not yet arisen, and agreed to leave their ultimate solution to

the common sense of whichever senior medical officers should be selected in due course to implement the policy and work side by side to a common end.

On February 28, the Admiralty informed the Army Council that it was in complete agreement with the proposal to provide, in the event of a general emergency, a hospital at Alexandria for the combined use of the Royal Navy and the Army in Egypt. Such a hospital would be administered by the Military Authorities, and would be of sufficient size to enable 600 beds to be allocated for the use of the Navy. As regards staff, it was assumed that the Military Authorities would provide such administrative staff as would be necessary, and that the Navy would provide 10 medical officers, including a surgical and medical specialist, and 100 male and 40 female nursing staff. As regards the Canal Zone, the question of combined hospitals at the Canal Terminal Ports was agreed, at each of which it was estimated that 50 beds would be required for naval use. The proposal to take over the British Hospital at Port Said as a strictly naval medical establishment seems to have been liquidated at this time.

By the beginning of June 1939 the proposed Inter-Services scheme of a combined hospital in Egypt had been developed to the extent of providing details of stores and equipment, medical and nursing staffs, and a suitable building for the purpose.

Victoria College, Alexandria, was marked down to be lent on the outbreak of war as a hospital containing 1200 beds, of which 600 would become available for naval personnel.

It was arranged that the Navy would provide from the United Kingdom the following medical and nursing staff:

8 medical officers, including one surgical and one medical specialist;
20 Q.A.R.N.N.S. and reserves;
20 V.A.D. nursing members;
4 sick berth chief petty officers;
6 sick berth petty officers;
6 leading sick berth attendants or sick berth attendants;
80 R.N. auxiliary sick berth staff reserve.

This staff would include two operating room assistants, one masseur, one X-ray assistant, and one laboratory assistant. In addition, it was arranged that two medical officers and four sick berth ratings would be sent to Alexandria from R.N. Hospital, Malta, on the outbreak of war, but would be replaced as soon as possible from the United Kingdom.

At the same time, it was finally agreed that any medical arrangements necessary in the Canal Zone should be left to the Military Authorities in Egypt, and an assurance was given to the Admiralty that all due regard would be paid to the provision of adequate accommodation for naval personnel at the Mediterranean end of the Canal.

Broadly speaking, such were the preliminary plans laid down for the medical organisation in the Mediterranean in the event of war.

NAVAL WING, GENERAL HOSPITAL, ALEXANDRIA

64th General Hospital, Egypt.

With the outbreak of war obviously imminent, the plans outlined above were implemented on Friday, August 25, 1939. On the morning of that day a surgeon commander on the staff of the R.N. Hospital, Malta, was ordered to be ready to sail for Alexandria on the evening of the same day, together with one other medical officer, four sick berth ratings, and two nursing sisters. The surgeon commander was instructed to put into motion the administrative organisation of the Naval Wing of the proposed General Hospital at Alexandria.

A high degree of security had been observed up to this time, and the surgeon commander has recorded in his own words: 'This was the first I had heard of the projected Combined Naval and Military Hospital at Alexandria'.

The party sailed from Malta that night in H.M.S. *Sussex*, but did not include the two nursing sisters owing to passage difficulties. H.M.S. *Sussex* was already crowded with officers and ratings from the United Kingdom, and among her passengers were a further 16 sick berth ratings for duty in Egypt. Two days later the party arrived in Alexandria. On the following day a conference was held by the Fleet Medical Officer in H.M.S. *Warspite*, Flag Ship, Mediterranean Fleet, to discuss the implementing of the planned medical organisation. It was confirmed that a military hospital would be established in the buildings of Victoria College at Ramleh, Alexandria, with a total accommodation for 1,200 patients, 600 beds being available for naval cases. It was also confirmed that the Royal Navy would provide 10 Medical Officers, and 40 female and 100 male nursing staff.

At this conference it was revealed that an interval of at least six weeks must elapse before conversion of the existing buildings into a hospital could be completed, and that only provided there was no interruption in conversion. The reaction of the Navy to this news was that this period of six weeks was too long, in view of the possibility of war affecting the Mediterranean Area at an early date and of the fact that a major Fleet Action had to be regarded as a possibility, with a large number of casualties resulting. It was therefore decided that, to cover the interim period, some temporary alternative accommodation must be sought as a precautionary measure.

During the next few days two possible buildings were inspected. The first was the old Greek Hospital, a building capable of ready adaptation to take 250 patients. But this idea had to be rejected, as already the building was established as the Mediterranean Fleet Club. The second building which was cited was the isolation block of the

new Greek Hospital. This was a small building standing in the grounds of the main Greek Hospital, which could have been made suitable for the accommodation of 150 patients. A provisional contract was drawn up at the British Consulate at an agreed rental of £100 (E) per month. This step was taken in spite of the fact that many disadvantages existed on closer inspection, not the least of these being the expense attached to providing extra necessary facilities, and the lack of suitable accommodation for nursing staff. At this point, the imminent arrival of the Hospital Carrier *Atlantis* solved the immediate problem, and rendered it unnecessary to arrange temporary shore hospital accommodation.

On September 3, 1939, a further problem arose due to a misunderstanding between the policies of the two Services which had not been realised before. The Admiralty had assumed that Victoria College, Alexandria would be taken over for conversion immediately on the outbreak of war. On the other hand, the War Office had not intended to take this step unless war was directly affecting the Mediterranean area. The matter in no way represented a conflict between the two Services, but was merely a question of a mutual mistake by each as regards the intention of the other when acting together to achieve a common purpose. Coincident with this problem, news was received that the naval medical and nursing staff for the hospital had already embarked and was on its way to Alexandria.

The problem was rapidly solved by the Military Authorities fully appreciating the difficulties, and an assurance was given that conversion would be undertaken forthwith, and that the aim should be to establish, with essential annexes, 600 beds for naval use, with available expansion to a maximum of 1,200 beds as military commitments should arise.

The matter which next received attention was the provision of suitable accommodation for the female nursing staff already on their way to Alexandria from the United Kingdom. Fortunately, an ideal building for the purpose existed near to Victoria College. This was a missionary rest home, the trustees of which agreed to accommodate the female nursing staff at a rate of £2 (E) per week. On the same day as the transaction was effected, the two nursing sisters who had been left behind in Malta arrived at Alexandria. They took up residence and immediately made preparations to receive the 40 others who were known to be arriving soon.

On October 5 the 20 nursing sisters and 20 V.A.Ds. arrived in Alexandria and took up residence in the quarters provided for them.

Seven R.N.V.R. medical officers also arrived from Marseilles in H.M.S. *Shropshire*. One of these medical officers was lent to the Army for duty at Mustapha Camp, and another for duty in the military section of the Anglo-Swiss Hospital at Hadra. A third was employed at Dekheila Camp, where units of the Naval Air Arm were based.

Further sick berth staff arrived from the United Kingdom and were accommodated in H.M.H.S. *Atlantis*. These men were auxiliary reserve ratings, of an average age of 35 to 40. They were mostly miners from the North of England, most promising material and full of enthusiasm. Many of them were without kit or uniform, a deficiency which received immediate attention. All were in need of training, and medical officers were employed upon this duty.

Meanwhile, under the supervision of the Royal Engineers, the work of conversion at Victoria College was making rapid progress.

During this period of conversion, the opportunity was taken by the Naval and Military Medical Authorities to study the fundamental differences between their respective organisations, with a view to establishing in the proposed combined hospital an administrative system which would be acceptable to each. The importance of this step can be appreciated, and it is to the credit of the senior medical officers concerned that potential difficulties were faced and many eliminated in advance. Others were left to solve themselves by the application of tact and common sense. It is considered of importance in this History that a detailed record should be set down of how harmony was achieved between two great Medical Services working side by side within a single building. Much of the success of this hospital during the period of its existence could later be traced to this mutual co-operation. The system of combining hospitals was repeated further east later in the war, and though racial difficulties arose which did not exist in Alexandria, the latter was always regarded as an example of the success which could be reached when circumstances required the two Services to pool their resources.

Taking the welfare of patients as the paramount consideration, and accepting the original principle that the hospital would exist under military administrative control, it was first decided that a definite division between the two Services inside the hospital would encourage possible antagonism, and certain waste of man-power. Efforts were therefore made to achieve complete unity and equality. It became apparent that there were vast differences in the methods of running naval and military hospitals, but as the hospital was to be administered by the Army, it was obvious that the naval element must learn and conform to Army requirements in this respect. Of greater importance were the differences which existed between the duties, and particularly the personal status of individual members of the Royal Naval Sick Berth Staff and R.A.M.C. other ranks, who would be working side by side. Not only was attention paid to duties and status, but also to customs and privileges, as well as general discipline.

In a naval hospital the sick berth staff are principally concerned with the nursing and treatment of the sick, while in a military hospital the personnel form a self-contained unit dealing with all administrative

matters. With a view to producing an efficient combined nursing unit, it was arranged that the essential services of stores, catering, cooking, and general administration should be carried out by military personnel, and that as far as nursing duties should permit, certain naval personnel should assist in the stores and dispensing department in order to relieve the pressure of work, and to act as replacements in time of emergency. In this respect it was obvious that the previous occupations of some of the naval reservists would be an asset, and would compensate for a lack of complete hospital training. In fact, the only branch of hospital organisation in which the Navy could give no assistance was in the provision of cooks.

It was also arranged that the bulk of the nursing duties of the hospital should be carried out by naval personnel when and where required. In this respect it was pointed out that in naval hospitals it is the practice to have a ratio of five or six patients to one of nursing staff.

It was decided that the special departments of the hospital would be staffed by mixed naval and military personnel where more than one was required.

The question of pay and allowances, not only of naval medical officers and nursing staff, but also of naval patients within the hospital, was a matter in which no combined system could be attempted, and it was realised that in this respect the naval element must be regarded as a separately defined unit whose affairs were dealt with by the Base Accountant Officer, Alexandria, and for which the Army need accept no responsibility or liability.

The question of discipline received the closest consideration, and became the subject of a special order issued by the Commander-in-Chief, Mediterranean. This order pointed out that a joint order applying Section 90A of the Naval Discipline Act and Section 184A of the Army Act was already in force in Egypt, and that all naval personnel serving in the hospital would accordingly be subject to the command and discipline of the Senior Army Medical Officer, Alexandria Area, so long as this officer should be the senior officer of the unit. It was realised, however, that these powers of command and discipline did not confer power on an Army officer to punish naval ratings for any offence they might commit. Therefore, in order to give adequate power of control to the Senior Naval Medical Officer at the hospital, and also to avoid unnecessary journeys into Alexandria for the purpose of having minor offences dealt with on board one of H.M. Ships, the Commanding Officer of H.M.S. *Maidstone* was authorised to delegate in writing to the Senior Naval Medical Officer limited powers to award summary punishment. On October 17, 1939, the Senior Naval Medical Officer was authorised to award summary punishment to naval sick berth ratings borne for duty at the General Hospital, Alexandria, in the same manner as that authorised by King's Regulations and Admiralty

Instructions, Article 536, for officers of the rank of surgeon captain and above, but on a slightly lower scale.

This step was of great value to the Senior Naval Medical Officer by virtue of the fact that it gave him a status in relation to his subordinates approaching, if not actually equivalent to, the status of the Senior Army Medical Officer.

Certain differences in dealing with naval patients admitted to a hospital administered by another Service received the closest attention. In this case the matters to be considered were not clinical, but were largely domestic and concerned privileges, status in relation to accommodation, and the provision of crockery and cutlery for the sailor who, unlike his military contemporary, does not carry his own about with him. Stowage of the sailor's bag and hammock had to be allowed for, no such provision being made in the normal Army hospital. These matters were dealt with to the satisfaction of all concerned.

In such a manner the Naval Wing of the General Hospital, Alexandria, was begun, and, as time passed and experience was gained, the success aimed at was achieved in full and the two Services worked side by side in complete harmony until the hospital was closed down in September 1944. Further details of the nursing organisation inside this hospital are given in Chapter 5, Queen Alexandra's Royal Naval Nursing Service. From 1940 to 1944 the Naval Wing of the Combined Hospital treated 11,431 patients.

ROYAL NAVAL AUXILIARY HOSPITAL, ALEXANDRIA

In March 1944, following a tour by the Fleet Medical Officer, Mediterranean, and the Staff Medical Officer, Levant and Eastern Mediterranean, the Director of Medical Services, Cairo, informed the Naval Authorities that political pressure was being brought to bear by the Egyptian Government with a view to the reversion of Victoria College to its educational function. In consequence, the Army proposed to close the 64th General Hospital at an early date, and to transfer its staff and equipment to Amirya.

It was considered that to continue the combined hospital system at Amirya would be impossible, as the remote situation of the proposed site was most unsuitable to the Navy as regards transport of major casualties, and the provision of out-patient facilities and specialist consultations for personnel of the Fleet in Alexandria Harbour.

Accepting the principle that the combination of the Services should now be dissolved, it was suggested that the Navy should take over and staff the Eighth General Hospital at Chatby, Alexandria. This would provide a purely naval hospital with 500 beds, in which Army patients could receive emergency treatment when necessary. This proposal was considered, but was discarded eventually owing to numerous difficulties in the way of retaining possession of the buildings.

It was next suggested that the Navy should take over the Marine Hospital at Mustapha, already existing as an Army hospital, which was offering accommodation for 284 patients. This suggestion was considered impracticable. The report of the Naval Medical Officer of Health was most unfavourable, for the alterations recommended to convert the building into a satisfactory general hospital were too great to be undertaken at this stage of the war, in addition to which it was possible that if put into effect the results might not justify the labour involved. The building itself was considered to be too small, and the 284 beds allowed no suitable accommodation for officers or W.R.N.S. patients. It was considered important to provide specialist departments, out-patient facilities, and treatment for venereal and mental cases. Staff accommodation was inadequate, and the complete lack of ground or gardens precluded the normal routine of convalescents.

Although the possibility was explored of maintaining this hospital as a small establishment, officers, W.R.N.S., and specialist cases being boarded out in other hospitals, it was felt that such separation of cases would not be consistent with satisfactory treatment and would cost a large wastage of staff. Further buildings considered at this time were Ras-el-Tin Palace, a proportion of beds in the Anglo-Swiss Hospital, and the San Stefano Hotel which was rejected earlier in the war owing to its glass roof.

An alternative suggestion was to provide an extra hospital ship at Alexandria.

Eventually, the buildings of the Casino at San Stefano were considered to be suitable, and arrangements were made to establish in them the Royal Naval Auxiliary Hospital, Alexandria. The buildings taken over were enclosed by walls and railings between the tramway and sea front, about eight miles from Alexandria, and offered pleasant surroundings and a satisfactory approach. Originally built around 1890 as a hotel and casino, the establishment consisted of a three-storey building 300 ft. × 130 ft. in area with a main entrance at the centre, facing south. The ground floor consisted of kitchens and dining rooms on the west, lounges and verandahs on the east, and concert hall and public rooms on the sea front aspect. Bedrooms occupied part of the first and second floors. The first floor east wing was used as the Casino proper. In 1910 the building had been modernised, and in addition to the main establishment, two semi-detached bungalows, and extensive garage accommodation were constructed in the grounds.

During the First World War the buildings were used as an Indian Army Hospital. For some years before 1935, the building had been unoccupied, but at a very considerable cost had been employed for 15 months as a hospital by the British Army at the time of the Italo-Abyssinian War.

In 1940, when Victoria College buildings were taken over as the 64th General Hospital, the College itself was transferred to San Stefano Casino. So in 1944, in order that Victoria College might regain possession of its own buildings, it became necessary for a naval hospital to be established in the buildings to which the College had previously been evacuated in 1940.

Posterity may well wonder why the end-result arrived at in 1944 could not have been achieved in the first place in 1940, but it must be remembered that the 1944 move represented only the provision of a naval hospital alone, and dissolution of the Combined Service principle which had prevailed in 1940 and aimed at pooling Service resources.

Conversion to a naval hospital necessitated many minor alterations, and in view of the age of the building it was considered essential that the whole of the electric wiring should be renewed. This item accounted for the greater part of the expense involved.

The ultimate conversion was most satisfactory. At this stage in the war the original estimated requirement of 600 beds for naval personnel was considered to be excessive in the light of the figures shown by the 64th General Hospital in recent months. These figures showed that the average number of beds occupied daily by naval personnel, including Merchant Navy, W.R.N.S., dockyard civilians and Allied Navies, was in the region of 303·4. Also, at the time when the figure had been set at 600 no convalescent accommodation existed in the Alexandria area. But in 1944 a convalescent depot was in existence at Dekheila, in which accommodation was available for naval convalescent patients.

The accommodation available at San Stefano was 274 beds, including 166 surgical and 68 medical. Water supply, shower baths, and lavatories were adequate. The main galley afforded adequate cooking facilities for 800 persons. The large concert hall was converted into a dining hall for walking patients and staff, and was partitioned into messes. Special Departments included radiography, physiotherapy, two operating theatres, facilities for treating venereal diseases, and a semi-detached neuro-psychiatry section. Separate accommodation was arranged for 37 cases of dysentery. Further adequate spaces were set aside for a dispensary, administrative offices, storerooms, and Church of England and Roman Catholic Chapels.

Among the outside buildings the garage was equipped as a pathological laboratory, and a storehouse alongside was converted into a mortuary. The ground floor of a semi-detached bungalow provided a blood bank, ophthalmic department, barrack room for Royal Marines borne for guard duties, and workshop for carpenters and electricians. The upper floors provided two dental surgeries, and living quarters for the Royal Marine guards. A three-storey bungalow was set aside as an infectious diseases hospital.

Equipment, furniture, bedding, crockery, cutlery and other essentials were in general obtained from military sources, and augmented by naval pattern in many instances.

Patients' accommodation included 28 rooms for officer or female officer patients, and six rooms for sick W.R.N.S. ratings. Naturally differences in medical and nursing staff requirements had to be studied on transfer from the Combined Services system to the separate naval system. An increase of three medical officers was necessary to provide ear, nose and throat and genito-urinary and pathology specialists, which functions under the combined system had been performed by Army medical officers. As regards female nursing staff, 15 nursing sisters were required and 18 V.A.Ds., a total of 33 in all, representing a reduction of 7 in the staff employed at the 64th General Hospital. An increase of 7 sick berth staff was necessary, and other increases included cooks, stewards, and supply and secretariat personnel originally provided by the Army. A Church of England chaplain was also appointed.

Preparations took some months to complete, and the Naval Wing of the 64th General Hospital was eventually closed down and the Royal Naval Auxiliary Hospital, Alexandria, came into being on September 9, 1944. The hospital was commanded by a Surgeon Rear Admiral and performed valuable work until it was finally closed in November 1945; 5,709 patients attended the hospital during the period of its existence.

ROYAL NAVAL HOSPITAL, MALTA

The Royal Naval Hospital, Malta, occupies one of the most imposing of the many beautiful buildings overlooking Grand Harbour from the edge of Bighi Bay. Malta first came under the administration of Great Britain in September 1800, and in November 1803, Lord Nelson represented the need for a permanent naval hospital in Malta. But it was not until the year 1827 that £17,000 was voted for the purpose, of which £6,000 was made available immediately. The Bighi plateau was acquired, and it was decided to convert an existing building, the Villa Bighi, into a naval hospital, extending it as necessary. The foundation stone was laid on March 28, 1830, in the presence of the Commander-in-Chief, Vice Admiral Sir Pulteney Malcolm. On June 1, 1843, the building was completed, and the first patients were received. Since then Bighi Hospital has continued to serve the needs of the Mediterranean Fleet.

During the war the ordeal to which this hospital was subjected during the siege of Malta may well be imagined. Its situation on the edge of Grand Harbour, and not far from the Royal Naval Dockyard, placed it well inside the target area, and it was repeatedly subjected to enemy air attack. On July 10, 1940, the hospital was severely damaged, and the operating theatres and X-ray department were destroyed. Fortunately, although casualties occurred among the staff, patients had already been evacuated some weeks before.

As explained earlier in this History, preliminary planning had always presumed that in the event of war with Italy, the Royal Naval Hospital, Malta, would prove to be untenable. On May 16, 1940, a pre-arranged scheme for the evacuation of patients from this hospital was put into effect, and all but a few convalescent cases were accommodated inland in the Military Hospital, Imtafa. This did not mean that the hospital ceased its work completely, for a skeleton medical and nursing staff was retained, and in spite of its damaged state, the hospital contrived to function as a casualty clearing station where much valuable work was done.

To assist in the care of naval patients at the 90th General Hospital, Imtafa, Malta, a Naval Wing was formed there. This consisted of three medical officers, including a surgical specialist and an ophthalmic specialist, a number of nursing sisters varying from 6 to 11, and 29 sick berth ratings.

As enemy air attacks decreased, the Royal Naval Hospital, Malta gradually began to function as an out-patient centre as well as a casualty clearing station.

This situation continued until the final relief of the island of Malta, and towards the close of the war in the Mediterranean Area the Royal Naval Hospital, Malta, damaged as it was, had attempted with some success to revert to its original function.

HOSPITAL FACILITIES, GIBRALTAR

A separate naval hospital did not exist in Gibraltar during the war. The original R.N. Hospital, Gibraltar, had long ceased to exist during peace-time, under the reciprocal arrangement whereby hospital accommodation for naval personnel was arranged by the Army Authorities.

Gibraltar fluctuated in importance at various phases of the war, in direct proportion to the trend of events in the rest of the Mediterranean Area. Broadly speaking, the organisation for hospital accommodation kept pace with commitments by expansion of the peace-time system. The Senior Naval Medical Officer of the port, with the assistance of a small staff, acted as liaison officer with the local military hospital. In addition to the care of naval personnel serving in local establishments ashore and afloat, an organisation for the reception of casualties from the Fleet and for onward transmission to the military hospital was built up, and worked with the greatest efficiency. Although apparently passed over briefly in this History, the work of the personnel associated with this organisation may here be accepted as of outstanding merit and assistance to those who experienced its benefit during the years in question.

SICK QUARTERS

The story has already been told of how the medical planning for war in the Mediterranean Area was directly linked with the presumptions that the Fleet would be based at Alexandria, and that the Royal Naval

Hospital, Malta, would be largely unused. The reader has also been reminded that a great part of naval medical organisation under conditions of modern warfare of necessity consists of improvisation and local development to meet situations as they arise. From what has been written above it will be appreciated that these presumptions proved to be correct. As is known, the entry of Italy into the war in 1940, the German invasion of Crete and Greece, the fluctuating events in the Western Desert, and the Luftwaffe's activities from German-operated air bases in Sicily, virtually closed the Mediterranean to the normal passage of shipping. The Fleet became split into two groups, operating in the Western Mediterranean on the one hand, and on the other under a separate Command, the Eastern Mediterranean and Levant. Such basic medical administration as existed was concerned with medical supplies and hospital facilities in these two areas, and to some extent with similar provision for the beleaguered naval forces in the island of Malta. In due course, beginning with the invasion of North Africa by Allied Forces at Algiers, Oran and Casablanca, the overall type of command of the Mediterranean Station was reconstructed under a Commander-in-Chief with a Fleet Medical Officer on his staff who advanced, so to speak, in company with the naval forces involved. From the historical viewpoint, records of this phase are scanty, and when the Mediterranean was reopened, the changing trend of events which led to victory in North Africa, and the subsequent invasion of Sicily and Italy were so rapid that the naval medical organisation involved could hardly be described as planned basic administration, but was instead largely an example of improvisation dictated by numerous operational requirements. In the background, the basic medical administration continued to exist, but grafted on to it was a vast operational organisation which involved a high degree of liaison with the Army, the R.A.F. and the Medical Services of the Allies. Included were the movements of hospital ships to the best advantage, the rapid supply of medical stores and equipment, and the establishing of sick quarters in temporary, semi-permanent and permanent form as the advance continued and the occupation of enemy territory progressed. Some idea of the organisation necessary to maintain an adequate supply of medical accommodation and facilities for naval personnel in the Mediterranean is given in the table below, which indicates the various sick quarters which were established and the work which each performed.

ROYAL NAVAL HOSPITAL, BERMUDA

Peace-time accommodation for patients in the Royal Naval Hospital, Bermuda, was 92, including 12 officers. The hospital served the needs of the North America and West Indies Squadron, and Naval Establishments in Bermuda. The peace-time complement was one surgeon

Patients Treated in Royal Naval Sick Quarters

Mediterranean Zone		1939	1940	1941	1942	1943	1944	1945	Total	Remarks
H.M.S. *Nile*	Alexandria	14	296	578	1,084	921	764	546	4,203	Opened 1939
	R.N.B. Laurens	—	—	—	—	553	148	100	801	
W.R.N.S.	R.N.B. Laurens	—	—	—	—	552	802	339	1,693	
T. 124X		—	—	—	—	—	16	—	16	
H.M.S. *Prometheus*		—	—	—	—	367	578	959	1,904	including D.E.M.S.
H.M.S. *Aboukir*		—	—	1,523	982	1,278	1,330	754	5,867	Opened 1941, renamed *Sphinx*
H.M.S. *Canopus*		—	—	587	550	789	—	280	2,206	including *Canopus I* and *II*
Grebe		—	51	845	555	253	207	286	2,197	Opened 1940 *Dekhelia*
Grebe		—	11	39	56	41	—	—	147	Fighter Squadrons
Grebe, H.M.S. *Nith*, Agami		—	—	56	60	110	133	72	431	Opened 1941
W.R.N.S.		—	—	—	—	—	2	9	11	
H.M.S. *Hannibal*	Algiers	—	—	—	105	1,688	1,268	—	3,061	Opened 1942
W.R.N.S.		—	—	—	—	117	140	—	257	
	S.Q. Isle of Ischia	—	—	—	—	—	268	167	435	
H.M.S. *Hamilcar*	S.Q. Djidjelli	—	—	—	—	1,114	1,340	1,247	3,701	Opened 1943
Byrsa	Bougie	—	—	—	20	171	1,400	1,025	2,616	Opened 1942 including W.R.N.S.
Byrsa	S.Q. Leghorn	—	—	—	—	—	—	170	170	
Byrsa	Caserta	—	—	—	—	—	329	466	795	
Byrsa	Marseilles	—	—	—	—	—	52	131	183	
Bastia	Tripoli (L)	—	—	—	—	80	200	—	280	Opened 1943–4. Advanced Base
Special Party X	Tripoli	—	—	—	—	44	—	—	44	
Naval Base	Tripoli	—	—	—	—	139	16	—	155	
Alton Party	Salonika	—	—	—	—	—	15	37	52	
H.M.S. *Medway II*	Mancel Island	—	—	—	412	694	1,301	697	3,104	Established and situated in the Aley District
	Piraeus	—	—	—	—	—	23	619	642	Opened 1944
H.M.S. *Talbot*		—	—	489	546	774	492	2,301	4,602	Opened 1941. Renamed *Sardo* 1944
H.M.S. *St. Angelo*	Malta	133	534	543	585	1,317	1,068	739	4,919	Opened 1939
H.M.S. *St. Angelo*	Fort Manoel	9	303	216	—	—	143	—	671	Sub Base Lazaratto
H.M.S. *St. Angelo*	Verdala	—	—	—	—	230	3,216	1,891	5,337	Transit Camp
H.M.S. *St. Angelo*	S.Q. Camarato	—	—	—	—	—	459	287	746	
H.M.S. *St. Angelo*	Fort Ricasoli	—	—	—	—	—	32	330	362	

Syracuse			—	—	—	—	274	—	—	274	
Toulon	S.Q.	Marseilles	—	—	—	—	—	10	77	87	S.Q. Opened 1945
Tripoli			—	—	—	—	139	46	—	185	
Cannae	R.N.S.Q.	Boné	—	—	—	—	—	127	—	127	
Tunis, R.N.B.			—	—	—	—	75	—	—	75	
Salerno	N.B.	Italy	—	—	—	—	14	—	—	14	
H.M.S. *Elissa*			—	—	—	14	192	912	64	1,182	Syracuse, Catania, Messina, Port Augusta, taken over May 1945
H.M.S. *Fabilis*	R.N.S.Q.	Taranto	—	—	—	—	—	1,171	854	2,025	
H.M.S. *Fabilis*	N.B.	Ancona	—	—	—	—	—	341	415	756	Opened 1944
H.M.S. *Fabilis*		Bari	—	—	—	—	—	—	80	80	Opened 1945
H.M.S. *Fabilis*		Porto Casino	—	—	—	—	—	—	9	9	Opened 1945
H.M.S. *Fabilis*		Rome	—	—	—	—	—	—	26	26	Opened 1945
H.M.S. *Fabilis*		Sousse	—	—	—	—	245	—	—	245	
H.M.S. *Fabilis*		Venice	—	—	—	—	—	—	139	139	
H.M.S. *Martial*		Beirut	—	—	142	127	—	—	—	269	Opened November 1942
Benghazi		N. Africa	—	—	—	56	175	18	—	249	
H.M.S. *Cormorant*		Gibraltar	—	—	894	907	908	1,366	769	4,844	Including W.R.N.S.
H.M.S. *Cormorant II*			—	—	—	—	—	94	37	131	R.N.A.S.
Admiralty House		Tobruk	—	—	343	—	—	—	—	343	
Goldfinch		Takali, Malta	—	—	—	—	—	—	245	245	
Brindisi		Italy	—	—	—	—	—	203	48	251	
H.M.S. *Hasdrubal*	S.Q.	Ferryville	—	—	—	—	229	445	100	774	Opened 1943
		Bizerta	—	—	—	—	271	242	100	613	Late N.P. 645
		Ferryville	—	—	—	—	—	232	49	281	Opened 1944
Messina			—	—	—	—	—	198	482	680	Opened 1944 including W.R.N.S.
Bari		Italy	—	—	—	—	113	372	165	650	
H.M.S. *Phoenix*		Levant Area	—	—	246	291	415	391	228	1,571	Opened May 1941
Manfredonia	R.N.S.Q.	Trieste	—	—	—	—	—	—	87	87	Opened 1945
La Maddalene		Malta	—	—	—	—	80	201	—	281	Advanced Base S.Q. set up at Bastia 1943
Anzio			—	—	—	—	—	44	—	44	
			156	1,195	6,501	6,350	14,362	12,155	17,426	68,145	

captain as Principal Medical Officer and surgical specialist, and one medical officer as medical specialist. In addition, an ophthalmic specialist was appointed to H.M. Dockyard, Bermuda. Sick berth staff numbered 13, including one warrant wardmaster.

On the outbreak of war, the complement was increased by one medical officer as surgical and ear, nose and throat specialist, three nursing sisters, and ten sick berth ratings. Further additions of locally entered employees were made. The accommodation of the hospital was increased to 153, including 26 officers.

Apart from minor structural alterations and expansions, little more was necessary to place this hospital on a war-time footing as conceived under the policy existing at that period of hostilities, and such matters as air-raid precautions and passive defence, though planned, were not implemented owing to the remoteness of Bermuda from enemy air attack.

As the war progressed, additional sick berth ratings were appointed to the hospital to be held as a pool on which demands could be made by naval establishments, such as the Air Station in Trinidad, which came into being in the West Indies.

In 1942, with the entry of Japan and America into the war, the picture changed in this part of the world and the hospital assumed a greater importance. Further staff additions were now made, and one extra nursing sister and 28 extra sick berth ratings were appointed. The latter included a sanitary inspector for public health duties. The increased complement remained constant until the end of the war. During the war years the Royal Naval Hospital, Bermuda, received and treated 4,921 patients.

SOUTH AND EAST AFRICA

ROYAL NAVAL HOSPITAL, SIMONSTOWN

The peace-time accommodation of the Royal Naval Hospital, Simonstown, was 47 beds in the charge of a surgeon captain. The staff consisted of two medical officers, one dental officer and nine sick berth ratings. Miscellaneous duties in the hospital were performed by employees engaged locally.

On the outbreak of war, accommodation was increased to 120 beds and later to 214 beds. Medical officers were increased to 5 in number, dental officers to 2, sick berth ratings to 29, and 6 nursing sisters and 22 V.A.Ds. were employed.

During the course of the war, three new wards were erected, and a new operating theatre block was built. The laboratory was also extended, and extra storerooms were added. Quarters were built for the extra sick berth ratings, and nursing sisters were accommodated in a house immediately outside the hospital gates. V.A.Ds. lived in a building erected for the particular purpose.

Although passive defence measures were instituted, no hazards arose from enemy action.

During the war the Red Cross and Order of St. John opened four convalescent hospitals within ten miles of R.N. Auxiliary Hospital, Simonstown. These hospitals were most valuable in receiving not only convalescent patients, but also post-operative and plaster cases.

In April 1945 an occupational therapy unit was officially arranged, and three occupational therapists were fully employed.

During the period of hostilities the Royal Naval Hospital, Simonstown received and treated 8,308 Service patients.

MEDICAL ORGANISATION, DURBAN

With the outbreak of war with Japan and the fall of Hong Kong and Singapore, the position of Ceylon and India was dubious for a time, and ports in South Africa and East Africa assumed a new importance in relation to the requirements of the Fleet operating in East Indies waters.

In 1941 facilities for the treatment and accommodation of naval personnel in Durban were available at the Military Section of the Addington Hospital, the Oribi Military Hospital, the Townhill Mental Hospital, Renishaw Hospital for Tuberculosis, and the King Edward VIII Hospital for coloured patients only.

In 1942 further accommodation was available in Springfield Military Hospital, Durban, and inland at the Howick Convalescent Hospital, and Baragwanath Military Hospital, Johannesburg.

At Defence Headquarters, Durban, an out-patient department existed early in the war capable of dealing with minor injuries, routine vaccinations and inoculations, and medical examinations. There was also a physiotherapy department, and a medical stores department belonging to the Army from which the Navy was able to obtain stores and equipment more economically than by local purchase.

In January 1942, following the withdrawal of the Fleet Administration from India and Ceylon, there was a vast increase in naval medical commitments in Durban, as in other ports on the coast of East Africa. With casualties arriving in large numbers in H.M. Ships, transports, and occasionally in merchant ships, the available hospital accommodation soon became severely taxed. By August 1942 something of a crisis arose in the hospital situation, for provision had to be made not only for casualties, but for sickness among the large numbers of naval personnel in the area. In addition, it must be remembered that the Mediterranean was closed at this time, and the evacuation and transport of invalids from India and Ceylon had to be effected to the United Kingdom via the Cape at a time when there was an acute shortage of shipping. With the defence of India and Ceylon of paramount importance, the presence of invalids in these countries for any length of time

was an embarrassment, and Durban became, so to speak, a ' dumping ground' for invalids awaiting passage to the United Kingdom. It was necessary therefore to arrange accommodation in Durban for patients from India and the Middle East who had little chance of reaching the United Kingdom for many months.

It was now obvious that there were adequate reasons for opening a naval hospital in Durban. The need for such an establishment was increased when two Royal Naval Air Stations were established near Durban. A W.R.N.S. establishment also came into being, and H.M. Dockyard, Durban, employed 2,567 persons entitled to Service treatment, of which 984 were Europeans. Large numbers of H.M. Ships underwent docking and refitting for periods as long as six months, in connexion with which hospital accommodation had to be provided. In 1942 and 1943, 6,626 naval patients had to be accommodated in Durban Military Hospital, and 3,100 Service invalids were cared for while awaiting passage to the United Kingdom. The whole medical organisation at this time was controlled by three medical officers, one warrant wardmaster, nine sick berth ratings, and one nursing sister for duty with the W.R.N.S. A superintending pharmacist was devoted to building up a naval medical stores depot. Assistance was given from time to time by visiting hospital ships.

In May 1942 it was decided to open in Durban a training establishment to be known as H.M.S. *Assegai*. This necessitated an increase in local hospital accommodation by some 200 beds, and had the effect of rendering the provision of a naval hospital an obvious and urgent necessity. This necessity was confirmed by the Director-General of Medical Services, South African Medical Corps, who declared that he could no longer provide extended facilities for naval patients in military hospitals.

It was therefore decided to commence building a naval hospital in August 1942, to accommodate 600 patients. Plans were drawn up based on the latest Army design for hospitals, modified by the Admiralty Superintending Civil Engineer. In December 1942 a senior naval medical officer arrived in Durban to supervise the final plans and building of the hospital, and 10 medical officers, 56 nursing sisters and V.A.Ds. had to be accommodated locally pending the completion of the building. The actual completion of the hospital was long delayed, the chief obstacles being selection of a suitable site, shortage of building materials, shortage of labour, and the questionably low priority granted to the hospital in relation to other building commitments.

The Royal Naval Auxiliary Hospital, Durban, eventually opened for the reception of patients on March 15, 1944, under the command of a Surgeon Rear Admiral.

In the short period of its existence the hospital received and treated 3,957 Service patients.

MEDICAL ORGANISATION, MOMBASA

Concurrently with the withdrawal of Eastern Fleet Administration to the East African coast early in 1942, medical commitments in the Mombasa area were greatly increased.

Sick bays were opened in various naval shore establishments and commitments included 1,600 personnel employed in H.M. Dockyard.

On August 1, 1942, the Royal Naval Auxiliary Hospital, Mombasa, was established with accommodation for 100 patients.

Valuable assistance in the supply of medical stores and equipment was given by the Army until the opening of a Naval Medical Stores Depot in charge of a Superintending Pharmacist.

ROYAL NAVAL AUXILIARY HOSPITAL, VAENGA, NORTH RUSSIA

The Royal Naval Auxiliary Hospital, Vaenga, was situated in the anchorage of Vaenga on the east bank of Kola Inlet, a few miles north of the 69th parallel. The hospital was 400 yards from the edge of Vaenga Bay, a deep water anchorage used by all H.M. Ships visiting Kola Inlet. The headquarters of the Senior British Naval Officer, North Russia, was at Polyarnoe, nine miles north of Vaenga. The port of Murmansk was 18 miles south of Vaenga, and accessible from the hospital either by sea or by road which was kept open by snow plough during the winter.

The hospital was established towards the end of 1942, and its necessity was dictated by the obvious need for some kind of naval hospital in the vicinity to afford accommodation to sick naval personnel serving ashore, and in particular to care for casualties landed after convoy battles. Previous experience had shown that Russian hospitals were too overcrowded and understaffed to provide adequate treatment for these casualties whose return to the United Kingdom was frequently long delayed.

The hospital consisted of three floors of a large Russian barracks. The first floor contained four officers' cabins, wardroom, pantry, galley and storerooms. The second floor comprised the hospital proper, and contained five wards with accommodation for 75 patients, one officer's cabin with two beds, a receiving room, a dispensary, an operating theatre and unit, a laboratory, an X-ray room, and an additional surgery. The third floor consisted of sick berth staff quarters.

The staff of the hospital consisted of two medical officers, one dental officer, one officer interpreter, and 20 sick berth staff. Non-medical staff in addition were two naval cooks, two stewards, one supply assistant, and four Russian girls for mess duties. Medical and surgical facilities in the hospital were in part adequate and in part rudimentary. The operating theatre was large and moderately well equipped for ordinary surgical procedures. Lighting was good at times, as was the secondary lighting system which frequently had to be used during

periods of defect in the main supply. There was no running hot water and sterilising facilities were confined to bowls heated on a primus stove and assistance offered by a Russian hospital nearby.

A portable Victor X-ray machine was used, albeit with difficulty, owing to fluctuations in electric power.

The lower floors of the same barracks were occupied by a Russian hospital with which a system of mutual aid was developed.

The essential services of the hospital were on the whole poor and surprisingly inconsistent with the extremes of climatic conditions which had to be endured during the course of each twelve months. The hospital was fitted with a central heating system which provided little warmth even when working. For long periods this system could not be used owing to shortage of fuel. Only one bathroom was available in the hospital, for which hot water could be provided only once a week, and only then if coal was available. The poor central heating was supplemented by numerous electric radiators which were sometimes out of use owing to deficient electric power. In winter the maximum temperature possible inside the hospital was 50° F., but the temperatures actually achieved invariably fell far short of this figure.

Food for patients and staff was cooked in a single galley on wood fires. Here again, shortage of fuel was a constant problem, and in addition to their nursing duties the sick berth ratings were engaged in chopping wood each day.

Another duty of the sick berth rating was the daily washing of hospital linen, for such local laundries as existed were unable to accept the hospital contract, and soap and soap substitute were in very short supply.

A large stock of tinned foods was maintained at the hospital and formed the basis of all diet of patients and staff. Russian bread was supplied locally ranging in colour from white to dark brown. Occasionally butter, cabbage, potatoes and onions were supplied locally, and quantities of fresh eggs and fresh meat were received from the United Kingdom.

The water supply to the hospital came from a lake five miles away. Owing to the fact that dysentery and typhoid were endemic, the local authorities chlorinated the water at source, but the chlorination plant was not always in working order, and all hospital water was boiled as a precaution.

A large stock of medical and victualling stores was maintained in a building a short distance from the hospital. These were constantly damaged by rats and damp, and in spite of Russian sentries, pilfering was frequent.

Transport was a major problem. The hospital had one Bedford 15-cwt. truck which was used for all purposes. Over-use and exposure to the severe climate soon brought this vehicle into an advanced state

of disrepair. An ambulance sent to the hospital from the United Kingdom took ten months to arrive, by which time it was so damaged that it could not be put into working order for some months longer. In these circumstances the hospital was largely dependent for its transport on the help of local Russian hospitals, and this was willingly given.

The function of R.N. Auxiliary Hospital, Vaenga, was to cater for all British and Allied personnel in the area of Kola Inlet, including warships and merchantmen. A medical officer from the hospital visited Murmansk each week to see patients from the British and American missions, and merchant ships in the docks.

In general, a friendly liaison was established with local Russian hospitals and their staffs, who were always ready to render any assistance within their powers, though their scope was frequently limited.

The efficiency and conduct of the small staff of this hospital was of the highest order, and their work was carried out under conditions which approached grave hardship at times. The winter was long and severe, with little daylight, and was followed by a summer of perpetual daylight and extreme moist heat accompanied by a mosquito menace. The heating in winter was inadequate and the food was far from good. There was no social life and recreation and entertainment was very difficult to provide. Physical fitness became affected, and fatigue and dyspnœa became common, similar to that experienced in high altitudes, except that toleration was not attained. In spite of these complaints the health of the staff remained satisfactory, and no case of anxiety was recorded, although nervous symptoms were common enough among local naval personnel. Admiralty policy was that the maximum period to be spent in North Russia by naval personnel should be nine months, but passage difficulties were such that the period was usually extended to 12 months and much longer in some cases.

The Royal Naval Auxiliary Hospital, Vaenga, received and treated altogether 735 patients. This number may appear small compared with the figures given by other naval hospitals. Nevertheless, the figures of Vaenga include casualties sustained in some of the most severe actions of the Arctic convoy route, and the knowledge that a British hospital existed at Vaenga was a great stimulant to the morale of the Royal and Merchant Navy Fleet in Northern Waters.

SHORE HOSPITAL ACCOMMODATION IN EASTERN WATERS

In peace-time, shore hospital accommodation in Eastern Waters was based on the requirements of the China Squadron, the East Indies Squadron and sloops serving in the Red Sea and Persian Gulf. The Royal Naval Hospital, Hong Kong, although far from being a modern clinical establishment, served the needs of the China Squadron and the port itself. This was in fact the only Royal Naval Hospital east of Suez.

The Naval Base at Singapore had its own Asiatic Hospital for the reception of Asiatic dockyard employees. The hospital accommodation for naval personnel and European employees was arranged with local civil hospitals in Singapore and Johore on a fixed scale of payment.

On the East Indies Station sick quarters existed at Trincomalee, and up-country at Diyatalawa, Ceylon. General hospital facilities on this station, which included Aden, Persian Gulf, India, Ceylon, Burma, the coasts of Kenya and Tanganyika, and extended south to include Mauritius, were invariably granted by civil hospitals and those of the Army and Royal Air Force where such existed.

As has been recorded earlier in this History, naval medical policy in Eastern Waters foresaw not only the loss of Hong Kong, but also Malaya and Singapore, and arranged that on the entry of Japan into the war the main centre of Naval Base Hospitals should be in Ceylon.

This policy was in evidence as early as the outbreak of war in Europe, and long before the fall of Hong Kong the staff of the naval hospital there had been reduced, and plans for the hospitals in Ceylon were well advanced.

In 1942, on the outbreak of war with Japan and the occupation of Hong Kong, Malaya and Burma by an advancing enemy, a phase came into being during which the East Indies Fleet, sadly depleted, was withdrawn to East Africa. The invasion of Ceylon and even of India itself had to be faced. But this phase was relatively short lived, and by 1943 plans were in motion which by 1944 brought the centre of activity back again to Ceylon and India, no longer as areas to be defended, but as strongly garrisoned bases from which the final assaults against Japan would be launched at the same time as the offensive grew in the Pacific Ocean.

In tracing medical organisation in Eastern Waters, the reader is referred to the Operational Volume of this History, in which are recorded the details of the loss of the Royal Naval Hospital, Hong Kong.

MEDICAL ORGANISATION, SINGAPORE NAVAL BASE

The effect of the loss of H.M. Ships *Prince of Wales* and *Repulse* (details of which are given in the Operational Volume of this History) on subsequent operations preceding the capitulation of Malaya and Singapore is well known. Naval medical organisation in Singapore at the time of the Japanese invasion was rapidly dissolved with the evacuation of Singapore Naval Base. Apart from individual experiences, there is little historical matter to record, for the policy of the Navy at that time was to evacuate its key personnel as soon as the inevitable capitulation became obvious. Naval medical organisation in this area was in any case essentially subsidiary to the far greater military organisation, and though the services of the few naval medical officers and sick berth staff were offered to the Army, it seemed better that these personnel

should be utilised in building up a fresh medical organisation elsewhere rather than that they should be wasted unnecessarily in useless captivity for the remainder of the war.

In the records of Naval Medical History the greatest interest medically is attached, not to the evacuation of Singapore Naval Base at the beginning of 1942, but to its re-occupation in September 1945. Some account of the health problems to be overcome in a large area in which matters of hygiene received little attention under Japanese control, is given in Chapter 2 of the Operational Volume of this History, and in the Medicine and Pathology Volume under 'Bornholm Disease'' in Chapter 14.

The medical parties which entered Singapore in September 1945 found that an area which in the years of peace had become a veritable model of perfection as regards standards of tropical hygiene, had been neglected by the Japanese to the point of complete decay. Such abortive attempts to maintain drainage, oiling and the usual anti-malarial measures evolved through a generation of European practice and experience had been but short-lived. Water supplies were polluted, dysentery was widespread in a reservoir of infection provided chiefly among the Japanese themselves. Little war damage had been repaired, the garbage of years had accumulated, and tropical vegetation had run wild. To all these defects was added a Japanese Medical Administration which had obviously barely existed at all, and in any case must have been embarrassed by the academic and practical limitations of its individual doctors whose medical learning fell far short of European standards.

The impact of this degeneration was chiefly felt by the large Asiatic population of Singapore Naval Base, who also showed the effects of ill-treatment and prolonged malnutrition. This large mixed population of Malays, Chinese, Indians and Sinhalese was composed almost entirely of dockyard employees for whose care the Navy felt responsible. Apart from malaria and amœbic dysentery the incidence of pulmonary tuberculosis was alarmingly high. The first step to be taken in the reconstruction of Singapore Naval Base was to attend to the health of its population. With this in view, a vast medical organisation was built up by the end of 1945 which aimed, not only at the resuscitation of rigid hygiene measures, but also at a meticulous attention to the clinical needs of the Asiatic evidenced by nearly four years of neglect. Within a few months the effects of these measures were seen in a gradual return to health of the population, and the care bestowed upon them went some distance towards compensating them for the sufferings which they had endured. By the end of 1946 it was possible to reduce the medical commitments to some extent, but, nevertheless, some years would have to elapse before this area could be brought back again to its previous high standard of health.

EAST INDIES 1944–45

Broadly speaking the period of greatest activity in which the Royal Naval Medical Organisation was involved on the East Indies Station occurred in the years 1944 and 1945. By this time the world picture of the war was changing, the Allied invasion of Europe was impending, the Mediterranean was re-opened, and preparations were in train for what was to be the major campaign against Japan.

At the beginning of 1944 the tide of war was receding from the Indian Ocean and the last of the Administration Department under the command of the Naval Commander-in-Chief, East Indies, was in process of returning to Ceylon from the temporary headquarters in East Africa to which the Central Administration had been withdrawn. The remainder of the year 1944 was chiefly occupied by the Navy with building up operational forces, and creating bases in India for assault craft in preparation for the re-taking of Burma and Malaya.

Two events then occurred which had far-reaching effects on naval policy and commitments in this area. The first was the unexpected recapture of Burma by the Army operating from the north. The second was the rapid formation of the British Pacific Fleet.

The East Indies Station was thus suddenly faced with the problem of hurriedly mounting unforeseen operations to assist the advance of the Army, and at the same time was reduced in status in relation to the requirements of the British Pacific Fleet, with consequent embarrassment to its shipping, personnel and equipment. Moreover, the progress of events was so rapid that the development of the Station was overtaken by circumstances with which it never really kept pace, and during the last two months of war the commitments of the Station and its operational forces increased at a rate with which the ancillary maintenance services could barely compete.

In January 1945, operations on the Arakan coast were just beginning and 'port parties' were forming for the occupation of Akyab and Ramri Island. Nevertheless, on January 19, 1945, the only operational ship available at Trincomalee, Ceylon, was a solitary cruiser. Numerous assault vessels were acting as river gunboats in the 'chaungs' of the Arakan.

The Higher Authorities then decided that a sea-borne assault would be necessary to effect the capture of Rangoon, and the East Indies Fleet was instructed to carry out this part of the operation with the limited resources available on the Station. It was essential that this operation should be completed before the break of the south-west monsoon. The assault was mounted in Akyab and Kyaukpyu and, so far as naval medical organisation was concerned, an anxious existence followed, for the margin of medical personnel was so small that in the end it was possible to fulfil the last commitment for a medical officer only because of a breakdown in one of His Majesty's Ships, with the consequent release of her medical officer for an appointment elsewhere.

It can now be admitted that the failure of the Japanese to defend Rangoon was the salvation of the naval medical organisation in the East Indies. By the time the operation began, resources in medical personnel were so exhausted that there were literally no reserves, and replacement of casualties could have been effected only by reducing the complements of establishments elsewhere and inshore hospitals.

As soon as the Army was firmly established in Rangoon it was the task of the Navy to return its personnel and equipment to India and Ceylon before the breaking of the monsoon. Fortunately the monsoon of 1945 was a comparative failure, and the object was achieved.

The next immediate commitment of the Navy was concerned with the major operations in preparation for securing an advanced base in Malaya, from which to mount the final assault which aimed at the recapture of Singapore. Strenuous efforts were made to overcome the state of unpreparedness of the bases in India, and to provide more hospital beds in Ceylon. Just as it appeared that the maintenance services had a chance to overtake the lag, the scheme for the re-allocation of man-power was applied. The immediate result was that many men had to be drafted to the United Kingdom for reliefs, while at the same time the supply of personnel to the Station suddenly fell far below requirements.

Fortunately, hostilities were soon brought to a successful conclusion, though in retrospect, if the expected battles for Malaya had had to be fought, it is doubtful whether naval medical resources would have been equal to the task.

Decentralisation of executive authority was delegated by the Commander-in-Chief of the East Indies Station to the following Commands:

Flag Officer Air, East Indies—based in Ceylon, and responsible for Naval Air Stations, India and Ceylon, and Aircraft Carriers.

Flag Officer, Ceylon—responsible for Naval Establishments in Ceylon, including the Ports, based in Colombo.

Senior Officer, Royal Naval Establishments, India—based in Bombay. Responsible for Royal Naval Establishments in India, including Landing Craft Bases and Assault Forces prior to their allocation to the Forces Commander.

Senior Naval Officer, Persian Gulf.

Forces Commander—responsible for Assault Forces after allocation.

The major medical appointments involved in these central sub-commands were as follows:

Fleet Medical Officer, East Indies. A surgeon captain on the staff of the Commander-in-Chief.

Staff Medical Officer to Flag Officer, Ceylon—a Surgeon Rear Admiral.

Staff Medical Officer to Flag Officer Air, East Indies—a surgeon captain.

Staff Medical Officer to Senior Officer Royal Naval Establishments, India—a surgeon captain.

Staff Medical Officer to Flag Officer/Commodore, East Africa—a surgeon captain.

The de-centralisation of executive authority into the Commands described was dictated by the size and complexity of the Station. Each Authority carried his own staff officer whose responsibility was to his Executive Commander. Such a system was naturally based on the normal staff procedure observed in the Navy, and tinged perhaps with what is best described as the 'Custom of the Service'. At first sight, the system should have been fool-proof, but when put to practical application there is no doubt that medical organisation and administration was hampered by lack of a co-ordinating administrative chief, and by too close adherence to the chain of executive command and to traditional naval organisation.

The position of the Commander-in-Chief to whom the Sub-Commanders were responsible was quite clear and the chain of command simple. But, to take a single example, to attempt to administer from a headquarters in Ceylon a vast organisation in India was bound to create difficulties if only because the needs and conditions of each country were so completely different. From the medical viewpoint the Navy, as confined to Ceylon, was largely its own master. On the other hand in India, naval medical requirements were largely placed under Army direction and advice, a system which was naturally welcome in view of the Army's long experience of local conditions.

In directing such an extensive area, there were bound to be times when conflicts of policy and authority arose. For instance, the Senior Medical Officer of a Naval Base in India would be responsible to the Staff Medical Officer to Senior Officer, R.N. Establishments, India, in Bombay. The Staff Medical Officer would in turn be responsible to the Fleet Medical Officer in Ceylon. Such administrative medical channels were obviously tortuous. Nevertheless, the same Naval Base in India might have within its boundaries a Naval Air Station, whose medical officer was directly responsible to the Staff Medical Officer to Flag Officer Air, in Ceylon.

For some time there was no clear directive to the Surgeon Rear Admiral on the staff of Flag Officer, Ceylon, and his duties, outside the confines of the Royal Naval Auxiliary Hospital, Colombo, were ill-defined. Eventually, his position was interpreted as adviser to Flag Officer, Ceylon, on policy concerning medical establishments in that country, but in no sense the administrative authority of hospitals other than his own.

The immense difficulties of the Fleet Medical Officer himself were obvious. Although, by virtue of the fact that he could speak officially only through the mouth of the Commander-in-Chief he was the actual head of the medical organisation on the Station, yet he had neither the seniority nor the staff to be formally established in such a position. The tortuous administrative channels throughout his Command have already been mentioned, and gave rise to delays in the receipt of vital

information. There were times when such delays might have been more serious, had individual medical officers, well realising the need, not decided to short-circuit their own immediate higher authority and communicate with the Fleet Medical Officer direct. The difficulty of his position was increased by the fact that he was the only medical officer from whom the veil of security was lifted, and therefore the only one capable of forming a true picture of the requirements of the Station as a whole from both the operational and administrative points of view.

A concrete example of the type of difficulty with which the Fleet Medical Officer was confronted may be cited:

It became evident towards the end of January 1945 that the general shortage of hospital ships was creating an unacceptable situation on the East Indies Station. It was also evident that, despite the declared intention of the Army Command not to call upon naval hospital ships, the Navy must be prepared for a reversal of this decision, and must be ready to meet a sudden demand for assistance. On January 31 a decision was reached that naval hospital ships could not be released for operational needs, until shore hospitals in Ceylon were able to take over the commitments which the hospital ships were meeting at that time in various bases. The primary consideration was the provision of 400 beds at Trincomalee, where the target date for completion of a Combined Services Hospital was April 1, 1945. In its practical sense the provision of these beds depended upon the construction of European wards in an existing Indian General Hospital. This project fell within the sphere of Flag Officer, Ceylon on the Navy side and the Commander-in-Chief, East Indies, on the Army side. It became evident that neither staff nor equipment for the hospital would reach the Station in time. It was therefore necessary to break security on the Fleet Medical Officer's side to the extent of informing the Surgeon Rear Admiral that an operational necessity had arisen for the hospital at Trincomalee to be completed and capable of relying on its own resources by April 1. But it was also apparent that the requirements of the Fleet might very well exceed the facilities that could be provided at Trincomalee, and it was therefore necessary to supplement with extra hospital beds in Colombo. In this way the Royal Naval Auxiliary Hospital, St. Peter's, Colombo, which must be distinguished from the original Royal Naval Auxiliary Hospital housed in part of the General Hospital, Colombo, became a vital factor in operational planning. The original date for the completion of this hospital was September 1944, and the project was entirely in the hands of Flag Officer, Ceylon. Lack of insight into the operational background had led to the repeated lowering of this priority, and it was almost impossible, under the handicap of security, for the Fleet Medical Officer to bring home the urgent need for this hospital.

At the same time the Fleet Medical Officer received the news, fortunately expedited by the short-circuit of official channels, that

work on the Combined Military Hospital at Cochin, Southern India, had virtually stopped at a moment when that Base was about to embark on a period of full activity. This project lay with General Headquarters, India, and it was evident that immediate and drastic steps were required if the hospital commitments of the Navy at that port were to be catered for in time. The channels of official correspondence were obviously going to be too slow to be effective, and immediate action was taken by diverting a hospital ship to be based temporarily at Cochin. The headquarters of the Supreme Allied Commander was now acquainted with the fact that no extra hospital ship could be released unless shore hospital facilities could be made available for the Navy at Cochin. The immediate result was that work on the hospital was restarted and very soon completed.

From these examples it might be argued that the Fleet Medical Officer carried sufficient authority to achieve the necessary results by personal inspection and subsequent reports to the Commander-in-Chief. But apart from the fact of intrusion into the Command of a Flag Officer, consideration of the Fleet Medical Officer's responsibilities in the light of the personnel of his department showed this to be impracticable. The Fleet Medical Officer had to carry out his vast duties with the assistance of a commissioned wardmaster and a W.R.N.S. shorthand typist. This was the full extent of his clerical assistance. He was primarily responsible for the health and hygiene of the Fleet Station. To this was added the day-to-day administration of the Fleet in all matters having a medical bearing, including proposals for the optimum complement of the medical personnel on the Station. It was necessary for him to keep abreast of the strategical and tactical situation and to plan the provision of both personnel and material for forthcoming operations. Beyond that lay logistical planning for future developments, while an intelligent appreciation of the latest advances in large-scale preventive medicine and pest control had to be maintained. Personal interviews with medical officers were prodigal of time, but played an essential part in the maintenance of the morale of the Medical Branch. Frequent Inter-Service meetings at the Supreme Commander's Headquarters called for the expression of the Naval point of view in all questions of hygiene, pathology and research. The overriding consideration was that a single day contained only 24 hours, which translated into practical terms meant that the Fleet Medical Officer could ill afford to leave his central office in Colombo for any length of time. The time factor on so big a Station was of importance, and had to be studied in relation to the effect of weather conditions on transport facilities. On one occasion the Fleet Medical Officer expended 12 days during an operational lull in an incompleted tour of India on the highest obtainable administrative priority for air passages. The programme allowed for one clear day at Delhi, Vizagapatam, Cochin and Mandapam, two

clear days in Bombay, and a passing glance at Calcutta. Owing to unforeseen factors in the way of weather and aircraft priorities, all that could be achieved in fact was Delhi, Bombay, an evening in Calcutta, and Vizagapatam. Some time later three days were expended in order to obtain one clear day at Cochin. The conclusion was that it was virtually impossible for the Fleet Medical Officer to leave his headquarters for long periods for the sake of settling one point at a distant base.

This immobilising of the Fleet Medical Officer inside his central office inevitably accentuated a tendency to the formation of separate and independent Navies, in which the Hospitals, the Naval Air Arm, India, Assault Forces and the more distant Commands were liable to take unilateral action with a resulting lack of cohesion and co-ordination. The location of the office of the Commander-in-Chief at Colombo while the Fleet was based at Trincomalee, militated against personal contact with medical officers and, more important, with Commanding Officers serving afloat. At the same time it was the responsibility of the Fleet Medical Officer to give the Commander-in-Chief sound and accurate advice on medical problems arising in any part of his Station.

The rapid march of events during the first seven months of 1945, as has been described, called for sudden changes of plans and produced a crop of unforeseeable contingencies, to meet which the constant availability of the Naval Medical Officer conversant with the true picture of events, supported by the scanty medical resources at his disposal, was virtually *sine qua non*.

Perhaps, the outstanding administrative drawback, when each subcommand tended to form its own separate Navy, was that there was no medical officer carrying sufficient weight to break down the parochial outlook. Each Staff Medical Officer was apt to present his own point of view to his Flag Officer through whom it reached the Commander-in-Chief after considerable delay. In this relation it was necessary for the Fleet Medical Officer to be in possession of very full and detailed knowledge of the local situation before he could advise the Commander-in-Chief to issue an order in direct rejection of a Flag Officer's stated requirements. In such circumstances it was impossible to avoid inequitable distribution of medical resources.

Another drawback to medical administration was the absence of means of issuing medical memoranda to the Fleet. The only channel open to the Fleet Medical Officer for addressing the medical officers was East Indies Temporary Memoranda, the utility of which was somewhat limited when subjects applying only to the Medical Branch required promulgation.

This account of the problems of the Fleet Medical Officer of the East Indies Station has been recorded in some detail as being an example, not of faulty organisation, but of the difficulties attached to

the medical administration of a large area which spreads over several countries and where the commitments of the Navy ashore are added to and even tend to over-balance its normal commitments afloat. These problems of a Fleet Medical Officer were by no means confined to the East Indies Station, but were experienced by other Fleet Medical Officers. They illustrate, as has been explained in the case of the Mediterranean Station, that naval medical planning is a most difficult matter to record on paper in advance in the hope that the ultimate picture will turn out to be the same as that anticipated. It is possible that the very smallness of naval medical resources compared with the far larger resources of the Army were inherently unsuitable to be exploited over large areas ashore, and that in consequence naval medical organisation in this and other theatres of war tended to be less planned in advance than improvised and built up as necessities arose. Obviously the position of Fleet Medical Officers in such circumstances was tenable only by virtue of the personal initiative and the co-operative spirit of the many medical officers throughout their Commands.

Finally, it may be stated with some confidence that the solution of such difficulties and problems had the effect of initiating in the Royal Navy a new idea which had been largely absent, though always well to the fore in the other Services. The full effect was that the influence of medical considerations on the conduct and success of naval operations became a factor more and more appreciated by Senior Executive Naval Officers. It began to be realised that the responsibility for implementing necessary and vital medical measures must rest with the Executive, and not with a small Medical Branch acting with limited authority. It began to be understood that though a Fleet Medical Officer may have nothing positive to contribute to actual operational planning, he should at least be conversant with affairs from the beginning in order to steer such plans on to a plane of security from interference by disease. This applied in particular to amphibious operations with which the East Indies Station was largely concerned, and it may be recorded that the work of the mobile malaria and hygiene units was given unstinted praise by Commanding Officers throughout the whole Station.

Some remarks on the supply of medical stores and equipment on the East Indies Station are considered to be of interest. As has been described elsewhere in this History, the Admiralty Department responsible for the supply of medical stores achieved remarkable success during the war years in the face of overwhelming adversity. It is therefore disappointing that the efforts of this department should not have been completely successful from the consumers' end on the East Indies Station itself. The extenuating factors were those which existed in the case of every foreign station to which such stores and equipment had to be supplied in large quantities, namely: shortage of supplies, shortage of shipping, and shortage of store-keeping personnel at the receiving

end. To this must be added the ever-present hazards to be overcome in transporting the stores many thousands of miles by sea in the face of enemy action. For this reason large quantities of stores never reached the Station at all, while some were held up in the Mediterranean Area when those waters were virtually closed to Allied shipping. The distances and hazards were such that a lapse of 9–12 months had to be accepted between the approval of a demand and the actual receipt of the stores on the Station. One of the greatest difficulties was that of supplying X-ray films to the Station in a serviceable condition.

In the plans made for the needs of the Station as a whole the provision made in India for replenishing the stores of landing craft was not completely adequate. The medical store depot in Bombay proved to be too small in design, and since no service afloat depots were included in the planning of the Indian Bases, Bombay was faced with an acute problem when the Assault Force was withdrawn from the Arakan and had to be prepared for an assault on Malaya by August 1945.

As regards Ceylon, although the provision of a store depot at Trincomalee was excellent in theory, circumstances were such that in practice it could not always fulfil all the heavy demands of the Fleet.

The appointment of a Superintending Pharmacist to the Station was a step forward, and the far-sightedness and co-operative spirit displayed by this officer eventually brought the stores position to an adequate level, with the result that material required by port parties began to reach the Station in sufficient quantity to fulfil requirements within the stipulated period of time.

Once again, in the case of medical stores and equipment, too close an adherence to the traditional organisation of peace-time tended to militate against efficiency, for the attachment of the service afloat store depots to the medical officers in charge of hospitals was apt to preserve a parochial outlook which concentrated on the needs of a particular port, rather than on the overall picture of the needs of the Station as a whole.

The problem of supplying replenishments to port parties and Fleet units in forward areas could never really be satisfactorily solved, but here the difficulty was eased by relying on assistance from the Army, which was always readily forthcoming, and some degree of storing on a common user basis between the Services was achieved locally with marked success.

MEDICAL ESTABLISHMENTS, CEYLON

COMBINED SERVICES HOSPITAL, TRINCOMALEE

In peace-time there was a small naval sick quarters ashore at Trincomalee. The forerunner of the Combined Services Hospital was the 54th Indian and British General Hospital, under Army administration. This hospital consisted of four two-ward buildings converted from barrack accommodation, with a bed strength of 250. In August

1944 it was decided to extend these buildings, and to provide accommodation for a further 900 patients, and at the same time to build suitable quarters for medical officers, nursing sisters, V.A.Ds. and male nursing staff. At first it was intended that 200 beds should be allocated to the Navy, but later it was decided to make the establishment into a Combined Services Hospital, the European section of which would be staffed by the Navy, and the Asiatic section to be staffed by the Army. It was also arranged for the Navy to supply all specialist services. In contrast to Combined Services Hospitals elsewhere which were under Army direction, this hospital was under naval direction.

The Combined Services Hospital, Trincomalee, came into being as such on April 24, 1945, but at that time was much understaffed and short of stores and equipment. The establishment was commanded by a surgeon captain, medical officers, supply officer and chaplain, totalling 25. The nursing staff consisted of Navy and Army nursing sisters, totalling 37, Navy and Army V.A.Ds., totalling 60, 48 naval sick berth staff, and naval ratings for clerical, supply and miscellaneous duties, totalling 48.

As regards the female nursing staff, the elements concerned were a Navy acting Principal Matron, senior sister, nursing sisters, and V.A.Ds., working together with an Army Matron, British and Indian Army nursing sisters, and Indian Army Nursing Service V.A.Ds. The nursing commitments of the hospital included both British and Asiatic members of all the Fighting Services. To avoid unnecessary overlapping of duties, the Army Principal Matron was replaced by an Army acting Principal Matron appointed to serve only in the Asiatic Section of the hospital. But after a short time it was found that some confusion and unnecessary difficulties were arising by virtue of the fact that the hospital held two acting Principal Matrons, and to facilitate administration the Army Principal Matron's appointment was replaced by that of an Army senior sister.

By August 1945 the bed strength of the hospital was 1,000, and a specialist block had been completed which contained consulting rooms for the ophthalmic, medical, E.N.T., neuro-psychiatry, and surgical specialists.

As regards essential services, a satisfactory supply of electricity was available (220 A.C.). Water was supplied from the mains to numerous small tanks in the hospital, but no hot-water system existed. Sterilisation was effected by primus stoves.

Passive Defence never reached a high degree of development as there were no air raids of note, and the hospital was still in a stage of construction when the war with Japan ended. The usual fire-fighting precautions were adopted within the hospital, and the R.N. Fire Service was always available at short notice.

A friendly liaison was established with the local civil hospital, to which assistance was given as required. When necessary, cases could be

transferred to Service hospitals in Colombo by train, road, air or hospital ship.

Welfare and recreations included occupational therapy, lectures and instruction by the education officer, a hospital library, and films both instructional and recreational. Bathing was available for convalescent patients, and also football, hockey and cricket for the staff.

During its time as a Combined Services establishment this hospital received 2,914 patients. At the end of 1945 the hospital was converted into a purely Royal Naval Auxiliary Hospital and later ceased to be auxiliary and became a Royal Naval Hospital.

ROYAL NAVAL AUXILIARY HOSPITAL, COLOMBO

The Royal Naval Auxiliary Hospital, Colombo, opened officially on December 23, 1941.

Before this date naval patients had been accommodated by the Military Authorities in the Colombo area. On December 13, 1941, official intimation was received from the Military Authorities that all naval patients were to be evacuated from the Military Hospital, Colombo, by December 23, 1941. Although this action by the Military Authorities might appear to have been unnecessarily sudden, it was not altogether unexpected, for advance information of the possibility had been promulgated some months before, and plans had been made to meet the contingency whenever it should arise. As soon as this intimation was received, the Navy requested that the Army would still continue to treat naval venereal cases, and this request was granted. An official intimation was now forwarded to the Governor of Ceylon that accommodation was required immediately in Colombo General Hospital.

The Civil Authorities immediately handed over a block of the General Hospital capable of accommodating 115 patients. Beds were provided by the hospital, and bedding, furniture, mess traps, etc., were provided from naval sources. This wing of the General Hospital, Colombo, formed the foundation of the future Royal Naval Auxiliary Hospital, Colombo.

To this original block was added, in January 1942, the De Soysa Lying-in Home, a distinct portion of the General Hospital, with its own Medical Superintendent. Besides the addition of a further 100 beds, this provided administrative offices, dispensary, laboratory, and an out-patient department.

Adjacent accommodation was secured for 100 female nursing staff.

Thus, by the beginning of 1942 a Naval Auxiliary Hospital existed with accommodation for some 200 patients, to be staffed half by the General Hospital and half by the Royal Navy. This unit was regarded as a nucleus to be expanded later in accordance with a capital expenditure of some £10,000. This expansion had in view:

Accommodation for 525 patients, seven medical officers, two warrant wardmasters, 33 nursing sisters, 60 V.A.Ds., and 46 sick berth ratings.
Two operating theatres, X-ray department, dental surgery, baggage store, and Royal Naval Medical Depot.
Three kitchens.

On April 13, 1942, a Surgeon Rear Admiral arrived from the United Kingdom and took over charge of the hospital. At this time the hospital was functioning under great difficulties, largely due to the fact that Colombo had suffered an air raid a week previously, and a large proportion of the native population had fled to the surrounding countryside. The result was an acute shortage of labour, particularly servants, cooks and laundry workers. Some disorganisation had also occurred in the supply of medical stores and equipment, but deficiencies were made good by local purchase and with the assistance of military and civil supplies.

The bed strength of the hospital at this time was 483, of which 150 were constantly kept available for emergencies in accordance with instructions of the Commander-in-Chief, East Indies.

By the end of June 1942 the hospital was experiencing difficulty in accommodating indefinitely cases of pulmonary tuberculosis awaiting transfer to Durban. This was also true to some extent in the case of mental patients. It had also become obvious that accommodation for sick sisters and V.A.Ds. had been overlooked, and in any case the sickness rate among the female nursing staff was much higher than had been foreseen.

Stores and equipment continued to cause anxiety, due to the non-arrival of lend-lease consignments from America. In due course 90 per cent. of the issues of the depot at Trincomalee were sent to Colombo, but even so the situation as regards drugs and dressings became acute as Army and civil stocks were nearly exhausted. However, the Army eventually made arrangements to draw supplies from a central depot in India, and included naval requirements with theirs.

Some slight difficulty also arose when the Army hospitals found it no longer possible to accommodate naval venereal cases. It therefore became necessary to open up two wards for these cases in the R.N. Auxiliary Hospital, thereby reducing the emergency accommodation available. Eventually, this problem was solved by establishing a mess for venereal patients in St. Joseph's Barracks. In due course stores and equipment started to arrive from the United States and the hospital approached independence, with the exception of certain essentials. Lack of X-ray apparatus necessitated the bulk of this work being done by the General Hospital X-ray Department. Shortage of equipment, particularly microscopes, necessitated the bulk of bacteriological and pathological work being performed by the Ceylon Government Laboratory. Some difficulty was also experienced in obtaining cylinders of nitrous oxide gas of the normal Service size.

As the year progressed the sickness rate continued to be high among the hospital nursing staff, the chief cause being dengue fever, which was rife in the district in which the hospital was situated.

By the beginning of 1943, the commitments of R.N. Auxiliary Hospital, Colombo, were such that some doubts were expressed of the adequacy of accommodation. The problem of accommodating cases of pulmonary tuberculosis awaiting passage was still unsolved, as was that of the accommodation in general of all invalids awaiting passage. As the majority of such cases were medical, this state of affairs threw a great strain on the resources of the medical section of the hospital, and it was frequently necessary to encroach upon the surgical wards set aside for emergencies. The Civil Authorities were unable to part with any more accommodation to the Navy, but it was agreed to build additional accommodation for sick officers to the extent of some 20 extra beds.

At the same time difficulties arose as regards the accommodation of sick berth staff, because, in order to complete the proposed operating theatre block of buildings, it was necessary to relinquish two wards into which sick berth staff were housed.

The main solution of accommodation difficulties at this time depended on the completion of the proposed Royal Naval Auxiliary Hospital, up country, at Diyatalawa.

By the middle of 1943 the situation was even worse as regards accommodation, for orders were received that Royal Indian Navy and Malay Navy patients were to be accepted in the hospital. Previously they had been treated in the General Hospital, Colombo.

In July 1943 the new operating theatres came into use and were of modern design.

Patients' accommodation had by now become even more congested, for yet another surgical ward had had to be given up to the occupation of W.R.N.S. patients. Approval was now given to take over a small private hospital a short distance from the main hospital, with a view to providing accommodation for about 60 female patients.

Towards the end of the year 1943 the accommodation question was somewhat eased by the commissioning of the Royal Naval Auxiliary Hospital, Diyatalawa, to which convalescent patients could be evacuated by hospital train.

As has already been described, the years 1944 and 1945 brought a tremendous increase in the medical commitments of the East Indies Station, and the impact of the changed trend of war in this area was severely felt by medical establishments in Ceylon.

On May 10, 1944, a change of Surgeon Rear Admirals took place in the Royal Naval Auxiliary Hospital, Colombo, at a time when unexpected medical commitments were rising, when the numbers of naval personnel in Ceylon were rapidly increasing, and when there was a general shortage of medical officers and nursing staff.

At the end of June 1944 it was officially reported that the hospital bed strength in the Island of Ceylon was totally inadequate to deal with essential commitments, that no pool or reserve of officers, V.A.Ds., or sick berth staff existed to replace losses due to a constant high rate of sickness, and that there was besides a shortage of pharmaceutical staff to cope with the local store requirements of the hospital and the vast demands for supplies to the Fleet. At this time the hospital's bed strength was 550, but the proportion of beds for sick officers was insufficient, as was that for sick members of the local female Service population among whom the incidence of sickness was especially high. Other disadvantages were a lack of isolation for zymotic diseases and cases of pulmonary tuberculosis, and the almost total lack of recreation space and facilities.

During the first six months of 1944 the daily admission rate to the hospital was almost doubled, and it was no longer possible to retain the stipulated reserve of 150 beds for an emergency. Any easing of the situation by frequent evacuations of patients to the R.N. Auxiliary Hospital, Diyatalawa was largely neutralised by the general increase in admissions. By now it was obvious that the continued treatment of Asiatic patients in European wards was unsuitable. Further disadvantages reported were lack of baggage accommodation, difficulties attached to the treatment of neuro-psychiatric cases, the lack of an E.N.T. specialist, and limited laboratory facilities. Also, apart from nursing and treatment, shortage of staff accentuated the difficulty of controlling administration in a hospital which was so divided and scattered and possessed no boundaries of its own. Food, linen, cutlery and stores disappeared to an extent which gave rise to grave concern.

By October 1944 R.N. Auxiliary Hospital, Colombo, was so overcrowded with patients that further routine admissions were impossible, and only urgent cases could be received. This crisis had the effect of expediting the use of St. Peter's Royal Naval Auxiliary Hospital, Colombo, which had already been planned for many months, but the construction of which was as yet far from completed.

ST. PETER'S ROYAL NAVAL AUXILIARY HOSPITAL, COLOMBO

St. Peter's Royal Naval Auxiliary Hospital was situated some five miles south of Colombo, on the main road to Mount Lavinia and Galle. Originally the building was occupied by St. Peter's College, a Roman Catholic boys' school. Earlier in the war it had been requisitioned by the Army for use as a military hospital for Indian troops, and on the playing fields of the school a series of 14 communicating 'banda' style wards were erected of brick and cement with 'cadjan' roofing. When it was proposed to convert the establishment to an Auxiliary Naval Hospital a great deal of additional construction was necessary to provide

suitable accommodation for European patients, but, unfortunately, this work held a low priority, and there was considerable delay before it was commenced.

In August 1944 a small number of wards was capable of being used, and all cases of venereal disease were taken over by St. Peter's from the R.N. Auxiliary Hospital, Colombo.

In October 1944, in consequence of the crisis of overcrowding which had arisen in R.N. Auxiliary Hospital, Colombo, it was decided that although St. Peter's Hospital had as yet no facilities for investigating or treating general patients, and had no staff for nursing them, beds were available to which suitable selected cases could be transferred with a view to easing the situation in R.N. Auxiliary Hospital. As a result, a number of invalids awaiting passage were sent to St. Peter's for accommodation, while technically remaining on the books of R.N. Auxiliary Hospital.

In December 1944 the number of officer patients requiring admission to R.N. Auxiliary Hospital, Colombo, became much greater than that hospital could receive. It was now agreed to utilise beds in St. Peter's for minor cases such as dengue fever.

By April 1, 1945, there was a total of 115 patients accommodated in St. Peter's, but borne on the books of R.N. Auxiliary Hospital. On that date St. Peter's officially came into being as a separate hospital, and ceased to be an annexe to R.N. Auxiliary Hospital, Colombo. All its patients were officially transferred to its own books. From that date all cases of venereal disease, and all chest cases were received direct, but suitable cases also continued to be transferred from R.N. Auxiliary Hospital.

The former school buildings were delightfully planned with wide, open verandahs on all sides, and overlooking intervening lanes and gardens. In these buildings were situated the administrative offices, the various specialists' consulting rooms, the laboratory, X-ray and massage departments. There was also accommodation on the ground floor for 48 patients in small open wards.

The first floor had accommodation for 30 officer patients in cabins each holding four or six beds. These cabins were placed so that they received a maximum of air and breeze and had wide verandahs on two sides, with a small verandah at each end. The officers' galley and pantry were situated on the second floor.

Attached to these buildings was a concert hall which could accommodate more than 1,000 persons. It was used as a recreation room for patients, for Ensa concerts, cinema shows and church services.

Near this concert hall were two 'banda' type wards each containing 74 beds for Asiatic patients. European accommodation consisted of eight wards of 26 beds each and six wards of 32 beds each, giving a total of 400 beds. The spacing of beds was, however, so generous that

the accommodation could readily be increased to a maximum of 750 beds. The additional equipment for such expansion was kept in store against any future emergency.

By the end of June 1945 most of the essential work of construction was completed, but it was impossible to open all the wards owing to shortage of staff.

The hospital was commanded by a surgeon captain. Although there was a slight deficiency in the agreed complement of medical officers and nursing sisters, the chief shortages were in the complements of sick berth staff and V.A.Ds. As regards sick berth staff there was a deficiency of 13 specialist ratings, the lack of whom seriously embarrassed the work of the laboratory and physiotherapy departments. As regards V.A.Ds., of the agreed complement of 100, only 39 were received from the United Kingdom, and in the absence of a commandant it was necessary to employ a nursing sister for this duty. In due course these shortages were solved to some extent, but on the whole were never completely remedied. Nevertheless, this hospital fulfilled a most valuable function during the relatively short period of its existence.

The Royal Naval Auxiliary Hospital, Colombo, and the St. Peter's Royal Naval Auxiliary Hospital, Colombo, together received and treated a total of 16,121 Service patients.

ROYAL NAVAL AUXILIARY HOSPITAL, DIYATALAWA

Diyatalawa is situated in the up-country district of Ceylon at an approximate altitude of 4,500 ft. It can be reached either by road, a somewhat tortuous journey, or more conveniently by a ten- to twelve-hour journey by train from Colombo. The district is occupied mainly by large tea estates, and the altitude of Diyatalawa itself occupies a position roughly midway between Banderawella, 1,500 ft. lower, and the hill station of Nuwara Eliya at approximately 6,000 ft. The climate is delightfully cool and the atmosphere rarified and pleasant. Sunshine is abundant at times, but long periods of continuous rainfall occur and constitute a serious drawback to the casual visitor.

For many years a Royal Naval Camp has existed at Diyatalawa in charge of a naval barrackmaster. The original function of this camp was to provide holiday accommodation for a month in each year for the ships' companies of the East Indies Squadron and Red Sea Sloops. The usual programme of His Majesty's Ships serving in these tropical waters allowed for an annual docking period in Colombo during which the ships' personnel were transferred to Diyatalawa and obtained the benefits of a cool climate and a rest period.

At the earliest period of its existence the Royal Naval Camp was somewhat primitive in its layout and construction, and amenities and recreational facilities were limited. A small sick bay served medical needs, but anything in the nature of an acute surgical emergency

presented a problem which could be dealt with only with the assistance of the limited facilities of the civil hospitals up-country or, if time allowed, by transferring the patient by road to Colombo, a journey occupying some hours, the safety of which depended on careful driving over a precipitous route. During the 1930's the camp was gradually extended and modernised and its facilities, comforts and recreational amenities were improved by the addition of bungalows, a sick quarters, fresh water supply and modern sanitation. A nine-hole golf course had existed for some years.

Before the outbreak of war it was planned to build a naval hospital at Diyatalawa. In principle, the project was sound for it had in view not only the provision of local general medical and surgical facilities where none had previously existed, but also adequate accommodation to relieve any overcrowding in other Service hospitals in Ceylon by the reception not only of convalescent cases, but such cases as skin diseases which would benefit from the cool climate, and neuro-psychiatric cases who would benefit from the peace and quiet of surroundings far removed from the stress and strain of war.

Though sound in principle the project took time to implement, and was subjected to long periods of delay and a position on the list of constructional priorities which varied with the trend and tempo of war in this part of the world.

The Royal Naval Auxiliary Hospital, Diyatalawa, came into being before the end of 1943, under the command of a surgeon captain, R.N. Its urgent need has already been evidenced in the description given of the crisis in bed strength of the hospitals in Colombo, and there is no doubt that Diyatalawa performed valuable service by the reception of altogether some 6,000 patients with a consequent easing of the burden borne by other establishments.

But the available records, though voluminous and carefully compiled, show little of historical interest except to suggest that in addition to constant delays in necessary construction, the hospital was only able to function at all in the face of almost insurmountable difficulties. It is doubtful whether stores and equipment were ever really adequate. Essential services were never wholly satisfactory and it is frequently mentioned that the fresh water supply was poor and contaminated to the extent of necessitating heavy chlorination. The supply of electricity would appear to have been deficient. Victualling obviously presented an anxious problem, and though there was never any serious breakdown, it was impossible to produce a light diet for patients owing to the scarcity of eggs and chicken, and the complete absence of any kind of fish. The refrigeration space was poor and such machinery as did exist was in a bad state of repair. Complaints were made of inadequate staff accommodation, though it was possible to maintain a bed strength for approximately 380 patients.

To these obvious drawbacks was added a constant shortage of medical and nursing staff, and this shortage was aggravated by a high incidence of sickness among them, the main cause being amoebic dysentery. As many as five medical officers and 12 nursing sisters fell victims to this disease, and there can surely be no greater drawback to militate against the efficiency of a hospital in the Tropics than the incidence of a serious tropical disease in almost epidemic form among the members of its medical and nursing staffs.

In lighter vein it is perhaps permissible to mention that the frequent marriages recorded in the quarterly reports of this hospital seem to have constituted a high 'casualty rate' among the female nursing staff.

MEDICAL AND HOSPITAL ORGANISATION, INDIA

Some idea of naval medical commitments in India has already been given above in the description of the medical administration of the East Indies Station. But to comprehend fully some of the problems which had to be surmounted it must first be realised that the position and status of the various Royal Naval Establishments which existed in India were very different from those held by similar establishments in other Eastern Waters forming part of the East Indies Station. It has already been pointed out that naval medical administration on the East Indies Station was perhaps complicated, and made more difficult than it need have been by too close adherence to the traditional system of naval sub-commands. In the case of India this became more obvious with the passage of time, and the task of directing from a central headquarters in Ceylon a large organisation in a country as vast as India, whose political and military problems alone were entirely different, proved impossible to achieve without long periods of misunderstanding and delay.

The function of Senior Officer, Royal Naval Establishments, India, was performed by a Flag Officer subordinate to the Commander-in-Chief, East Indies. The chief establishments for which he was responsible were the Royal Naval Bases in Bombay, Calcutta, Vizagapatam, Cochin and Mandapam. In addition, he had certain responsibilities for Naval Air Stations within his Command, the chief of which were at Cochin, Coimbatore, and Solur. The actual Administrative Authority for these Air Stations was Flag Officer (Air) on the staff of the Commander-in-Chief, East Indies.

The Senior Officer, Royal Naval Establishments, India, had as his Staff Medical Officer a surgeon captain, R.N., who, subordinate to the Fleet Medical Officer, East Indies, was responsible for naval medical organisation and administration throughout India.

The headquarters of Senior Officer, Royal Naval Establishments, India, was in Bombay, where in addition to the Staff Medical Officer, a Naval Medical Officer of Health was borne, who was responsible for

the hygiene and public health requirements of the various naval establishments in India.

Broadly speaking, the essential difference between the Royal Navy in India and the Royal Navy elsewhere on the East Indies Station was that it had to function in a manner which would conform to the requirements of a political background on which its existence and welfare largely depended. In this respect it must be remembered that the Navy had entered and set up bases in a country which possessed its own Central Government, and which, while producing an enormous war effort in the way of finance, material and man-power, was at the same time rapidly approaching emancipation, independence and Dominion Status. It can be seen, therefore, that the Royal Navy in India had a responsibility to the Government of India as well as to the Commander-in-Chief, East Indies, whose headquarters were in Ceylon. Also at least one of the Naval Bases in India was set up in an Indian State, virtually a foreign country, the requirements of whose own separate Government had to be comprehended and observed. To impose upon local authorities the multifarious medical and hygiene demands of many thousands of naval personnel entering India was by no means easy, and called for a careful study and understanding of local conditions.

The needs and welfare of the Royal Naval Establishments in India were amply met by the Government of India, and for all practical purposes the Government of India may be regarded as having been represented by the Indian Army. The Royal Navy in India might be regarded as a tenant, with the Army in India acting as the agent of the landlord, the Government of India. This might suggest that the Government in India became subordinate to the Army in India, and perhaps this was true in the case of naval medical administration in that country. The Navy was in fact a newcomer to India, while the Army had seen generations of service there. With its long experience of medical problems in India the Army was able to guide the Navy in its basic hygiene, in its preventive medicine, to afford hospital facilities, to provide labour and building materials, as well as to fulfil many of the medical requirements unique to the Senior Service. Throughout the whole country, therefore, it may be stated that a high degree of medical liaison and co-operation grew up between the Navy and the Army which was wholly to the advantage of naval personnel. Naturally there were instances where, in a single area, Navy and Army medical organisation tended to differ, but wisely the Navy bowed to the superior knowledge possessed by the Army of local conditions, and was glad to modify its own organisation and to accept the advice and assistance which was always so freely offered.

As regards the hospital accommodation of naval personnel in India, the policy evolved aimed at establishing a Royal Naval Auxiliary

Hospital in Bombay, and elsewhere the admission of naval patients to military hospitals to which assistance would be given by way of naval medical and nursing staffs where necessary. In point of fact the trend of war was such that anything of the nature of a Combined Services Hospital was only attempted in Cochin, though small naval liaison units were established in military hospitals elsewhere. The policy also aimed at establishing a large Royal Naval Sick Quarters at Mandapam in Southern India, but this project had been barely put into effect by the end of hostilities with Japan.

THE ROYAL NAVAL AUXILIARY HOSPITAL, BOMBAY

A surgeon captain was appointed in April 1944, as Staff Medical Officer to Senior Officer, Royal Naval Establishments, India, and as Medical Officer-in-Charge of the Royal Naval Auxiliary Hospital, Bombay. He arrived in Bombay on June 1, 1944. The situation then was that Livingstone High School, Bombay, was in process of being converted into a Naval Auxiliary Hospital of 300 beds. Necessary outbuildings had been erected but not equipped, electrification had not been carried out, and a water supply had not yet been provided. The building had been handed over by the Governor of Bombay on October 4, 1943, at a monthly rental of Rs. 7,849.

In the meantime accommodation for naval personnel was provided in St. George's Hospital, Bombay, on the upper floor of which 100 beds were set aside for naval use. Medical and surgical patients were treated by naval medical officers lent to St. George's Hospital, medical records were kept by two naval sick berth ratings, while nursing and catering were carried out by the civil staff of the hospital.

The original plans for the conversion of Livingstone High School into a hospital were drawn up by the Admiralty Civil Engineers' Department, with an estimated cost of £19,000. In August 1944 this sum was increased by £3,820 to cover the construction of concrete roadways and other essential works, such as the substitution of gas for electricity as a means of cooking and heating, and extra water supply to operating theatres. The staff of the hospital consisted of one surgeon captain and six medical officers, one accountant officer, one warrant wardmaster, one Matron and ten nursing sisters, 37 V.A.Ds. and 29 sick berth ratings. By the end of 1944 the medical and nursing staffs had only arrived in part in Bombay, but certain deficiencies were met by diverting for duty in R.N.A.H. Bombay a number of the medical staff intended ultimately for the Combined Military Hospital, Ernakulam, Cochin. The complete medical staff for Bombay arrived by March 30, 1945.

Staff accommodation was a problem which was solved only after many months of difficulty.

The Royal Naval Auxiliary Hospital, Bombay, was officially opened by Lady Louis Mountbatten on January 26, 1945, in the presence of

His Excellency the Governor of Bombay, and Lady Colville. The Senior Officer, Royal Naval Establishments, India, was also present as were many other distinguished British and Indian residents.

It is of interest to record that the original date proposed for opening this much needed hospital was April 1944, and there is no doubt that in this particular case the chief delay was due not so much to slow conversion as shortage of nursing staff.

In the subsequent months various difficulties were encountered which necessitated some constructional modifications, and lack of an air-conditioning plant for the operating theatre was keenly felt. This meant that the bulk of theatre work still had to be carried out at St. George's Hospital.

The system of victualling by contract was not altogether satisfactory. Efforts were made eventually to put a general mess system into force, but here the difficulty was to obtain the necessary cooks, catering and victualling staff. In addition to employees of the victualling contractor, the civil staff of the hospital numbered 16.

The shortage of nursing staff continued, and it was soon obvious that the numbers in each category were insufficient to make provision for leave or sickness. In this respect a disquieting feature during the first few months of the hospital's existence was the realisation that dengue fever was endemic in the district in which the hospital was situated. This disease exacted a high toll among the staff, and a large number of cases occurred among patients who were infected while under treatment in the hospital for some other disease. In November 1945 a change took place of Medical Officers-in-Charge, and, with one exception, all medical officers on the staff of the hospital were discharged to the United Kingdom for demobilisation. Work was continued with a new team, all fairly junior in rank.

The hospital was transferred back to Livingstone College on February 15, 1946, having treated 3,230 Service patients in the course of its existence. Its work was taken over by St. George's Hospital until March 15, 1946, after which date the peace-time system was reverted to whereby hospital accommodation for naval personnel was provided by the British Military Hospital, Colaba.

ROYAL NAVAL LANDING CRAFT BASE, COCHIN, SOUTHERN INDIA

The coast of India is not well provided with sheltered anchorages, and up to a few years before the war the only ports on the west coast capable of receiving a ship of any size were Karachi and Bombay. Secondary ports did exist at Ratnagiri, Mangalore, Calicut, Aleppy and Tuticorin, but provided only open anchorages up to five miles off shore. The third port of reasonable size in relation to Karachi and Bombay was Marmagoa, in Portuguese territory. Before 1931,

passengers and merchandise to and from Southern India were faced with either:

Disembarkation at Bombay, followed by several days' onward transit by rail.

Disembarkation at Colombo, and transit from Ceylon to India by rail and ferry.

Disembarkation at Madras on the east coast.

Particularly affected were the vast Nilgiri tea estates, and the industries of Travancore, for though only a few hours' journey from the west coast by road, all export and import had to be effected through Madras, a journey of many days.

Early in 1930, an ambitious engineering project was commenced in Cochin, and by dredging and reclaiming, first-class harbour facilities were created in the following years. The port of Cochin promptly became a place of importance in Southern India, and before the war passenger liners were calling regularly.

With the entry of Japan into the war and the fall of Malaya and Burma, the invasion of Ceylon and Southern India from the south and east seemed inevitable. The port of Cochin now became of strategic importance, and on the assumption that transport through the Madura Plain might be impossible, an escape route was constructed over the High Range and Nilgiris, allowing the passage of men and materials across the mountains from Madras to Cochin via Kodaikanal and Munar. At this time military attention was concentrated on the west coast of India, the fear being that a Japanese invasion from the south and east might coincide with a German invasion through Iraq and Persia from the north, following the fall of Egypt and Russia. So great was the importance of Cochin during this phase that all military works and projects in the area were marked down as Priority 1, and vast quantities of material and labour were sent from all over India to prepare for its defence. Naturally hospital construction on a large scale was included in this planning. During the subsequent eighteen months construction was advanced on this Priority 1 basis.

But meanwhile the war picture had changed, because events in Russia and North Africa had reduced the threat to India from the north, and the Japanese had been impeded in the east. The pendulum now began to swing back, but Cochin still retained its importance, though as an offensive rather than a defensive base.

At this point the Royal Navy entered the picture in Cochin, and it was decided to establish there a large naval base with two main functions:

A first-class Landing Craft Base, which would offer facilities for maintenance and refitting, and would also act as a training area for landing craft and operational personnel.

A large Royal Naval Air Station where aircraft could be received from merchant ships, unpacked, assembled, tested and then transferred

into aircraft carriers or flown to Ceylon as required. During 1944 and 1945 an average of 150 naval aircraft was assembled in Cochin each week.

When planning naval requirements in Cochin, hospital arrangements for R.N. personnel had to be included. In November and December 1943 the following agreement was reached with the Army:

1. The British Military Hospital, Ernakulam, Cochin, should be extended to allow beds for 280 Naval patients.
2. The hospital should become a Combined Military Hospital and should remain under Military Command and Administration.
3. The complement of Army Medical Officers to be:
   1 lieutenant colonel I.A.M.C. in command.
   3 majors I.A.M.C. or R.A.M.C.
   10 captains I.A.M.C. or R.A.M.C., to include surgical, medical, anaesthetic, X-ray, bacteriological and ophthalmic specialists.
4. Army Nursing staff to consist of:
   1 matron
   1 assistant matron
   30 nursing sisters.
5. The Royal Navy to supply:
   1 surgeon commander
   2 surgeon lieutenant commanders
   4 surgeon lieutenants
   28 naval sick berth staff.

The whole project was assessed as Priority 1 and the date of completion was to be September 30, 1944.

On December 9, 1944, a surgeon commander R.N. arrived in Cochin to take up the joint appointment of Senior Naval Medical Officer of the Combined Military Hospital, Ernakulam, and Senior Naval Medical Officer, Cochin.

It was found at once that the target of completion, September 30, 1944, had not been achieved, and that construction and expansion of the hospital were still in progress. During the subsequent three months work became more and more casual, and by March 1945 was virtually at a standstill. Much of the coolie labour force had been released or diverted elsewhere.

The cause of this was all too obvious. During the past few months a further change had come over the war picture. The European war was obviously drawing to a close, and progress in Burma had exceeded all expectations. The military pendulum had in fact swung from the west to the east, and the port of Cochin, though of increasing naval importance, was of rapidly decreasing importance to the Army. To meet urgent and unforeseen constructional requirements elsewhere the scale of priorities in India had to be recast. The importance of R.N. commitments was well realised and remained Priority 1, but the purely military

projects in the Cochin area fell to Priority 6. Unfortunately the Combined Military Hospital, Ernakulam, was included among the latter, despite the fact that it contained large naval commitments.

In March 1945 the following facts were reported to the Senior Royal Naval Officer, Cochin, relating to the medical organisation and hospital accommodation for naval personnel under his Command:

1. Constructional work was at a standstill in the hospital.
2. No specialist facilities were available, and that cases requiring any specialist opinion had to be transferred by rail or air to Madras, Bangalore or Poona.
3. All acute and emergency surgery had to be sent to Ernakulam General Hospital to the care of Indian civilian surgeons.
4. The only X-ray plant in the whole Cochin area was in the civil hospital, and that screening only could be carried out.
5. The standard of nursing was lamentable, there being only two qualified nursing sisters on the staff, both Indian, under the direction of an Indian matron of limited experience as regards the treatment and care of European patients.
6. It was obvious that with naval commitments increasing rapidly in Cochin the hospital situation was most unsatisfactory, and showed no prospect of improving for many months.

As a result of this report, representations were made to the Senior Officer, Royal Naval Establishments, India, and to the Commander-in-Chief, East Indies Station. Within a few days H.M. Hospital Ship *Vita* arrived in Cochin to assist with naval patients. Unfortunately, *Vita* was removed after 14 days for operational reasons, and was replaced by the Military Hospital Ship *Melchior Treub*. This ship had no specialist facilities, no X-ray plant or laboratory, and was of no value at all. However, these results had a markedly stimulating effect on the general conception of naval hospital requirements in Cochin, and labour and materials were rapidly obtained and construction recommenced. A new target date, June 30, 1945, was laid down, and every effort made to achieve it. Actually, construction was completed at the end of July 1945.

At this time staff difficulties arose, and Army G.H.Q. doubted whether it would be able to meet the guarantee originally given regarding naval patients. The hospital consisted of separate British and Indian Wings, and the Commander-in-Chief, East Indies, was approached by Army G.H.Q. with a view to the British Wing being taken over entirely by the Navy. The Senior Naval Medical Officer, Cochin, was asked to report on the advisability of this procedure. He reported strongly against the proposal, stating that although 80 per cent. of the in- and out-patients of the hospital were naval personnel, should the Army evacuate the hospital, the Royal Navy would be left a number of formidable legacies which included:

A Families Wing, for treating wives and children of Royal Indian Navy, Indian Army and Indian Civil Service personnel in the area.

A complicated system of catering by private native contract, which was already understood to have led to grave disadvantages in the case of R.N. Auxiliary Hospital, Bombay.

The complement of Indian cooks, sweepers, clerks, etc., to the number of 123.

It was strongly recommended that such an undertaking would be most hazardous in the light of the lack of naval experience of such matters, and should be considered only as a last resort.

This proposal was abandoned for the time being but not altogether, for at the end of the war with Japan it was obvious that R.N. commitments in Cochin were likely to continue for many months, during which a shore-based complement of some 5,000 naval personnel would have to be catered for. In view of this fact the proposal that the Royal Navy should take over from the Army *in toto* was again put forward at a later date, and once more was considered inadvisable.

The Indian State of Cochin is situated in the south-west corner of India, bounded by the Malabar coast on the west, Malabar District on the north, Coimbatore State and Madura District on the east, and in the south by Travancore State. The Port of Cochin is made up of three towns, grouped around an inland waterway formed by the Alwaye River and Cochin Peninsula.

The majority of Service personnel was stationed on Willingdon Island. This island, roughly pear-shaped and about three miles long and one mile wide at its broadest part, lies in the estuary of the river. It is completely flat, being composed of reclaimed land. On the island were situated the Naval Base, Royal Marines, Royal Naval Air Station, Royal Indian Naval Base, and R.A.F. and Army Sub-area H.Q. Willingdon Island is owned jointly by the Governments of India, Cochin, and Travancore States. The island is joined by two bridges to Cochin Peninsula on the west, and the mainland on the east.

British Cochin is a small township on the tip of the Cochin Peninsula, which forms part of the Malabar District under the Madras Presidency. It is contiguous with Mattanchery, a highly congested native town on the peninsula.

Ernakulam, the capital town of Cochin State is situated on the mainland, east of Willingdon Island.

The Combined Military Hospital, Ernakulam, consisted of Indian and British Wings, a mile apart. Apart from Goanese patients, R.N. interest was solely in the British Wing. The British Wing had been formed by modification and extension of the Ram Mohan Palace, Ernakulam. The Palace was a most imposing white-stone building, originally used only for Viceregal visits, and then lent by the Maharajah of Cochin for use as a hospital. The Palace was situated on the waterfront of Ernakulam Channel, and faced the harbour entrance, due west, a delightful position. By road the British Wing was 7 miles from

Willingdon Island, and by water 1½ miles. It had a private jetty at which patients could be landed by boat.

The hospital provided 700 beds, with possible emergency expansion to 1,000. Naval beds numbered 280. Naval in- and out-patients constituted 80 per cent. of all patients treated. The main palace building provided six large airy wards with annexes. Modern plumbing and sanitation, with long baths and hot and cold water was supplied throughout. Each upper ward had a verandah, shaded and carpeted, which was used as a lounge by convalescent officer patients. The palace building contained:

55 beds for officers;
44 beds for chief and petty officers and warrant officers, Army;
29 beds for Families, i.e., W.R.N.S., W.A.A.C.(I)s., W.R.I.Ns. and families of local Government officers entitled to Service medical attention.

An air-conditioned ward was included in the palace building, for treatment of heat stroke and dangerous cases, etc.

The remaining accommodation was provided by extra building on a most lavish scale, and included:

X-ray department
Laboratory
Operating theatre block
Animal house
Dispensary
Galleys
Dining Rooms
Administration Block
Recreation rooms
Baggage store
Isolation block
V.D. department
Dysentery ward
Main surgical and medical wards
Patients' institute and cinema.

Operating theatres were air-conditioned.

General surgical and medical wards were mainly in groups of two 25-bedded wards with communicating annexes centrally situated. Beds were evenly spaced, with a generous supply of overhead fans. The dysentery block was fly-proofed in accordance with Indian Army Regulations. All wards and departments were separated by tarmac roads, but were connected by covered ways between, which were essential during the monsoon.

The introduction of R.N. patients, medical officers and sick berth staff into a military hospital anywhere would naturally present certain problems and difficulties. In the case of a hospital controlled by the Indian Army such problems tended to be even greater. Knowing India

well, the Senior Naval Medical Officer realised what the main difficulties were likely to be, and was able to instruct his medical officers and staff in the problems ahead.

It was laid down that the basic policy to be observed was 'that at all costs the hospital must be a success'. To achieve this, certain broad rules of conduct were to be observed by R.N. personnel at all times:

1. The first essential to be efficient treatment and welfare of patients.
2. At no time would friction between the Services be tolerated. In this respect
   The Navy would always remain subordinate to the Army.
   Relative seniority must be forgotten for the good of the cause.
3. Every effort to be made to appreciate the Indian mentality, and R.N. Medical Officers and Staff to be trained to accept orders from Indian Medical Officers and Indian Nursing Sisters without question.

Inter-Service liaison and co-operation in the hospital were of the highest order. Friction never existed, even during the hot weather when tempers become short. Any difficulties which existed were of a minor nature and quickly adjusted.

R.N. medical officers were accommodated in the officers' mess of the hospital. Each had a separate cabin, bathroom, and 'heads', and though strictly on Indian lines, accommodation was very comfortable. Soon after taking up residence it was realised that, living in an Army mess, R.N. medical officers were becoming embarrassed financially. The reasons for this were:

1. Higher cost of living in an Army mess, coincident with the fact that as well as earning considerably less pay than their Army colleagues, R.N. Medical Officers also paid full British rates of income tax.
2. Quarters were charged for in an Indian Army mess, which varied quarterly from Rs. 25 to Rs. 65 per mensem.
3. No stewards were provided, and each officer had to provide himself with a personal native bearer.
4. To conform with Army requirements each officer was requested to provide his bearer with suitable uniform out of his own pocket. Here it must be recorded that the appearance of R.N. bearers in a white uniform, blue waist-band, white turban with a blue band adorned with an ivory R.N. badge did much to improve R.N. prestige in the hospital, particularly with the Indian Medical Officers.

But the financial aspect was one which called for early attention, and following an application to the Senior Royal Naval Officer, Cochin, Commander-in-Chief, East Indies, approved the following allowances to R.N. medical officers accommodated in the hospital:

Payment of two-thirds Colonial Allowance in place of Far Eastern Allowance.

Payment of Provision Allowance.

This greatly eased the position of these officers in the hospital.

Senior sick berth staff were accommodated in a separate cabin each, and lived in the senior military mess. Junior staff were accommodated in dormitories, which they shared with military other ranks. Messing at times left much to be desired, but improved. As in the case of R.N. medical officers, the living conditions of sick berth staff caused some financial loss, and the staff were considerably out of pocket as compared with their contemporaries in the Naval Base who lived under normal Service conditions. The main reasons for this loss were:

1. Lack of one meal a day when comparing Army messing with R.N. messing. Sick berth staff therefore had to purchase food privately.
2. Lack of native stewards, galley boys, bearers, etc., who had to be employed privately. The only alternative was for the staff to do their own cleaning, washing-up, and menial tasks which were not in accordance with R.N. custom in shore-establishments in India.
3. Lack of facilities for washing clothes necessitating employment of native 'dhobies'.

On these lines a detailed account was rendered to S.R.N.O. Cochin, taken over a six-week period, in which it was demonstrated that sick berth staff accommodated in the hospital were out of pocket about Rs.1 As.8 a day.

Representations were made through S.O.R.N.E.(I) to Commander-in-Chief, East Indies, that staff should be paid an allowance of Rs. 1 a day, while living in the hospital. In due course an allowance of As. 5 only per day was approved, and though the staff accepted this in good part, there was no doubt that the decision tended to constitute an irritation to men working under strange conditions.

One of the early difficulties to be solved at C.M. Hospital, Ernakulam, was that of arranging that R.N. personnel should not be cut off from the sports and amenities of their own Service in the Naval Base, to which it was considered essential that they should have frequent access. In point of fact little was ever done in this way for military other ranks, the main difficulty being that of transport, which under Indian Army Regulations was extremely restricted for purposes of recreation or amenities. S.R.N.O. Cochin was eventually approached, and was most co-operative in every way. An R.N. boat routine was established between Willingdon Island and the hospital, by which all hospital personnel, irrespective of Service, were enabled to shop, attend cinemas, play games, etc. At the same time a naval truck and driver were based on the hospital, and employed for R.N. duties, e.g. mail in the day-time and for recreational purposes in the evening. It was placed at the disposal of the staff senior mess on one evening a week, and the medical officers and sisters during the week-ends. These transport facilities did much to maintain R.N. standing in the hospital.

At preliminary discussions between the Officer Commanding the Hospital and the Senior Naval Medical Officer, it was decided that any

attempt to divide the British wing into separate naval and military wings was both unnecessary and inadvisable. It would have represented a great wasting of space and man-power.

The following organisation was therefore initiated:

1. R.N. patients were not to be separated from patients of other Services.
2. R.N. medical officers were at the disposal of the Officer Commanding, for employment on any clinical duties he might consider suitable.
3. R.N. sick berth staff could also be employed by the Matron on any nursing duties for which she might consider them suitable, with the exception of the Senior staff, who were employed on administrative duties.
4. Senior Naval Medical Officer dealt with all matters of discipline, documentation, survey boards, and acted in an advisory capacity to the Officer Commanding in all matters affecting R.N. patients and staff.
5. Sick berth chief petty officer acted as secretary to the Senior Naval Medical Officer, and was in charge of the naval office in the hospital.

This system of pooling medical and nursing resources was not only in the best interests of patients, but also did much to establish harmony and working understanding between the two Services.

Every effort was made to provide adequate welfare and amenities for patients and staff. The Hospital Institute, which corresponded to a N.A.A.F.I. canteen, was used for entertainments of all kinds. Periodic E.N.S.A. performances were given, both Indian and English, but no cinema projector was available until later.

The Senior Naval Medical Officer acted as President of the Hospital Welfare Committee, and also served on the Committee of the Cochin State Welfare Service. The latter embraced the local W.V.S. and Indian Red Cross, and a liaison was established which was greatly in the interests of the hospital.

The question of finance for the Patients' Fund caused some worry at one time, but generous contributions from the various R.N. Canteen Funds in the Area were made and were of great assistance.

The provision of N.A.A.F.I. supplies for R.N. patients needed tactful handling. N.A.A.F.I. canteens were established in R.N. shore establishments in India only as a great privilege and after some difficulty. The Army in India had no access to N.A.A.F.I., but a system of supply by a ring of outside contractors existed, which attempted to run on the same lines. The goods supplied, however, were of inferior quality and produced locally. In C.M. Hospital, Ernakulam, it was therefore arranged that N.A.A.F.I. supplies should be sent for R.N. patients as required. This did not meet with the approval of the local Indian contractor, but the system continued under the protection of S.R.N.O. Cochin.

A hospital Clinical Society was formed, and fortnightly meetings were held which were attended by the Service medical officers in the

Area. Reciprocal membership was established with the All-Cochin Medical Association, and interesting discussions about professional subjects took place.

By October 1945 the position of the Royal Navy in this hospital was greatly strengthened by the appointment of naval medical officers as medical and hygiene specialists. On their part the Army agreed to maintain an Army surgical specialist.

In November 1945 the Commanding Officer of the Hospital returned to the United Kingdom, and it was some weeks before a lieutenant colonel, R.A.M.C., arrived in India to relieve him. In the interim period both wings of the hospital were commanded by the Senior Naval Medical Officer, a situation which is considered to be unique in naval medical history, this being, as far as is known, the only instance of a military establishment in India being commanded by a naval officer.

Other changes which had occurred by this time were the replacement of the Indian matron and nursing staff by members of Queen Alexandra's Imperial Military Nursing Service, and a small number of English V.A.D. nursing members.

With the decline of Royal Naval commitments in the Cochin Area, the naval element of C.M.H. Ernakulam ceased to exist at the end of June 1946, having received and treated during its life some 2,500 Service patients.

Further details of Naval Medical Administration in the Cochin Area are given in the part of this History which covers Mobile Landing Craft Advanced Bases.*

A further commitment in this area was the large Royal Naval Air Station, which existed under the title of H.M.S. *Kalugu*, virtually in the middle of the Naval Base itself. This establishment possessed its own naval medical officer and sick berth staff, and though it lay within the Command of the Senior Royal Naval Officer, Cochin, and his Senior Medical Officer, for some time it was difficult to include it inside the general Naval Medical Administration of the district. Several reasons played a part in creating this minor problem of administration, and they are here recorded merely to provide an example of that too close adherence to the traditional chain of naval command which has already been described.

H.M.S. *Kalugu*, although possessing its own Commanding Officer, was in fact a satellite of the large Royal Naval Aircraft Repair Yard at Coimbatore, which with the neighbouring Air Station of Solur came under the direct command of Flag Officer Air, East Indies, whose headquarters were in Ceylon. The establishment at Coimbatore was adequately provided with a modern naval sick quarters, stores and equipment, medical officers, nursing sisters, V.A.Ds. and sick berth

* See Chapter 2 of the Operational Volume of the Naval Medical History.

staff as normally required to fulfil the needs of the Naval Air Arm in this theatre of war. H.M.S. *Kalugu* had existed for a considerable time before the remainder of the large Naval Base in Cochin was opened. It had developed a system whereby its hospital cases were flown to Coimbatore, and at times to Colombo. Its general health organisation and medical administration were dictated by the Senior Medical Officer, Coimbatore, who was himself responsible to and advised by the Staff Medical Officer to Flag Officer, Air, whose headquarters were also in Ceylon.

In addition, H.M.S. *Kalugu* was accommodated in an Air Station belonging to the Royal Air Force. With the advent of Cochin Naval Base it found itself absorbed into the local administration of the Senior Naval Medical Officer, Cochin, who, though advised locally by the Army Medical Authorities, was directly responsible to the Staff Medical Officer to Senior Officer, Royal Naval Establishments, India.

It was only natural that H.M.S. *Kalugu*, faced with responsibilities locally to the Royal Air Force, the Army, Senior Royal Naval Officer, Cochin, and general responsibilities to Senior Officer, Coimbatore, and Flag Officer, Air, East Indies, should adhere to whatever policy was dictated by the latter, with the result that certain conflicts were bound to arise.

A notable example concerned the question of fresh water supply. Fresh water in the Cochin area was supplied by pipe lines, recognised as being defective, from the Cochin State water works at Alwaye, some miles inland. By dint of tactful negotiations with the Cochin State Government, the local Army Medical Authorities had taken over a measure of control of the water works, particularly as regards the working of a chlorination plant by which the water was chlorinated at source, and the laying of a new pipe line. Local Army orders required periodical samples of water to be taken in all establishments within the area, and these samples were then sent by air to be tested by the military laboratories in Bangalore. Recognising the necessity and the convenience of this system, the local Naval Authorities identified themselves with it. But H.M.S. *Kalugu* had its own system whereby its water samples were sent to Colombo for testing in accordance with instructions of Staff Medical Officer to Flag Officer, Air.

A further minor difficulty concerned the taking of mepacrine by Service personnel within the Cochin area. This policy was dictated by the Army in spite of the fact that Cochin was non-malarious, in order that Service personnel, accommodated locally, should be trained in every branch of anti-malarial hygiene. The policy was accepted by the Navy, but here again H.M.S. *Kalugu* did not accept the ruling.

Yet a further difficulty was the tendency of H.M.S. *Kalugu* to continue to send its hospital cases by air to Colombo and Coimbatore, even after naval hospital facilities had begun to exist locally at the Combined Military Hospital, Ernakulam.

These difficulties which have been described were soon solved, and by the rapid understanding of Flag Officer, Air, East Indies, and his Staff Medical Officer, H.M.S. *Kalugu* was in due course absorbed into the general medical administration of the Cochin Area. But it is important to record how obedience to a traditional chain of command within a single Service can bring about a state of affairs whereby a single small unit, commanded by an Executive Authority in another country, can embarrass the vast medical organisation of a large area in the middle of which it happens to be situated.

A further medical commitment of the Cochin area was the maintenance of a medical organisation in the various leave centres which were established up country at such places as Munar, Kodaikanal, Conoor and Ootacamund. As regards the latter, adequate hospital accommodation was provided by the Military Authorities at the British Military Hospital, Wellington.

ROYAL NAVAL SICK QUARTERS, MANDAPAM, SOUTHERN INDIA

During the war years three Royal Naval Camps, together constituting H.M.S. *Tengra*, came into existence on the southern shore of the narrow peninsula running down towards Adam's Bridge, which lies between South India and Ceylon. This peninsula, which is in places little more than a mile wide, is bounded by the Gulf of Manar to the south and Palk Strait to the north. The terrain is for the most part flat and sandy, and does not rise more than 50 ft. above sea-level at any point. The vegetation consists of sandy grass, coconut palm and wild shrub. Fresh water can be found almost everywhere by sinking wells. The local population is Tamil.

The South Indian Railway runs down the centre of the peninsula to its terminus at Dhanushkodi, where passengers are transferred to ferries for the sea journey to Ceylon. The Marine Superintendent of the South Indian Railway had his headquarters at Mandapam, where workshops and docks were maintained for repairing and refitting the ferry boats.

For many years the Ceylon Government had maintained a quarantine station at Mandapam Camp for the purpose of supervising the native labour battalions proceeding from India to work on the tea and rubber estates in Ceylon. This camp occupied a considerable plot of land, and included an infectious disease hospital, inspection wards, disinfection plant, and chalets for the segregation of smallpox cases. A piece of ground set aside acted as a catchment area containing many wells from which fresh water was pumped to two large reservoirs and automatically chlorinated there.

Early in the war, the Royal Indian Navy established itself at Mandapam and made use of the buildings with an adequate supply of electricity and fresh water. Nearby were the docks and workshops

of the South Indian Railway, and three camps were constructed. Expediency was paramount, and little consideration was given to the undesirability of building camps in the close vicinity of several native villages and a quarantine station. The old infectious disease hospital became a sick bay, and the smallpox chalets and inspection wards were converted into living spaces.

In the summer of 1944 these camps were taken over by the Royal Navy, and additional construction included extra refrigeration space, new electric generators, and sick quarters with 250 beds.

So far as the sick quarters was concerned, financial approval to build was not obtained from G.H.Q. Delhi until January 1945. A surgeon commander, R.N., arrived at Mandapam as Senior Medical Officer on February 2, 1945, at which time the naval sick quarters was represented merely by a load of bricks. On February 22 a siting board was convened, and a plan for the sick quarters was drawn up, after which construction of the operating theatre began. Changes in the standardised hospital drawings, on the basis of which the engineers of the Indian Army effected construction, had now to be accepted, and a new plan was made to accommodate buildings of a different size, while adhering where possible to the original conception of the sick quarters around the operating theatre already under construction. The new proposals for wards were regarded as unsatisfactory in several important respects, and a mild conflict of Inter-Service opinion had to be survived before naval requirements were granted. Construction proceeded very slowly, and was held up altogether at times owing to shortage of material. The estimated date of completion was gradually altered from March 1945 to July 1945, but doubts were expressed regarding the possibility of achieving the latter target date.

The Royal Naval Sick Quarters, Mandapam, was finally completed sufficiently to be occupied on September 16, 1945, by which time the war with Japan was just at an end. The establishment proved to be compact and conveniently arranged, with light and well-ventilated wards, and an ample allowance of overhead fans.

During those months of 1945 in which the sick quarters had been under construction, the numbers of naval personnel in the Mandapam area had rapidly increased, and the lack of hospital facilities was keenly felt. Anything more than minor ailments had to be discharged by sea and rail to hospitals in Colombo, and though, when eventually completed, the quarters fulfilled a valuable function, they were completed six months too late to be of any real use.

MEDICAL ARRANGEMENTS, CALCUTTA

The medical commitments of the Royal Navy in Calcutta were varied, and concerned the requirements of an establishment, which under the description of H.M.S. *Chilwa*, consisted of a large scattered

area of private houses and buildings in the dock area in which naval personnel were accommodated and employed. In addition to shore-based administrative staff and Royal and Merchant Navy personnel afloat, D.E.M.S. and Maritime Regiment personnel were catered for.

Hospital accommodation was provided by 160 beds set aside in the 21st B.G.H. by the Army Authorities.

MEDICAL ARRANGEMENTS, VIZAGAPATAM

On March 1, 1945, under the name H.M.S. *Amzari*, a Royal Naval Landing Craft and Coastal Forces Base was commissioned at Vizagapatam on the east coast of India.

Personnel numbering 800 ratings and 50 officers were accommodated in a hutted camp constructed by the Indian Army Authorities. The camp was situated at the seaward end of a valley on low-lying reclaimed land. Officers' accommodation was near the jungle about half a mile from the main camp.

The living space for ratings consisted of huts with rough concrete floors, brick walls up to 3 ft. and 'tatti' walls for 8 ft. Roofs were of corrugated iron covered with palm thatch. Overhead fans were provided. Officers were accommodated in single cabins constructed on the same lines. As regards sanitary and public health requirements the situation of the camp was appalling, the chief reasons being:

The existence above, and abutting immediately on to one side of the R.N. Camp, of a large native labour camp in which were accommodated 2,000 coolies with their wives and families, employees of the Scindia Steam Navigation Co.

A large open sewage drain which formed one boundary of the camp.

The coolie camp constituted a grave reservoir of infection by fly-borne diseases. Also, twelve months before, there had been an outbreak of malaria in the area, and many of the cases had originated in the Scindia coolie camp.

The open drain described was essentially a storm water drain for passage of the monsoon floods into the harbour. It was unlined, an earth ditch 15 ft. wide at the top and tidal for some 400 yds. Before passing the R.N. Camp, this drain first ran the whole length of the coolie camp from which it received crude sewage from inefficient septic tanks. Tidal action was insufficient to produce any clearing effect, and the drain was constantly filled with putrified material, faeces, decomposing food, and bred millions of flies. The stench was intolerable.

A further burden was that of bed bugs with which huts of the R.N. Camp were heavily infested from the start. In the officers' camp a plague of white ants was encountered which attacked woodwork and clothing.

Fresh water supply originated from sources controlled by the Military and Civil Authorities where the water was filtered and chlorinated at

source. A certain amount of pollution, however, was likely to take place in the reservoir, the tank of which was inadequately covered and protected.

Victualling was satisfactory, and carried out by a civilian contractor. Unfortunately it was a considerable time before galleys and dining rooms were fly-proofed or supplied with adequate concrete drains or grease traps. Latrines and wash places were built on the 'through flush' system, which was unsatisfactory from the start. Water from the wash places was apt to flow away on to the ground and formed pools in which mosquitoes, including anophelines, bred in large numbers. Open drains were eventually built to carry the water to the main drain. The flushing system usually failed to work owing to lack of water supply. In due course 115 tanks were incorporated into the system, by which the latrines were flushed about every four hours.

A small sick quarters provided limited accommodation and the main hospital facilities were provided by the Combined Military Hospital at Waltair, where 100 beds were set aside for European Service personnel.

At an early date the Naval Camp at Vizagapatam was condemned by the Naval Medical Officer of Health on the staff of Senior Officer, Royal Naval Establishments, India. Numerous improvements were instituted in course of time, but hygiene and sanitation never really became satisfactory in spite of every effort being made to achieve a reasonable standard. In view of the fact that personnel in the camp were eventually increased to 2,000, it is perhaps fortunate that the war ended and H.M.S. *Amzari* closed down before any major medical disaster was encountered.

COMMENTARY

In retrospect, there is no doubt that the Navy in India represented an individual unit which, while differing essentially from other units of the East Indies Station, was nevertheless a necessary and valuable part of the whole administrative organisation. Within the general framework its position was unique, chiefly perhaps because India itself was unique. There is no denying the fact that Higher Policy aimed at making G.H.Q. Delhi largely responsible for the ultimate provision of the bulk of shore medical facilities likely to be required by the Royal Navy in its various bases in India. This policy would undoubtedly have proved completely successful had Navy and Army commitments in India remained at the same level in relation to the trend of hostilities. As it was, the policy was outpaced by the rapid march of events in the Eastern Theatre of war. Broadly speaking, at a time when the general commitments of the Naval Bases in India were approaching a peak, the particular commitment of medical requirements, itself a commitment of the Army, tended to be overlooked as the local responsibilities of the latter Service declined.

Briefly, the position may be summarised thus:

Organisation A undertakes to provide certain domestic requirements for Organisation B, both A and B having similar commitments in country C. Obviously, if circumstances arise whereby the commitments of B remain in C, but the commitments of A are diverted to country D, it is difficult for A to fulfil its obligations to B in full and B is likely to suffer in consequence.

The problem is one which is always likely to arise where a particular element of one Fighting Service is supported by another Fighting Service. In the light of shortage of material and man-power the pooling of resources is sound in theory, but in practice its ultimate success largely depends upon the local commitments of the two Services involved remaining at the same level. Though in the planning phase in India the system whereby the medical commitments of the Navy should be supported by the Army had obvious economical advantages to each Service, in course of time the Army found itself saddled with something of a naval medical burden. The whole question is one which casts no adverse reflection on either Service, for the true answer was to be found in the unexpected collapse of the Japanese at a particular time.

MEDICAL ORGANISATION, BRITISH PACIFIC FLEET

From the historical point of view the chief interest of the medical organisation of the British Pacific Fleet is concerned with the closing stages of the war against Japan. As regards His Majesty's Ships afloat in operational areas, the system followed was, in general, that existing in other British Fleets, with certain modifications which were introduced in the case of the British Pacific Fleet to overcome the medical disadvantages of the long lines of communication involved, and the vast sea areas in which ships were operating. In the operational areas medical and surgical facilities for the Royal Navy were provided by the United States Medical Authorities. The Fleet Medical Officer, a surgeon captain, R.N., was based ashore in Sydney, and in addition to the assistance afforded by the Americans in the forward areas, the broad policy aimed at making Australia the chief centre of hospitalisation for naval personnel. The medical disadvantages which were likely to arise in a Fleet operating at an enormous distance from its main hospital centre, were overcome to some extent by the Hospital Ship services, by the Air Evacuation Unit already described in Chapter 5, and by the introduction of the Fleet Train.

A study of the records suggests that the bulk of the medical work carried out by the Royal Navy in the Pacific Area arose immediately after the cessation of hostilities with Japan, and was concerned with the care and repatriation of Allied personnel from Japanese prisoner-of-war camps.

PLANNING PROGRAMME AND OPERATION OF THE FLEET TRAIN

The replenishment of medical stores to ships of the Fleet in the forward areas involved problems similar to those experienced by the victualling and armament store departments. The Fleet operated several thousands of miles away from the main base in Australia, and no intermediate or advance base was ever set up. The space available for medical stores in individual ships was strictly limited, as in the case of all men-of-war. Modern construction has called for a large increase in complement, with no comparable increase in the size of a ship's sick bay. At the same time, modern methods of warfare and modern weapons have increased both the potential number and severity of casualties. Parallel with these increases, progress in medical science calls for the provision of extra drugs and medical stores, many of which are bulky and perishable and require refrigeration space.

For example, in the Pacific theatre, experience of 'Kamikaze' attacks showed that it was necessary to carry dried blood serum in the proportion of one pint to every ten men on board. It was found that one serious case of burns may require as much as six pints within forty-eight hours of injury. In effect, this meant two pint bottles for each pint of serum administered, one bottle containing the dried serum and one to dilute the fluid. To these were added a giving set in a sterile container, from which it will be appreciated that this requirement alone added very greatly to the amount of space needed.

The storage and replenishment of penicillin and plaster-of-paris presented additional problems, the net result being that it was impossible to make ships independent of replenishment of medical stores and equipment when absent from a main base for months on end. It became necessary, therefore, to provide replacements at sea in a replenishment area.

At first it appeared that hospital ships would provide a partial solution of the problem, but this proved impossible in practice for the following reasons:

1. The doubtful permissibility of the use of hospital ships to replenish the medical stores of warships, having regard to Geneva and Hague Conventions.
2. Few of the hospital ships available were of more than small size and limited endurance, and few could therefore be retained in any area for longer than a few days.
3. In most hospital ships the increases in sick accommodation necessitated encroachment on storage space; also it was necessary for hospital ships themselves to carry extra stores for their own needs. These ships were therefore in no position to replenish store deficiencies in other places, except in extreme emergencies.

Unfortunately, as far as the war in the Pacific was concerned, there was delay in attempting to solve this problem. Shortage of medical

officers was a problem here as in the East Indies Fleet, and a medical officer could not be appointed to the staff of Fleet Office, Fleet Train, until February 1945, although the advance party for arranging its general organisation had arrived in Australia in 1944.

When the British Pacific Fleet sailed from Australia on its first operation, the only action possible was to instruct each ship to take on board the largest possible quantity of medical stores which could be accommodated. This arrangement did not prove satisfactory, especially in the case of the smaller ships. Eventually it was decided that the units of the Fleet Train, that subsidiary section of vessels employed to refuel and re-store the Fleet at sea, should include a Medical Store Issuing Ship. This ship would provide in addition to the usual storage space:

1. An air conditioned store for X-ray films, blood serum, and items likely to deteriorate rapidly under tropical conditions.
2. Refrigeration space for vaccines and penicillin.
3. An inflammable store for anaesthetics, surgical spirit and the like.

The ship's company would include a Superintending Pharmacist assisted by an adequate pharmaceutical staff, and by sick berth ratings. This project received the approval of the Commander-in-Chief, British Pacific Fleet, but the details of such a Medical Store Issuing Ship *per se* had not been completed when hostilities came to an end.

In the interim, as an alternative and temporary measure, three victualling store ships were fitted each with a medical store of approximately 5,000 cu. ft. capacity. At the time when hostilities ended two more such ships were being fitted similarly. The store, which was in the charge of a pharmacist assisted by a sick berth rating included refrigeration space for vaccines and penicillin, while X-ray films were carried in the special cool rooms of the ship. The drawbacks of this arrangement were the small size of the store, which restricted seriously the quantity of supplies which could be carried, and the extravagant wastage of skilled pharmacists. On the other hand an advantage was that there was always at least one victualling store ship in the replenishment area of the Fleet, so that urgent replacements could always be made.

In order to meet the need to replenish depleted stocks of certain items urgently required in the Fleet fuelling area, to which the victualling store issuing ships did not proceed, a number of special replenishment units were made up and placed in tankers. These units were numbered from A to J and their contents were notified to all medical officers throughout the Fleet. In this way a ship with an urgent requirement for any particular type of supply could arrange to collect it from the tanker while oiling, and no trained dispensing staff was required. The different units were well designed and the contents well chosen. Unit A was the ordinary emergency dressing chest included in the

standard service afloat scale. Unit B contained only cotton wool. Unit D contained gauze, lint and bandages. Unit H contained dried serum and reconstituting fluid.

On the whole these arrangements worked well, but provision was in some ways insufficient, chiefly because of the late date at which the measures were instituted. In particular, experience proved that the appointment of a medical officer and superintending pharmacist to the staff of the Administrative Authority responsible for the replenishment of the Fleet should have been made at the earliest opportunity. Only in this way would it have been possible for the planning of medical supplies to the Fleet to be kept parallel with the measures adopted to meet all its other problems of supply.

ROYAL NAVAL AUXILIARY HOSPITAL, SYDNEY

This establishment was occupied by the Royal Navy on January 10, 1945, and opened for patients on January 15, 1945. The bed strength proposed was 2,000, contained in a hutted hospital formerly occupied by the United States medical authorities. The hospital covered an area of 170 acres, and had been unoccupied for the six months immediately before being taken over by the Navy.

Preliminary preparations for its occupation were made by an advance party of medical and nursing staff who left England for Australia in November 1944. As the British Pacific Fleet was due to arrive in Sydney on February 10, 1945, it was necessary to expedite the re-arrangement of the hospital in time to serve its needs. It was therefore decided to take the staff into residence as soon as possible, and this procedure brought to light many necessary measures of reconstruction, refurnishing, and re-equipment more quickly than would have been the case if an attempt had been made to organise the hospital's re-occupation from Sydney, twelve miles away.

Many of the huts needed repairs; complete refurnishing was necessary and was complicated by slow production and adherence to the Australian field scale, which was much lower than the scale for equivalent British units. Provisional equipment had to be obtained from Australian sources and was in short supply.

The living conditions were of necessity arduous during the first few weeks, and it was some time before the considerable deficiencies and discomforts were overcome.

During the first five months, however, effort was directed towards the satisfactory reconstruction of the hospital. The admission figure of 172 in February 1945 had increased progressively to 786 in June 1945, by which time 1,400 beds were ready for occupation. By this time the hospital was beginning to function smoothly, though clinical equipment was still somewhat short, and administration was hampered by lack of office equipment, stationery and typewriters.

On May 31, 1945, the Commander-in-Chief, British Pacific Fleet, visited the hospital, and signified his approval of all that had been done for the comfort of patients. By the end of June 1945, the improved situation in the hospital had been maintained, and 990 beds were occupied by 535 medical and 455 surgical patients. At this time the ultimate maximum bed strength had been reduced from 2,000 to 1,750, as the trend of war was such that it was obviously permissible for the local authorities to divert a proportion of the main constructive effort away from Service establishments to the needs of the civilian population. In addition to purely clinical matters, great improvements had been effected in the accommodation of medical and nursing staffs, particularly as regards sick berth staff and V.A.Ds., whose quarters and amenities were much superior to those enjoyed by their contemporaries in the other Services locally.

Immediately after the end of the war with Japan, the commitments of R.N. Auxiliary Hospital, Sydney, increased and called for versatility on the part of the medical and nursing staffs and an intricate administrative organisation. The hospital became, in addition to base hospital for the British Pacific Fleet, a reception and rehabilitation centre for prisoners-of-war released from Japanese prison camps, as well as the evacuation centre for recovered prisoners-of-war proceeding to the United Kingdom. A further commitment rendered the hospital a drafting centre for nursing sisters and V.A.Ds. required for transport duties ashore and afloat, and for duties concerned with the reconstruction and medical organisation in many areas evacuated by the Japanese. The hospital was also connected with the formation of an Air Evacuation Unit, some details of which have been given in Chapter 5 of this volume. In spite of these extra commitments, which were further embarrassed by considerable reductions in medical and nursing staffs, the professional work of this hospital was maintained at a remarkably high level, and very great credit was due to the Medical Officer-in-Charge and his staff, who by their zeal overcame the initial handicap of limited equipment and built up a highly efficient clinical organisation.

R.N. Auxiliary Hospital, Sydney, received and treated 9,003 Service patients, and a welcome feature was the repeated testimony by officers and ratings to their comfort and the care with which they were treated and nursed.

ROYAL NAVAL AUXILIARY HOSPITAL, BRISBANE

In addition to the Royal Naval Auxiliary Hospital, Sydney, a further auxiliary hospital existed for a few months at Ekibin, Brisbane. This hospital was established early in 1945, and was handicapped by poor buildings, bad essential services, and lack of amenities; 220 beds were provided for ratings and 30 for officers, making a total of 250.

The number of patients under treatment usually totalled about 200, with admissions and discharges averaging 15 to 20 each day. Use was made of a convalescent camp at Coolangatta, 63 miles away.

The general health of naval personnel in the Brisbane area was on the whole good, and such casualties as were received by the hospital were very light. Nevertheless, by June 13, 1945, 225 were under treatment, of whom 13 were officers, and at the same time 46 patients were convalescing at Coolangatta. At this time the medical facilities at Brisbane were strained and would not have been capable of dealing with the normal emergency requirements of visiting ships of the British Pacific Fleet, such as casualties arising through enemy action, fire or explosion, and the accidents commonly to be expected during refitting. Moreover, no naval hospital accommodation was available to cope with any outbreak of epidemic disease.

The supply of medical stores and equipment presented a serious problem for a time. No medical stores from naval sources were available to replenish those ships whose demands had not reached the R.A.N. Medical Store in Sydney in sufficient time to be packed and despatched to Brisbane. It was necessary therefore to obtain medical stores from local Australian Army sources, and this expedient and assistance made it possible to fulfil all demands from H.M. Ships visiting Brisbane.

A further problem was that of road transport, shortage of which compelled the uneconomical use of ambulances and other heavy vehicles for routine journeys and reduced the efficiency and speed with which out-patients could be seen and returned to their ships.

In order to make adequate provision to cover all the possible naval medical commitments in the Brisbane area, including the reception of patients from the forward areas effected by sea or air, negotiations were undertaken to acquire 750 beds at a hospital at Holland Park, Brisbane, occupied by the U.S. Army. The negotiations were protracted, but eventually the Royal Naval Auxiliary Hospital, Brisbane, functioned as a wing of the 102nd Australian General Hospital, and received patients from the British Pacific Fleet, Royal Australian Navy, Royal Canadian Navy, and South African Naval Forces.

Because of lack of specialist medical officers in the Australian Army, medical officers of the naval wing of the hospital assisted in the care of Australian Army patients.

After receiving and caring for 595 patients, R.N. Auxiliary Hospital, Brisbane, was closed down on September 7, 1945, patients remaining being transferred to the 102nd Australian General Hospital. This procedure was largely prompted by the necessity to transfer the administrative staff from Brisbane to Hong Kong on September 13, 1945, in order to commence the reconstruction of naval hospital facilities in the Colony.

CHAPTER 16

THE DENTAL BRANCH OF THE ROYAL NAVY

Compiled from Naval Records by
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under the direction of
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INCEPTION AND EARLY DEVELOPMENT

IN 1882, a medical officer began minor dental work at the Royal Naval Hospital, Haslar, and in 1889, two staff surgeons were detailed to give instruction in dental surgery to newly entered medical officers who were later expected to carry out dental treatment aboard ship. The scope of this treatment is not mentioned, but official interest in dental health appeared to be increasing, and in the following years a civilian Licentiate in Dental Surgery was nominated to give instruction in these matters to medical officers at Haslar and to proceed aboard H.M. Ships to give similar lectures.

In 1904, a limited number of civilian dental surgeons was appointed for full-time duties at certain naval establishments, and a dental surgeon was lent to the Fleet when it sailed for manœuvres in Northern Waters. These appointments were on a monthly basis and were later extended to a year. During the next ten years the number of these civilian dental surgeons was increased to 28. This complement was maintained until the War of 1914–18, and in 1915 the civilian dental surgeons who were serving afloat were granted commissions as temporary dental surgeons in the Royal Naval Volunteer Reserve. They wore the same uniform and distinguishing colour as R.N.V.R. medical officers. Dental officers were borne in the Grand Fleet in His Majesty's Ships *Collingwood*, *Centurion*, *Colossus*, *Emperor of India*, *Thunderer* and *Valiant*, and in the Hospital Ships *Amarapoora*, *Garth Castle*, *Plassy* and *Sudan*. Where medical officers were employed on dental duties they were paid an extra allowance of three shillings a day.

The year 1918 brought several changes in the Dental Branch. The branch designation (D) was introduced, and temporary surgeon lieutenants R.N.V.R. became temporary surgeon lieutenants (D) R.N.V.R., while the colour of the distinguishing cloth was changed from scarlet to orange.

In 1920 the Dental Branch of the Royal Navy was instituted by the transfer of 24 temporary surgeon lieutenants (D) R.N.V.R. to permanent commissions in the Royal Navy, their former war service being

allowed to count in full towards seniority. No allowance was made for promotions higher than surgeon lieutenant commander (D), which rank was obtained automatically after six years' total service. Officers were entered subsequently by competitive examination which included naval as well as professional subjects.

One of the original 24 officers forming the nucleus of the Dental Service was appointed as Dental Assistant to the Medical Director-General, and this position was given further authority by his promotion to surgeon commander (D) early in the following year. The years 1920 to 1926 saw a considerable increase in the number of dental officers, which rose to 64, an average of one officer to 1,500 patients. The Dental Assistant was promoted to the rank of surgeon captain (D) and the Senior Dental Officers of each home port, Portsmouth, Chatham and Devonport were promoted to surgeon commanders (D) and appointed as Port Dental Officers. In the year 1923 a Dental Section of the Royal Naval Volunteer Reserve was introduced, and an establishment of 25 officers allowed.

No further changes of note occurred until 1935, when general improvements were made in the Dental Branch. The rank of the Port Dental Officers was upgraded from surgeon commander (D) to surgeon captain (D) and the numbers of surgeon commanders (D) increased to fifteen. Before 1935 dental officers were admitted to the Permanent List on entry, but in this year a scheme of Short Service was instituted under which dental officers gave six years service before being selected for the Permanent List.

Dental surgery attendants were provided from the sick berth staff for duty afloat, and naval pensioners carried out these duties ashore. Dental mechanical work was undertaken by civilian dental mechanics in the laboratories at Chatham and Malta. In stations at home and abroad where no naval or Service dental facilities existed, treatment, as far as practicable, was provided by private practitioners under contract.

This was the situation at the outbreak of war in 1939, and it is appropriate here to view the growth of the Royal Naval Dental Service in retrospect. A rough analysis will show that increases in facilities were made at intervals of approximately ten years.

The pioneers of the Dental Branch met many difficulties and not a few disappointments in their endeavours to compete with the increasing demands for dental treatment made upon them. Considerable efforts were made to establish the Dental Branch on a basis which would offer the young dental surgeon a permanent career comparable with that enjoyed by members of other professional branches in the Service, and whose numerical strength would be sufficient to maintain adequately dental facilities for naval personnel.

Statistics presented by the Ministry of Health have shown that the increase in the number of dental operators in the twentieth century has

not been enough to stay the steady deterioration of the dental health of the nation and to meet the new demands upon the profession. This fact is also relevant to the Royal Navy, and whereas a Dental Department is the normal concomitant of a large ship or naval establishment, in the early years of the Dental Service the establishment of naval dental facilities was sanctioned only when it became evident that a financial economy could thereby be effected.

The progress of dental science, however, and the psychological approach to dentistry in the uses of anaesthesia and prophylactic and conservative treatment found a new public interest and co-operation. This inevitably influenced naval personnel and was reflected in an increased demand by them for dental treatment. Thus the Dental Branch grew in size and importance.

MOBILISATION AND EXPANSION

The general mobilisation for war in 1939, and the very considerable expansion of the Navy which followed, brought new and immediate responsibilities. The appreciation of the work of the Dental Branch through these former years had obtained for it full recognition as an integral unit of the Health Services of the Navy, and upon this foundation was laid its contribution to the maintenance of general health and fighting efficiency in the War of 1939–45.

The policy in rendering dental treatment to the personnel of the Royal Navy, and the scope and degree of that treatment, has depended upon the dental resources available for rendering fit the maximum number of personnel. It has always been the endeavour of the Dental Branch to provide adequate treatment in order to prevent casualties due to dental lesions, and to assist in maintaining the health of the Royal Navy. This policy was to a considerable extent altered during the war to meet the new circumstances of personnel and forms of treatment.

DENTAL STANDARDS AND TREATMENT

Before the war, certain dental standards were laid down which would fail a candidate for entry into the Navy, and these were assessed as follows:

5 teeth missing or irreparable for boy ratings for continuous service.
7 teeth missing or irreparable in other persons under 17 years of age.
10 teeth missing or irreparable in persons above 17 years of age.

Candidates were required to possess some sound molars and incisors in efficient occlusion on either side of the mouth, credit being given for unerupted teeth other than third molars. The absence of sound opposing molars did not, however, disqualify men ratings from entry, provided the deficiency was unilateral and compensated for by two pairs of sound opposing molars on any one side.

The experiences of the War of 1914–18 clearly demonstrated the necessity of maintaining as far as possible standards of dental fitness on enrolment and subsequent re-enrolment in the Reserve Forces. Dental treatment at the public expense was available only during periods of training or when called up for service. Candidates for the Royal Naval Reserve were required to be within the same dental standards as those required for original entry into the Royal Navy. These men were not subject to dental re-examination during their enrolment, but they were advised as to the importance of maintaining themselves in a dentally fit condition for service in the event of mobilisation.

Greater supervision was possible, however, with the Royal Fleet Reservists. These attended regularly for drills and were subject to re-enrolment at specified periods. They were required to have clean and healthy mouths, and to possess not less than ten sound natural teeth in the upper jaw, including at least one molar, in good functional occlusion with corresponding sound natural teeth in the lower.

Ratings on continuous service engagements who applied to re-engage were expected to provide themselves with dentures at their own expense where such were necessary to restore full masticatory function. Special standards were required for the dental health of personnel serving in H.M. Submarines and as divers, and full dental treatment had to be completed before final acceptance for these special services.

Dental standards of entry have been temporarily modified from time to time, their application being governed by the urgent necessity for the recruitment of any particular class of naval rating. Normally, however, the ratio of 5, 7, 10 has been maintained.

The foregoing conditions of entry and re-entry into the Royal Navy are mentioned in some detail, since they display the endeavours of the Dental Branch to maintain definite standards of dental health for all grades of personnel in preparation for an eventual war.

As a matter of general policy the dental fitness of naval personnel was maintained by the conservation and the extraction of teeth and the subsequent fitting of dentures. Where no Service dental facilities are available the loss or fracture of a denture may affect a man's services on that station, and ship and Service efficiency are thus impaired. Considerable efforts were therefore made to render personnel dentally fit in every respect before being drafted to sea, and for this reason the majority of dental personnel were employed in shore establishments.

The operational requirements of a ship or fleet are so uncertain that it is difficult to forecast where naval dental facilities might best be disposed, and to conjecture the amount of dental treatment which may be made available. In modern marine warfare the policy that personnel may rely upon shore bases for their dental treatment has changed, and such facilities must now be brought to them—a direct reversion of the

former conception. It is not practicable, therefore, in the Royal Navy to work accurately upon a ratio of dental officers to personnel, since the dental health of a small unit stationed in isolation may be as important to the Service as that of a very much larger commitment. In peace-time, however, a percentage was roughly maintained which allowed one dental officer to every 500 recruits and one to every 2,000 trained men.

A temporary modification in the dental standards required of recruits on entry, which had a direct bearing on the subsequent war years, was introduced in 1938 by Admiralty Fleet Order. This provided that artificer and artisan candidates should not be rejected on account of dental defects which could be remedied by treatment, including the gratuitous supply of dentures. Ordinary seamen candidates who were in possession of satisfactory dentures could now be entered, and other men ratings below the normal standard to the extent of the loss of one pair of opposing molars were also accepted.

At the outbreak of war it was evident that to attempt to maintain any dental standards on entry in the case of 'hostilities only' personnel, was impracticable in view of the very rapid recruitment and the time available for the conservative treatment of this class of personnel, and the extremely poor dental condition of the majority. It would indeed have been both unreasonable and uneconomical if such personnel were exempt from service on account of a dental condition which could be corrected by treatment.

In 1940, therefore, the following further relaxations in standards were introduced:

All men ratings for special service were accepted if satisfactory dentures were worn.

Artificers and artisans were not rejected for any dental deficiency or condition capable of being remedied, including a gratuitous supply of dentures.

This was the only possible decision in the circumstances, and it was maintained throughout the war. Official memoranda were produced from time to time which gave instructions for maximum treatment to certain classes of personnel, e.g. commando, special service, divers, submarine, and personnel earmarked for service on isolated stations abroad. An important point, however, is that no modifications were introduced in the standards on entry for candidates for boy ratings.

A moderate dental standard on entry was maintained for continuous service personnel, with the exception of the urgent classes of artisan rating mentioned, but invariably standard on entry for 'hostilities only' personnel was not applied.

Ratings who served on temporary agreements, and who had not undertaken to serve for the full period of hostilities (T. 124 and F. 124),

were not entitled to dental treatment other than for the relief of pain. Those, however, who were employed on temporary agreements for the full period of the war (T. 124X and T. 124T) and whose services were required, were entitled to extensive dental treatment provided:

That treatment had been sought voluntarily, and was necessary to prevent infection to other personnel.

That the treatment was necessary to prevent invaliding, and to render the man fit for general service.

During the war, facilities for dental treatment were extended to a number of miscellaneous personnel not previously entitled. These included N.A.A.F.I. personnel in uniform, Royal Marine Police, special dockyard personnel, and officers and members of the W.R.N.S., V.A.D., Q.A.R.N.N.S. and Q.A.R.N.N.S.(R). R.N. and R.M. officers and nursing sisters became entitled to the supply of prosthetic appliances on repayment of the cost, but no charge was made when the disease or injury was attributable to the Service.

It will thus be understood that, whereas all forms of dental treatment were available for the majority, the extent to which that could be given depended upon existing dental facilities. Some patients received maximum treatment throughout their service, while others might have to wait as long as two years before receiving only scant treatment when passing through their depot. Service exigencies frequently made it impossible to ensure complete uniformity of treatment.

It is perhaps in the sphere of administration that the Dental Branch made the greatest strides during these years. The creation of staff appointments and of senior dental ratings allowed greater efficiency, particularly in administration, and identified the Dental Branch as a separate unit within the Health Services of the Navy. Particular and unique dental requirements could now be supervised by dental personnel. The allocation of dental facilities to meet the special circumstances of ship or station could thus be controlled by the Command, Fleet or Staff Dental Surgeon in accordance with local conditions, and dental treatment of the widest scope could be brought to cover the widest range of personnel.

Within its prescribed peace-time limits the Dental Branch had established a system of record-keeping which may have been the best in the circumstances. The advent of war, however, necessitated a new approach to this matter, since records of dental treatment had to be evolved which would cover continuous service and 'hostilities only' personnel. The upkeep of records requires careful supervision, adequate accommodation and supply of documents, and a fully trained clerical staff. It was not intended to preserve records in war for statistical reasons only, but because of their importance in the further treatment of any serious dental condition, or in the assessment of claims made upon the Admiralty.

DENTAL TREATMENT RECORDS

For the purpose of recording dental treatment during the war, systems were evolved which may be presented under the following headings:

A. Continuous service personnel.
B. 'Hostilities only' personnel.
C. Dominion and Allied personnel.
D. Army and Royal Air Force personnel.
E. Annual and monthly returns of dental treatment.
F. Prosthetic treatment.
G. Dental condition on dispersal, Form M.51A.

A. Continuous Service Personnel

Officers. Treatment was recorded on Dental Treatment Form M. 228, and these were forwarded at regular intervals to the Medical Department of the Navy where they were filed.

Ratings—Boys. The condition on entry of a boy rating was carefully charted on a Dental History Card, Form M. 227. This card was marked 'original', and a 'duplicate' one used to record subsequent treatment in the Training Establishment, the original and duplicate forms being stapled together. On completion of treatment the forms were forwarded for filing to the Command Dental Surgeon of the boy's port division to which he was assigned.

Records on Form M. 228 were forwarded each month to the appropriate filing centre for entry on the rating's Dental History Card, Form M. 227. Forms M. 228 in respect of personnel in ships were retained until the patient left the ship.

B. 'Hostilities Only' Personnel

No official record was at first kept of the condition on entry of 'hostilities only' personnel. Senior Dental Surgeons of the different Training Establishments each kept their own system of examining new entries on joining, and such examinations were carried out to facilitate the delegation of treatment within each dental department, and not to provide permanent records. In the Training Establishments a system was introduced locally in 1944 designed to constitute such permanent records. The dental condition of new entries was charted in red ink on Form M. 228, and subsequent treatment in the training establishment marked in blue. These forms followed the rating while he was under training, and were eventually sent to the appropriate filing centre when his training was complete.

Owing to the acute shortage of paper, and the lack of adequate clerical facilities, a new system was devised for the permanent recording of dental treatment of 'hostilities only' personnel, which it was hoped would effect a saving in paper and clerical man-power. The former

system of recording dental treatment in ink on Form M. 228, and forwarding the form to the patient's filing centre was abolished in the case of all 'hostilities only' personnel when ashore, but was continued in respect of the following:

1. 'Hostilities only' personnel who received treatment afloat.
2. Army, Royal Air Force or Allied personnel.
3. Civilian Admiralty employees who were entitled to treatment.
4. Cases of exceptional professional interest.
5. Continuous service personnel.

Dental treatment for all other 'hostilities only' personnel was temporarily entered in pencil on Form M. 228, and permanent records effected by the introduction of two new forms, Form M. 228A or Dental Case Sheet, and Form M. 228B or Alphabetical Index.

Entries from Form M. 228 were transferred in ink to Forms M. 228A and B, the pencilled details on Form M. 228 being erased, and the latter form used again.

Form M. 228A. This form was divided into sections and a case number recorded against each patient. Brief details of extractions, conservations, gum treatments and appliance work undertaken, and the date of commencement of treatment and the disposal of the case were noted under the appropriate sections of the form. With extractions and conservations, only the index of the tooth was recorded, and no further details of appliance work was made other than a note of the type of denture supplied.

Each sheet, known as a case sheet, was signed by the officer who carried out the treatment.

Form M. 228B. The surname, initials, rank or rating, official number, case number, and case sheet number of each 'hostilities only' patient who required dental treatment were first recorded on Form M. 228B, the alphabetical index. The patient was then allocated to a surgery, and in multiple departments the number of the surgery marked in parenthesis after the case number. Where more than one dental officer was employed in one surgery a further note was made in parenthesis of the name of the officer treating the case.

The surgery case sheet and alphabetical register were subsequently disposed of in the main Commands, and the intention was that the overall treatment of any patient could be assessed from ships or establishments in which the man served, this information being obtained from his port index card.

A complete record of the treatment afforded to 'hostilities only' ratings in shore establishments was obtainable from Forms M. 228A and B. Treatment afloat was recorded in ink on Form M. 228 and was obtainable from this source.

So many thousands of Forms M. 228 of 'hostilities only' and other naval personnel serving in ships were sent to the filing centres that it

was extremely difficult, and sometimes quite impossible, to keep the files up to date. Many Forms M. 228 were lost in transit. Personnel of different divisions would be included together in the alphabetical register, and could not be separated into their Port Divisions, thereby further complicating the situation when these registers were disposed of after the war. The records on Forms M. 228A and B on the one hand, and Forms M. 228 on the other, could not therefore be accurately related.

In the smaller filing centres (e.g. for Royal Marines) it was possible to keep files up to date, but movements and category changes of personnel led to complications, and accurate and complete records could be obtained only by much correspondence and searching of records within the Commands and filing centres, involving loss of valuable time.

One of the many difficulties with which dental departments had to contend was the lack of trained clerical personnel. These records had of necessity to be maintained by unskilled sick berth staff (D), and the confusion which prevailed under the shift system of employment of staff, and the sudden drafting of dental officers, which was such a feature of the war years, precluded complete accuracy. It is therefore doubtful whether the new system of recording on Forms M. 228A and B achieved the economy in paper and man-hours for which it was originally designed.

C. Dominion and Allied Personnel

Dental treatment afforded to Dominion and Allied personnel was recorded on Form M. 228, and the cost in accordance with the current Admiralty scale of fees as laid down in Admiralty Fleet Orders noted in respect of each case. These forms, together with a nominal list were forwarded monthly to the Deputy Director-General for Dental Services.

D. Army and Royal Air Force Personnel

Full reciprocity of dental treatment existed between the Dental Branches of the three Services. Treatment of Army and Royal Air Force personnel in naval dental departments was recorded in duplicate on Form M. 228, one copy being forwarded to the Deputy Director-General for Dental Services and the other to the patient's Commanding Officer.

E. Annual and Monthly Returns of Dental Treatment

Annual Returns (*Forms M. 235 and M. 235B*). Each dental officer compiled annual statistical returns of all dental treatment afforded by him throughout the year. The return, which comprised a nominal list of his patients, was retained by the officer during the year, whatever his appointment. It was submitted on December 31 each year, or on termination of his service, due to retirement or invaliding, through the

Commanding Officer to the Command, Fleet, or Staff Dental Surgeon for transmission to the Deputy Director-General for Dental Services of the Navy.

Monthly Returns (*Form M. 235C*). This form was completed at the end of every month and forwarded to the Admiralty through the same channels as the Annual Statistical Return. The form summarised the statistics of the treatment afforded by the dental officer each month, and provided evidence of how he was employed. The back of the form provided room for 'General Remarks', and under this heading matters and cases of interest might be described.

F. Prosthetic Work

Forms M. 234 and M. 234A were used respectively in cases where dentures were supplied either at the public expense or on repayment of the cost. Completed forms were forwarded monthly to the appropriate filing centres.

The supply of prosthetic appliances was recorded on the patient's medical history sheet and in his pay book on Form M. 230. If drafted from one establishment to another while awaiting the supply of dentures a notation of approval and the stage reached in construction was made on Form M. 239 in the patient's pay book.

Naval personnel who had received operative treatment in the Service and were discharged before the necessary gratuitous supply of dentures could be effected, were given a certificate outlining the prosthetic appliances and/or treatment approved, and defining the liability of the Admiralty in each particular case.

A copy of the certificate was sent to the Deputy Director-General for Dental Services, for use in dealing with claims made by dispersed personnel. Claims were not entertained unless presented within one year of the person's discharge.

G. Dental Condition on Dispersal

Form M. 51A. An appreciation of the general dental condition on discharge of 'hostilities only' personnel was made by assessing the number of teeth in each jaw, and the particulars of the supply of artificial dentures, whether from Service or private source, on Form M. 51A. Remarks as to the oral condition whether good, fair or bad were noted and any general remarks could be made.

Dental statistics were kept in the Royal Navy during the war, as in peace, and were submitted each month to the Deputy Director-General for Dental Services. They were kept as an indication of the degree of work which was being effected in the different dental departments of the Navy, and were used as a barometer within the dental branch to show the success or otherwise of any policy with any type of personnel.

DENTAL ESTABLISHMENT

DENTAL OFFICERS

Before 1939 dental surgeons up to the age of 28 were granted commissions in the Royal Navy provided they were of British nationality, in possession of a recognised degree or diploma in Dental Surgery, and were medically fit to serve in any part of the world. They were required to pass a personal interview at the Admiralty. After acceptance they were sent to the Royal Naval Hospital at Haslar for a course of instruction under the Senior Dental Surgeon in Service routine and customs and the organisation of the Dental Branch.

At the outbreak of the war, 123 dental officers were serving. This number comprised:

Dental Officers of the Royal Navy	116
Dental Officers of the Royal Navy, Retired and Emergency List	4
Dental Officers of the Royal Navy, Naval Volunteer Reserve	3
	123

The sources from which additional dental officers were drawn are given below:

Royal Naval Retired and Emergency Officers. Of these the former category is self-explanatory. The latter were officers who had completed their period of short service or who had retired with a gratuity before reaching retiring age. Eight officers were available and three were actually serving on September 1, 1939. Two were called up on general mobilisation, and three when mobilisation was complete. Two were found to be medically unfit.

Royal Naval Volunteer Reserve (*R.N.V.R.*). The authorised complement of the permanent Dental Branch of the R.N.V.R. in 1939 was 27 officers. Of these, two were medically as well as dentally qualified. Three were serving at the outbreak of war.

Royal Naval Volunteer Supplementary Reserve (*R.N.V.S.R.*). Approval was given in April 1939 for the enrolment in the R.N.V.S.R. of 30 dental surgeons. Such peace-time enrolment did not carry with it rank, nor did it preclude subsequent entry into the Royal Naval Volunteer Reserve in suitable cases on the occurrence of vacancies.

The object of this section of the R.N.V.S.R. was to maintain in time of peace a list of dental surgeons who were desirous of service as dental officers, R.N.V.R., in the event of war, but who were unable to be commissioned as such for personal reasons or because there were no vacancies.

On being called up, members of the R.N.V.S.R. were granted commissions as temporary surgeon lieutenants (D), R.N.V.R. Seniority was given from the date of mobilisation. Relative seniority between individual officers called up together depended upon the date of their enrolment in the Royal Naval Supplementary Reserve. The first batch was called up in December 1939.

Recruitment in War. Subsequently the additional dental officer requirements were satisfied by the dental surgeons who were called up for service. These dental surgeons were made available by the Dental War Committee of the Ministry of Health. This committee in turn was advised by the Emergency Dental War Committees who assessed the local dental requirements of any district, and could recommend the retention of dental surgeons in a reserved capacity. It was, however, the policy to direct into the Services the maximum number of available dental surgeons possible consistent with a proper regard for the needs of the civilian population.

Training of Temporary Dental Officers, R.N.V.R. Dental surgeons were entered as probationary temporary surgeon lieutenants (D), R.N.V.R., and were appointed to a Royal Naval Barracks for a comprehensive disciplinary course for the duration of six weeks. On the conclusion of this they were placed under the Command Dental Surgeon for a detailed training in the organisation of the Dental Branch. This lasted for about four weeks, and thereafter they were available for appointments elsewhere as probationary temporary acting surgeon lieutenants (D), R.N.V.R.

Post-Graduate Training. Although the six months post-graduate training which prevailed in peace-time was not available during the war, dental officers were selected to attend a two-weeks course at the plastic and jaw centre of the Queen Victoria Hospital, East Grinstead, where they were instructed in the latest surgical and prosthetic techniques in the treatment of maxillo-facial injuries.

WARRANT WARDMASTERS

The increasing responsibilities laid upon the Port Dental Surgeons (and subsequently the Command Dental Surgeons), particularly in respect of staff organisation, necessitated the appointment of warrant wardmaster officers to assist them. The first two were appointed in 1943 to the Port Dental Surgeons at Chatham and Portsmouth respectively, and the following year one was appointed to the Command Dental Surgeon, Western Approaches. These first three were promoted from pensioner sick berth chief petty officers (D) then serving. Subsequently nominations to warrant wardmaster were made for duty with each Command Dental Surgeon. The selection of these ratings for promotion was made in the Medical Department, and although they were appointed for dental duties, they did not carry the designation (D)

after their names. They were technically liable for transfer back to medical duties if required.

WOMEN TEMPORARY DENTAL OFFICERS, R.N.V.R.

To augment the number of dental officers, women dental surgeons were entered in 1943 as probationary temporary surgeon lieutenants (D), R.N.V.R., under the same conditions of service as dental officers. Their uniform was similar to that of W.R.N.S. officers, but the rank and distinction lace and hat badge were as for dental officers, R.N.V.R.

Their relationship to the Command or Senior Dental Surgeon was similar to that of dental officers; they came under the Commanding Officer of the establishment for administrative and disciplinary purposes and were not responsible to the Senior W.R.N.S. officer.

Altogether seven were entered and they served in Barracks, Training Establishments and W.R.N.S. Quarters, but not afloat. Three of them served abroad.

NUMBER OF DENTAL OFFICERS—STATISTICAL TABLE

The following table gives figures of dental officers from September 1, 1939, until August 1, 1945, in relation to the overall strength of naval personnel:

Date	Number of dental officers serving				Total strength (including W.R.N.S. etc.)	Ratio of dental officers per 1,000 personnel
	R.N.	R.N. Retired and Emergency List	R.N.V.R.	Total		
September 1, 1939	116	4	3	123	162,170	0·758
January 1, 1940 .	115	13	34	162	211,390	0·766
January 1, 1941 .	111	14	125	250	335,150	0·746
January 1, 1942 .	108	11	225	344	472,110	0·729
January 1, 1943 .	95	21	345	461	613,160	0·752
January 1, 1944 .	79	36	500	615	825,450	0·745
January 1, 1945 .	64	46	543	653	862,050	0·757
August 1, 1945 .	50	56	580	686	847,600	0·809

Whereas this table shows a consistent overall ratio of dental officers to personnel, further perusal of this History will show a marked disproportion within the Service in this respect (e.g. British Pacific Fleet—one officer to 4,500 personnel). The proper disposition of dental officers to the best advantage is affected by a number of conditions, which will be dealt with in their appropriate context. Considerable wastages of personnel occur, particularly as a result of absence from duty due to sickness or leave, and the time lost in transit of officers from one appointment to another.

Further losses may be assessed as follows:

Losses during the period September 1, 1939 *to August* 1, 1945—

Killed or died on active service	11
Invalided	24
Prisoners-of-war	1
Retirements (not re-employed)	3
Losses from other causes (reversion to Retired List, return to civil life, etc.)	20

SICK BERTH STAFF (D)

In peace-time the dental surgery attendant was obtained from two sources:

(*a*) Pensioner sick berth ratings who were employed as such in the home establishments in a civilian capacity. This system had the advantage of economy and afforded an avenue of employment for men with specialised knowledge.

(*b*) Sick berth ratings who were lent from the sick berth staff to provide dental surgery attendants. Whereas the dental officer could assess the efficiency of these ratings, their advancement was obtained through essentially medical knowledge and recommendation.

On the outbreak of war, it was evident that both these categories would be available for transfer, if required, to the medical category of sick berth rating, and many were at once removed. Subsequently, the loan of sick berth staff for dental duties was arrested by Admiralty Fleet Order. The pensioners, however, were in most cases retained in the Dental Departments in view of their experience, and several were found to be fit for shore and harbour service only. The immediate problem, therefore, was how to obtain sufficient attendants to man the Dental Branch. The first available source of supply was the Royal Naval Auxiliary Sick Berth Reserve. Since these were primarily trained in medical duties, it was evident that they too could be recalled if ever the sick berth staff was undermanned. In 1940 it was decided to constitute, for the duration of hostilities, a branch of dental surgery attendants, to be known as sick berth staff (D), within the sick berth branch. The nucleus of this was formed from the pensioner attendants who were fit for general service, from those of the sick berth branch lent for dental duties who elected to remain in the Dental Branch and who could be spared, and from a number of the R.N.A.S.B.R. who were in excess of Medical Branch requirements at that time. The pensioners were given their original rank and status, and they therefore constituted the first sick berth chief petty officer (D) ratings. It must be noted that this rate was not formally introduced into the Dental Branch, and that these chief petty officers, although paid as such, were counted in their Port Division numbers as sick berth petty officers (D).

On the formation of the sick berth branch (D) 'hostilities only', ratings were called up into the Dental Branch direct, and, after their preliminary training, they were drafted into the Dental Departments of the depots for training in dental matters. Endeavours were made at first to select ratings from men who intended to adopt dentistry as a career, but eventually probationary sick berth attendants (D) were nominated indiscriminately as they were required and became available.

No qualifying examination was introduced for the advancement of sick berth ratings who were transferred or entered specially for dental duties, but ratings so transferred could count their time served in the sick berth branch for advancement purposes in the dental section.

Sick berth attendants (D) were eligible for temporary advancement on the following lines, in each case recommendation being made by the dental officer concerned:

(*a*) *Probationary S.B.A.(D) to S.B.A.(D)*—after six weeks' satisfactory training.

(*b*) *S.B.A.(D) to L.S.B.A.(D)*—on the completion of fifteen months' total service, a rating could be recommended for advancement provided he was efficient in every respect of his duties. This advancement was governed by depot roster.

(*c*) *L.S.B.A.(D) to S.B.P.O.(D)*—recommendations were made after two years' satisfactory service as L.S.B.A.(D).

S.B.P.Os.(D) were allowed as follows:

(1) One for each surgeon commander (D) authorised by complement.

(2) One for duty with the Senior Dental Surgeon at dental laboratories.

(3) One for every six dental ratings at large establishments.

Advancement from L.S.B.A.(D) to S.B.P.O.(D) was also governed by depot roster.

These provisions were found to delay the advancement of many suitable attendants, and in 1942 the promotion of L.S.B.As.(D) to S.B.P.Os.(D) was made without depot authority provided the rating was qualified in all respects. Such authority was delegated to the Commanding Officer of the rating's ship or establishment. Advancement from S.B.A.(D) to L.S.B.A.(D) was unaffected and remained subject to depot roster, the average time being two years and nine months. Pay and conditions of service were analagous to those of the sick berth branch.

Complement.

At peak 566 sick berth staff (dental) were borne, of whom 252 obtained leading or petty officer rates.

DENTAL MECHANICS

Up to 1939 prosthetic work was effected for the Dental Branch of the Royal Navy in two establishments, the Royal Naval Barracks at

Chatham, and the Royal Naval Hospital at Malta. The former met the requirements of all naval dental personnel in establishments at home and the Home Fleet, and the latter attended to the Mediterranean Fleet. In other stations abroad contracts were arranged either with dental surgeons or mechanics to the profession.

When war broke out, the demand for prosthetic treatment in the Navy grew out of all proportion to the laboratory facilities then available. Attempts were made to enter more civilian mechanics for duty in naval laboratories, but the demand for dental laboratory facilities abroad and afloat became as urgent as that which prevailed at home. The complications of the employment of such civilian tradesmen in a uniformed Service were many, and so in 1940 the Admiralty decided to form a uniformed branch of dental mechanics within the sick berth branch of the Navy.

The nucleus of the branch of dental mechanics was made from the civilian mechanics employed by the Navy at the time. Those fit for full service were given uniform and rated as described below.

Dental mechanics were entered as sick berth attendants (D.M.) and attended the usual short disciplinary course for sick berth attendants. They were entered under the following conditions:

1. Entries will normally be restricted to candidates who can produce satisfactory written evidence that they have completed at least four years practical experience in their craft (including apprenticeship), but a limited number of apprentices and improvers with less than four years total experience may be accepted, provided they are certified by their previous employers to have shown aptitude and zeal and that they are likely to become efficient mechanics after further training.
2. Applications from candidates with less than four years' experience should be referred to the Medical Director-General for consideration and approval before acceptance.
3. S.B.As. (D.M.) will only be employed at naval dental laboratories under the supervision of experienced dental mechanics (civilian or S.B.P.Os. (D.M.)).

Advancement to L.S.B.A. (D.M.)

1. S.B.As. (D.M.) will be eligible for advancement on the satisfactory completion of a practical test of efficiency as a mechanic, which includes all stages of construction and repair of plastic base dentures, and the preliminary training course, which includes:

(*a*) Part I recruit training.
(*b*) Anti-gas course.
(*c*) A series of lectures in first aid as for S.B.As. (D).

2. In all cases the recommendation of the Senior Dental Surgeon under whom they may be serving is required.

3. Ratings who fail to pass the prescribed tests may submit themselves for re-examination after an interval of not less than two months.

Advancement to S.B.P.O. (D.M.)

1. L.S.B.As. (D.M.) will be eligible for advancement to S.B.P.O. (D.M.) on completion of eight years' total practical experience, including apprenticeship and civilian employment, if recommended by the Senior Dental Surgeon under whom they are serving.

2. Such recommendations are to be based not only on technical skill and experience, but also on general suitability and ability to take charge of a laboratory.

A civilian mechanic transferred to naval status was entered as an S.B.A. (D.M.) and immediately rated up to S.B.P.O. (D.M.).

Pay was similar to that of members of the Sick Berth Branch, and there was no allowance in respect of specialised training.

At peak there were 165 uniformed dental mechanics.

Where it was conveniently possible to do so, civilians were employed as dental surgery attendants, clerks and dental mechanics. In the majority of cases these were pensioner ratings from different branches of the Royal Navy, who were unfit for transfer to uniformed status by virtue of age or general health. Some civilians were, however, recruited direct, and were employed in shore establishments only.

WOMEN DENTAL SURGERY ATTENDANTS

In accordance with general Admiralty policy to employ women in establishments where they could be appropriately accommodated, attempts were made to incorporate personnel of the Women's Royal Naval Service and the Voluntary Aid Detachments into the Dental Branch as dental surgery attendants. It was always considered that women would be suitable for such posts, but a number of factors precluded this policy from being implemented on any large scale.

It had been noted that several highly trained civilian women dental surgery attendants and receptionists had joined the W.R.N.S., and it was considered that these would form a valuable nucleus of a section of W.R.N.S. dental surgery attendants. Examination of their rates of pay in civilian life, and their status as skilled and experienced women revealed that they would have to be employed at least in the rating of Chief W.R.N.S. Although in one or two isolated cases local appointments were made on these lines, no definite policy was encouraged, and such W.R.N.S. ratings were eventually absorbed back into other branches.

V.A.Ds. were lent for duty as dental surgery attendants in the category of V.A.D. N/M (Nursing Member). From 1941 onwards 120 were employed and given a six-weeks course of instruction in dental duties. Their category was changed to V.A.D. N/M (Dental), and they were

all volunteers. Some were allocated to these duties on joining, and every effort was made to encourage recruits among the nursing staffs of hospitals.

DENTAL CONSULTANTS

In peace-time two civilian dental surgeons were employed as dental consultants to the Royal Navy. The advent of war greatly increased their work. Naval establishments were scattered, and the Dental Branch was manned to a very great extent by newly qualified dental surgeons, who, with inexperience, had to meet many unusual and serious dental conditions. It was impossible to expect these two consultants, who practised in London, to meet all the demands made upon them, especially in view of the necessity of undertaking long journeys into the provinces. In 1944, therefore, the number of consultants in dental surgery was increased to provide ten appointments, in Aberdeen, Belfast, Birmingham, Bristol, Edinburgh, Liverpool, Manchester, Newcastle-on-Tyne, Newton Abbot and Plymouth respectively. Such appointments were on a regional basis, so that the services of a consultant were available in all parts of the country.

An organisation was thus established which proved of much value to the dental officer, and increased considerably his confidence in his work and the scope of treatment which could be given.

Up to 1944 no dental officer in the Royal Navy received any allowance in respect of specialised duties or responsibilities. If he had qualified in medicine, he was entitled to draw the higher rate of pay of a medical officer when appointed to undertake medical duties, but, although several officers were doubly qualified, this situation never arose. In naval hospitals the dental officer had the responsibility of dealing with cases of septic oral lesions, abnormality of dental tissue growth, and certain types of jaw injuries which were admitted to hospital. In 1944 the position of these officers was recognised, and they were appointed as specialists in dental surgery in certain defined appointments, viz., the Royal Naval Hospitals, Portsmouth, Plymouth, Chatham and Malta, the Royal Naval Auxiliary Hospitals at Kingseat and Colombo and at H.M.S. *Golden Hind*, Sydney.

Specialist officers were selected from those who had attended the maxillo-facial course at East Grinstead. These appointments were confined to officers of and below the rank of surgeon commander (D).

ADMINISTRATIVE DEVELOPMENTS

It has already been recorded that a dental officer was appointed to the Medical Department, Admiralty, as Dental Assistant to the Medical Director-General of the Navy. The Dental Branch of the Royal Navy before the war was an autonomous branch of the Naval Medical

Service, under the Medical Director-General who was advised by his Dental Assistant. The growth of the Dental Branch, with its own particular problems of administration, personnel and supply, led to the appointment in 1940 of the Dental Assistant as Deputy Director-General for Dental Services (D.D.G. (D)).

The Deputy Director-General for Dental Services was entirely responsible to the Medical Director-General for the policy and administration of the Dental Branch, and for recommending the entry, appointment and promotion of dental officers. He was assisted by three dental officers whose respective duties are described below.

ASSISTANT DEPUTY DIRECTOR-GENERAL FOR DENTAL SERVICES (A.D.D.G. (D))

The Assistant gave general help to the Deputy Director in the administration of the branch, and deputised for him in his absence. His duties included the provision and distribution of dental equipment and stores, and the disposal of surplus and unserviceable equipment. He maintained close liaison between the Ministries of Supply and Health, and other Service departments, such as the Director of Plans, the Director of Aircraft and Carrier Requirements, and the Director of Combined Operations. He was also concerned in dental accommodation afloat, and worked with the Director of Manning concerning matters of dental complements.

The other two dental officers were designated as D.S. I and D.S. II.

D.S. I. This officer assisted A.D.D.G. (D) in the distribution of initial dental outfits and the scrutiny of periodic demands, and undertook some routine work for D.D.G. (D). He supervised the claims of the civilian dental practitioners particularly in respect of approval of fees, etc., and assisted in the application of the age and service group system to dental officers.

D.S. II. This officer was concerned with the scrutiny of records and reports. His duty was to sift from these any matter of immediate importance to D.D.G. (D) and A.D.D.G. (D) and to extract information on such specific points as might be required from time to time. He kept liaison with the different authorities in the Medical Department in obtaining any documents or information required, and took the place of A.D.D.G. (D) or D.S. I when they were absent from duty.

Organisation in war led to the formation of a number of new appointments in the Dental Branch. It has been recorded that in 1932 the Senior Dental Officers in the three home ports were appointed as Port Dental Officers, and they were responsible for the organisation of dental facilities in these ports. The first appointment to the staff of a Commander-in-Chief occurred in 1936 when the Senior Dental Officer of the Home Fleet was upgraded to the rank of surgeon commander (D) and appointed to the staff of the Commander-in-Chief as Fleet

Dental Officer. The added commitments in war, and the many problems connected with new construction, personnel, stores and accommodation made it necessary to identify as Staff Officers the Senior Dental Officers to administrative Flag appointments.

The original four appointments of Port Dental Officer (P.D.O.) and Fleet Dental Officer (F.D.O.) and the various Senior Dental Officers (S.D.Os.) were now absorbed into the broader responsibilities of Command Dental Surgeon (C.D.S.), Fleet Dental Surgeon (F.D.S.) and Senior or Staff Dental Surgeon (S.D.S.).

COMMAND DENTAL SURGEON (C.D.S.)

Command Dental Surgeons, with the rank of Surgeon Captain (D), were appointed to the staffs of Commanders-in-Chief of the large Commands, i.e. Portsmouth, Nore, Plymouth, Western Approaches, Rosyth, Mediterranean, and subsequently the East Indies and the British Pacific Fleet. They were responsible direct to the Commander-in-Chief for the efficient organisation and administration of dental facilities within the Command. The Staff Dental Surgeon on the staff of Admiral Air (Home) was similarly responsible for facilities in all Fleet Air Arm Establishments in the United Kingdom.

STAFF DENTAL SURGEON (S.D.S.)

Dental Officers were attached to the staffs of a number of sub-commands, and were responsible to the Command Dental Surgeon for their own local organisations. Staff Dental Surgeons were also carried abroad on the staffs of Flag Officer, Alexandria; S.E.A.C.; Commander-in-Chief, South Atlantic; Rear Admiral, Training Establishments, South Africa; Flag Officer, East and West Africa; Rear Admiral, Fleet Train, British Pacific Fleet; Vice Admiral, Administration, British Pacific Fleet.

FLEET DENTAL SURGEON (F.D.S.)

Fleet Dental Surgeons were appointed on the staffs of Commanders-in-Chief afloat and in addition to their staff duties, were responsible for the dental treatment for the ship in which they were borne. They moved from one ship to another with the Flag. On many occasions the Commander-in-Chief would wear his Flag on shore, and the Fleet Dental Surgeon would go ashore with him, where he was usually employed in a purely administrative capacity.

An important duty of staff officers was the regular inspection of dental departments in the Command.

The scattered nature of operational commitments in war necessitated the provision of dental facilities at many isolated bases where electric power or adequate water supplies might be unobtainable, and in such operational units as the Mobile Naval Base Defence Organisation

(M.N.B.D.O.), the Mobile Operational Naval Air Base (M.O.N.A.B.) or the Mobile Operational Landing Craft Advanced Base (M.O.L.C.A.B.).

The problems and difficulties which confronted the Dental Branch Organisation will be apparent to the reader. War-time shortages, lack of man-power, and enemy action were all factors which mitigated against adequate supplies. By ingenuity and personal contacts with the other Services and the dental manufacturing companies a satisfactory state of affairs was eventually reached.

DENTAL EQUIPMENT

Dental equipment and stores before the war were obtained by the Medical Director-General of the Navy out of the Medical Department vote by purchase from civilian contractors through the Director of Navy Contracts. Whenever substantial new purchases were to be made tenders were obtained from the dental manufacturing companies by this authority.

In addition to the orders arranged by the Director of Navy Contracts, the Medical Director-General had a limited direct local purchase authority up to £50 value. Facilities also existed for the purchase of small urgent requirements by local authorities, such action being subsequently reported to the Medical Director-General with an explanation of the necessity of the transaction.

At the outbreak of war some consumable dental stores were available at the Royal Naval Hospital, Haslar, and at the Admiralty Medical Store Depot at Deptford. There was only a very small reserve of surgery furniture. Supplies were demanded in full every six months on the basis of previous demands and any new known requirements or additional commitments, and for the first year very little change was made. In March 1940 the store at Deptford was destroyed by bombing. This placed a heavy responsibility upon those concerned with the supply of dental stores. By immediate contact with the contractors, and the assistance of the Army and Royal Air Force authorities, equipment was obtained in due course, and through the Director of Navy Contracts the dental officer concerned with the supply of stores, eventually succeeded in stepping up a fair allocation for the Navy from civilian contractors.

In 1941, under lend-lease, the United States agreed to supply dental stores to naval establishments in Bermuda and Ceylon, and H.M. Ships refitting in United States dockyards.

In 1942 it was decided to assemble at the main medical depots basic outfits of dental stores, which were maintained for immediate issue to any part of the world at the direction of the Deputy Director-General (D). They were then distributed among subsidiary or 'holding' depots (e.g. Leicester, Dunfermline, etc.) for issue as required. Each outfit was assembled from the revised war-time schedule which covered

surgery furniture (Section A), instruments (Section B) and consumable stores (Section C). Drugs and medicaments were demanded from the hospitals and establishments which carried a naval pharmacist.

The contents of Sections B and C were common to all basic outfits, but special directions would be given in demanding Section A to accommodate the circumstances of the project (whether ashore, afloat or mobile).

The manner in which consignments of dental equipment from the United Kingdom reached H.M. Ships and establishments at home and abroad is dealt with in Chapter 11 of this volume.

DENTAL SURGERIES

In the early days of the Dental Branch, dental amenities were confined to the main depots and training establishments, and desultory appointments were only made to sea-going ships and stations abroad, when, as has been explained, an economy might be effected. Most of the buildings in these establishments were old, and room had to be found in existing premises to house the dentist and his department. For this reason provision was made on the lines of one compartment to one officer. Waiting room, store room, toilet, office accommodation and other normal requirements were usually shared with other departments, or improvised in some way or another. This proved to be a matter of much inconvenience at all times. In 1928 the first dental department to be designed and built as such was erected in H.M.S. *Ganges*, the Boys' Training Establishment at Shotley Gate, Suffolk. Although improvements were incorporated, it was still evident that insufficient attention was given to the full ancillary requirements of a dental department.

The importance and the implications of organised dental services within the Royal Navy grew through the years in proportion with the increased scope of treatment and the responsibilities of the Dental Branch. The small premises envisaged very soon overflowed into other departments, frequently at the expense of living accommodation of personnel. This invariably led to the necessity for the appropriate allocation of full and adequate accommodation for a dental department well in advance of the appointment of dental staff.

In 1940 a standard design for dental surgeries in H.M. Ships was produced, and a copy of this with an appropriate specification was sent to each Port Dental Officer. These plans proved of little more than academic value, since these officers had no mandate to supervise the dental accommodation of ships under construction in any other than their own ports, and the naval dockyards ceased to be used for shipbuilding early in the war. A valuable list of the fittings required in a dental surgery was produced in one of the Commands, which had the

advantage of classifying the requirements under the different works department authorities concerned.

The prints and specification did on occasion reach the hands of the shipbuilders, and were carefully copied. Since there was no dental officer available to supervise, fittings were occasionally installed without consideration of the size and shape of the compartment, and the dental officer who was eventually appointed found difficulty in installing his equipment.*

DENTAL TREATMENT OF RECRUITS IN TRAINING

Under the National Service (Armed Forces) Act, 1939, the medical fitness of a recruit was determined by a Civilian Medical Board appointed by the Ministry of Labour and National Service, whose medical gradings were final in so far as the Admiralty was concerned. A cursory examination of the mouth was made by a doctor, and recruits were accepted with any dental lesion that would, within reason, answer to treatment. In the main, only medically Grade 1 men were entered, but in the case of a few categories men medically Grade 1, but placed 2A vision or 2A feet, were also accepted. These recruits were duly entered and were sent to the main entry establishments for Part I training, which comprised 'kitting-up' into uniform and a general comprehensive disciplinary training. Ratings were categorised into substantive classes, and where necessary, were subsequently posted to suitable establishments for Part II training in their specialised branches. Exceptions to this principle were the tradesmen who failed trades tests for entry as such; these were forwarded to the appropriate establishment entering the category for which they were otherwise suitable. Volunteers who failed the trades tests could, if they so desired, refuse alternative entry.

Since men of non-specialised ratings were available for general draft on completion of their Part I training, it is evident that this time was to be the most favourable for the general assessment of the man's dental health and such remedial treatment as could be effected in order to render him dentally fit for general service. The general dental condition of recruits was very bad. Much hard work had to be effected in the large dental departments of training establishments in order to meet the flood of new entries, and to reach some degree of dental fitness. In addition to the many lessons which the naval recruit learned on entry, he was taught, frequently for the first time in his life, the importance of oral hygiene.

A number of mushroom establishments sprang up during the war years to meet overflow, but the following were the main entry establishments: H.M. Ships *Britannia*, *Collingwood*, *Duke*, *Europa*, *Excalibur*, *Ganges*, *Glendower*, *Gosling*, *Raleigh*, *Royal Arthur* and *St. George*.

* Similar difficulties are referred to in the Operational Volume of the Naval Medical History, Chapter 1.

For the purpose of administration the training establishments came under the Command in which they were situated, with the exception of H.M.S. *Gosling*, which was responsible to the Air Command (Home). To these must be added the established R.N. Depots ashore in the United Kingdom.

Establishments	*Duties*
H.M.S. *Britannia*, Royal Naval College, ex Dartmouth (Western Approaches)	Cadets.
H.M.S. *St. George*, Isle of Man (Western Approaches)	Seamen Boys
H.M.S. *Royal Arthur*, Skegness (Nore)	In the first instance all ratings until additional entry establishments were opened. All ratings for re-categorisation through failure in courses, etc.
H.M.S. *Ganges*, Shotley Gate (Nore)	Seamen
H.M.S. *Collingwood*, Fareham (Portsmouth)	Seamen
H.M.S. *Raleigh*, Torpoint (Plymouth)	Seamen
H.M.S. *Gosling*, Warrington (Air)	Air Mechanics
H.M.S. *Duke*, Malvern (Nore)	Stokers
H.M.S. *Excalibur*, Alsager	S.B.As., Coders, Cooks, Stewards and Seamen.
H.M.S. *Glendower*, Pwllheli (Western Approaches)	S. B. As., Cooks, Stewards and Seamen.
H.M.S. *Impregnable*, Devonport (Plymouth)	Communication Ratings
H.M.S. *King Alfred*, Hove (Portsmouth)	C/W Candidates
H.M.S. *Europa*, Lowestoft (Nore)	All R.N. Patrol Service Ratings
Boom Defence Depot, Rosyth (Rosyth)	Boom Defence Ratings
R.N. Barracks, Portsmouth	Artificers, shipwrights, and artisans. Seamen (mine watchers)

R.N. Barracks, Chatham	Artificers, shipwrights and artisans; tradesmen, skilled labourers, and labourers for Fleet Repair Bases known as Special Repair Ratings (D), seamen and others, Merchant Navy
R.N. Barracks, Lee-on-Solent	Tradesmen for Fleet Air Arm.
Royal Marine Barracks, Eastney " " " Chatham " " " Plymouth " " Depot, Lympstone	Royal Marines
Royal Marine Depot, Deal	Royal Marines and tradesmen for Royal Marine Engineers.
Royal Marine Mechanical Training Establishment, Fort Cumberland, Eastney.	Tradesmen and motor drivers for M.N.B.D.O.

H.M.S. Britannia, Royal Naval College, Dartmouth

A civilian dentist from the district visited the college once a month to effect such treatment as was required for the ship's company on a repayment basis, but the majority of cadets received their dental treatment from private practitioners at their homes. A watching brief was kept on affairs by the Port Dental Officer at Devonport.

In November 1940 it was decided to establish a Service dental officer at the college in view of the increasing numbers of cadets and the number of personnel in the area which was slowly being converted into a port. He took over the surgery previously occupied by the civilian dentist.

The dental officer examined all cadets on joining and subsequently each term.

The establishment of the estuary of the Dart as a base for small craft considerably increased the work of the dental officer, and also attracted the interest of enemy raiders. Dental treatment was continually interrupted by air-raid warnings, and on September 18, 1942, an air attack was made by the enemy on the building which housed the dental surgery. The report of the dental officer may be repeated here:

> 'Fortunately the aircraft opened up with machine gun and cannon fire while still some distance from us. The instant I heard the gunfire I shouted to the S.B.P.O.(D) and the patient to get away from the window. We just had time to throw ourselves on the floor when the effect of two heavy bombs one each side about twenty yards away from the surgery gave us an unpleasant few moments. Fortunately no one except myself received any injuries in the surgery, and we were able to get out.'

New accommodation then had to be found, and an extra officer was appointed to meet the rapidly increasing commitments. As a temporary measure the E. W. Roberts Memorial Pavilion on the rugby ground was converted into two surgeries, but subsequently it was decided to move the college to Eaton Hall, near Chester, the seat of the Duke of Westminster. The college buildings were then commissioned as H.M.S. *Dartmouth*, and a routine dental department was established. The dental surgery at Eaton Hall was placed in a new building, and treatment was carried out on similar lines to those already established at Dartmouth.

The United States forces eventually took the establishment over, and Royal Naval dental equipment was transferred for their use.

H.M.S. Collingwood

This training camp, supplying the needs of 25,000 recruits each year, was built near Fareham. The dental department was originally built to accommodate four dental surgeries in a wooden hut. This was soon found to be insufficient for the requirements, and an extension was built providing five extra surgeries and a dental laboratory.

Damage to the building by enemy action seriously upset the routine in March 1941 and led to arrears of work which was not overtaken for many months. The training period of these seamen was only ten weeks, and the patients were not available for the last two weeks of their course owing to intensive gunnery training.

The complement comprised one surgeon commander (D) as Senior Dental Surgeon and twelve dental officers. Occasionally probationary surgeon lieutenants (D) R.N.V.R. were appointed for training.

H.M.S. Duke

Since H.M.S. *Royal Arthur* and H.M.S. *Glendower* were unable to meet the initial training requirements it was decided to open a further establishment, H.M.S. *Duke*, at Malvern, in April 1941, for the reception of stoker and engine room ratings. This was at first a temporary establishment, and two dental surgeries were situated in the sick bay. The main camp was opened in August of that year and a complete wing of a building was given to the dental department, which at that time comprised six dental surgeries, a laboratory and usual offices. Increasing commitments led to the appointment of further personnel, and until further accommodation was obtained the shift system was worked. In addition to the commitments in H.M.S. *Duke* the dental department also looked after the personnel of the R.A.F. Station at Malvern.

The shortage of dental equipment at the time of the commissioning of this establishment very seriously retarded treatment and caused many complications. Eventually the situation was resolved and H.M.S.

Duke carried a complement of one surgeon commander (D) as Senior Dental Surgeon, and 13 dental officers. Of these, two were women dental surgeons, the first to be entered into the Service.

H.M.S. Europa

This establishment was concerned with the entry and training of R.N. Patrol Service personnel. In addition there was a number of light coastal forces and mine-sweeping personnel based on the harbour.

The personnel were billeted in different scattered buildings in the town of Lowestoft, and two dental departments were established to meet the requirements of some 16,000 personnel. Of these there was a turnover of 300 joining and leaving each week. The one dental department was formed from two houses, 63 and 65 Royal Avenue, and the other was two miles away in St. Luke's School. Incoming drafts were examined in the medical examination room at specified times, and also at St. Luke's School. This routine took up at least two hours of the Senior Dental Surgeon's time each day.

The condition of the patrol service recruits and personnel was extremely bad, and it was soon realised that it was impossible to maintain a high standard of dental fitness.

Only those requiring dentures and volunteers for treatment were accepted, and others whose dental condition was a menace to their Service efficiency. In view of the scattered nature of the establishment there was much difficulty in obtaining patients by appointment, but there was always a sufficient flow of volunteers and urgent cases to keep both departments busy.

There was a complement of one surgeon commander (D) as Senior Dental Surgeon, five dental officers in 63, Royal Avenue, and two in St. Luke's School, and there was a laboratory of four dental mechanics.

H.M.S. Excalibur

This establishment at Alsager, Cheshire, was originally built as accommodation for workers and was used for the new entry training of sick berth attendants, coders, cooks, stewards and certain classes of seamen. Since the importance of the training of the majority of these types of rating is concentrated in Part II, the trainee would not normally spend more than five weeks in H.M.S. *Excalibur*. They numbered approximately 1,000 and the routine was similar to all training establishments.

The dental department was housed in a brick building originally intended as a hairdressing saloon, and the dental complement consisted of a Senior Dental Surgeon and two dental officers, with a laboratory of two dental mechanics.

H.M.S. Ganges

The seamen boys' training establishment at Shotley Gate, near Ipswich, was converted into use for 'hostilities only' trainees in 1940. This commitment very quickly grew until H.M.S. *Ganges* was responsible for about 20,000 trainees each year. In addition to this there was a large number of personnel in the harbour and local defences who were dependent on *Ganges* for dental treatment.

By the building of a Nissen hut and conversion of four rooms in the new entry annexe and one room in the baggage store of the main barracks, dental surgery accommodation was provided for 13 operators. The Senior Dental Surgeon was appointed also as Senior Dental Surgeon, Harwich, and was responsible for the administration of the dental facilities of that port. A laboratory for three dental mechanics was placed in the Nissen hut.

H.M.S. Glendower

When the commitments of H.M.S. *Royal Arthur* were realised it was decided to open a further establishment, and this was commissioned in July 1940 as H.M.S. *Glendower*, near Pwllheli, in North Wales. Three dental officers were drafted with portable equipment, and set up their surgeries in bell tents. The limitations imposed by makeshift accommodation and the shortage of equipment and staff rendered it impossible for the dental facilities to meet the intake of recruits which came at the continuous rate of 300 per week, with a result that only extractions and dentures were undertaken. These temporary premises were situated near a large house called Broom Hall, which was requisitioned for administrative purposes. One of the surgeries was moved from a bell tent into an outbuilding, which subsequently housed three surgeries.

In March 1941 the establishment took over the Butlin Holiday Camp nearby, which was in the course of construction, and the dental department was placed in the chalet type of sleeping accommodation. The dental department consisted at first of four surgeries and laboratory in proximity to the Sick Bay. In September seven dental surgeries were available, and since this complement proved inadequate to meet even minimum requirements further dental officers were appointed as they became available, and were employed on the 'shift system'. The three-watch system was used in this establishment which facilitated the working of the shift arrangements in the Dental Department, hours being from 0900 until 1830 daily. A complement of one surgeon commander (D) as Senior Dental Surgeon and eleven dental officers was ultimately carried.

The routine of 'extraction surgeries' was used in this establishment and the Forms M. 228 of these patients were delegated to the surgeries employed in conservative work for the necessary treatment. A number

of Royal Netherlands Navy personnel were trained in this establishment, and three Dutch dental officers were appointed as part complement to attend to their treatment.

H.M.S. Gosling

In order to provide an establishment for the new-entry training of Fleet Air Arm personnel (air fitters, air mechanics, and radio mechanics), the Admiralty took over from the Ministry of Supply five hutted camps, which had been intended as accommodation for the women attached to the adjacent munitions works at Risley, near Warrington. The policy was to enter 500 recruits a week, for an instructional course of ten weeks; this was realised by the entry of 100 men each day for five days each week of the year and made H.M.S. *Gosling* the busiest of this type of establishment.

The camps were separated from one another by distances averaging from one to four miles, so the dental administration required for such a complex establishment may be understood. Camps 1 and 3 were situated in Croft village, Camp 2 was in Culcheth, Camp 4 at Glazebrook, and Camp 5 was at Lowton St. Mary's. Although mainly Fleet Air Arm personnel were entered, the organisation was further complicated by the other classes of trainees, e.g. Royal Marines, who used the accommodation from time to time, and mechanical work was received in the laboratory from H.M.S. *Blackcap* at Stretton, H.M.S. *Ariel* (embracing another two camps) and H.M.S. *Nuthatch*, near Carlisle.

To meet these intensive and varying commitments the Senior Dental Surgeon had his office and store in No. 1 camp, which was used solely for entry and 'kitting-up' purposes. He had also one dental officer with a surgery in this building. The new entries were inspected in this camp, and deficiencies were noted and conveyed to the dental officer in charge of the camp to which the man was allocated for training. There were three dental officers in Camps 3, 4 and 5, and four in Camp 2, making a total of one Senior Dental Surgeon and 14 operators.

The different dental departments were situated in the hairdressing section of the laundry block of each camp, and a room was built on to the end of the department in Camp 3 to house a dental laboratory.

H.M.S. King Alfred

This establishment, near Hove, was a training establishment for officer cadets recommended from the lower deck. The ratings joining H.M.S. *King Alfred* presented a fair assessment of the efforts of the Dental Branch to maintain standards of fitness from the initial training establishment and under full war conditions. Whereas in the early stages of the *King Alfred* organisation an average of 65 per cent. of cadet ratings were found to require dental treatment, this percentage fell through the years to an average of 40 per cent., which decline was

in step with the increased facilities at the preliminary training establishments at H.M.S. *Royal Arthur* and others. It must also be borne in mind that the type of rating chosen for C/W status* had a keen personal interest in his general health, and would seek dental treatment when he could. In spite of this, a tremendous amount of conservative work was required, and the dental laboratory was kept busy with denture work.

H.M.S. *King Alfred* was commissioned in 1939. The first officer cadets were taken from the Royal Naval Volunteer Supplementary Reserve, and from those yachtsmen and university graduates who possessed yachtmaster certificates.

Arrangements were at first made for the dental treatment of volunteers to be undertaken by a civilian practitioner in Hove under contract at the prevailing National Health Insurance rate. The increase in numbers of C/W candidates necessitated a larger establishment, and in 1941 Lancing College at Shoreham-on-Sea was requisitioned and a dental officer was appointed. Mowden Road School in Hove was also taken over and used for kitting-up and medical and dental examinations, and in due course two dental surgeries were established. All cadet ratings joined at Mowden, where their dental condition was charted and treatment commenced, and the charts were sent to Lancing with each class for delegation of such treatment as was still required. A second officer was appointed to Lancing, which gave a permanent total complement of four dental officers, two at Lancing and two at Mowden Road; the latter also treated the shore-based personnel in the Brighton defence area.

In 1942 a dental laboratory was established in the old printing room of H.M.S. *King Alfred*, Lancing College, to accommodate three dental mechanics. This laboratory undertook all denture work for the *King Alfred* commitments, and in addition H.M.S. *Marlborough* (Eastbourne), H.M.S. *Vernon* (Roedean School), H.M.S. *Lizard* (the Combined Operations centre in Hove), and H.M.S. *Forward* (Newhaven).

The services of the contract practitioner were dispensed with after the establishment of these dental arrangements with the exception of X-ray facilities, which he continued to provide.

The proximity of these establishments to the coast invited regular 'tip and run' visits from enemy aircraft, and work was very frequently disturbed. There are no records of any casualties among dental personnel from these.

H.M.S. Raleigh

This establishment was built at Torpoint, Cornwall, to meet the requirements of the Part I training of 'hostilities only' personnel. The site had been acquired for Admiralty purposes before the war, and at the outbreak of hostilities the building of a training establishment had

* C/W status. Ratings promoted to Commissioned or Warrant rank.

commenced, although no definite policy had been decided for it. The buildings were of the Army wooden hut pattern, and were sufficiently advanced in September 1939 to enable the commissioning of the establishment on January 9, 1940. The dental department was completed the following April and consisted of seven surgeries, a laboratory, etc. Before this the Senior Dental Surgeon and three officers worked in temporary accommodation. The surgeries (10 ft. × 9 ft.) were somewhat small, and, with an intake of 320 trainees a week for an instructional period of ten weeks, the dental complement appears to have been lower than in the other Part I training establishments. An additional and important commitment was the adjacent Artificers' Training Establishment whose trainees were systematically treated in the dental department of *Raleigh*. A maximum of eight operators was employed at peak, and the shift system in one surgery was applied with unsatisfactory results.

In view of the shortness of the training time, it was only possible to give each man two appointments, except for prosthetic work. The average treatment required was three fillings and one extraction, but after 1942 the proportion of extractions increased as the standard of new entries was lowered. From April until July 1944, H.M.S. *Raleigh* was transferred to the United States Army, during which period four rooms in the dental department were used by officers of the United States Army Dental Corps and their assistants. The equipment of these four surgeries was handed over intact to the United States authorities, and the remainder was removed to a store in a part of the camp which was wired off and remained under R.N. administration. In this portion a small laboratory with one mechanic was installed for the requirements of the United States Forces, and the Artificer Training Establishment in which a surgery had been opened in 1943, and which was unaffected by the change. A temporary surgery was opened in the sick bay outside the camp area for the residual Royal Navy personnel.

The establishment was returned to R.N. care in July 1944, and was used until the end of the war for the training of a variety of categories of rating including upper yardmen, new entry C/W candidates, University Naval Division, and Combined Operations personnel. A complement of a Senior Dental Surgeon and four officers was employed to meet these commitments.

H.M.S. Royal Arthur

At the outbreak of hostilities the Admiralty took over Butlin's holiday camp at Skegness as a Naval Training Centre for new entry 'hostilities only' ratings. The establishment was to be capable of accommodating 4,500 ratings.

A dental department was formed in one of the large buildings, the Princes Hall, and was composed of six small and temporary surgeries, a dental laboratory, waiting room and store room. Four of these

surgeries were separated by partial partitions, and much inconvenience was caused by the passage of patients at the rear of the operators. The dental laboratory had no natural light, and the ventilation was poor.

It was evident that the small dental department was far from satisfactory and inadequate to meet the vast amount of work to be done. The flood of recruits and their bad oral condition necessitated the increase of complement in 1940 to 10 operators. This accentuated the inconvenience of the department, especially as these officers were working on the 'shift system'.

Plans were laid for the construction of a suitable department in a Butlin theatre which was nearing completion, but air attacks intervened, and this project was shelved. In due course, however, further accommodation was obtained in the Princes Hall, and it was possible for each operator to have his own surgery.

It had been intended that *Royal Arthur* should be the sole entry establishment for all 'hostilities only' ratings, but this proved impracticable, and in 1940 H.M.S. *Glendower* was opened in North Wales as an overflow, and subsequently in 1941 another training establishment at Malvern—H.M.S. *Duke*.

At peak H.M.S. *Royal Arthur* carried one surgeon commander (D) as Senior Dental Surgeon and 15 other dental officers. Sick berth staff (D) was provided from male ratings and V.A.Ds. N/M dental, and there were six dental mechanics.

Since this was in fact the parent initial training establishment throughout the war, much interesting experimental work was done in the matter of routines, and a visit was paid by the Senior Dental Surgeons of other establishments to compare difficulties and to tighten up organisation generally. This was an admirable precedent and made for greater efficiency.

H.M.S. St. George

It was the Admiralty policy that the normal entry of boys into continuous service engagements in the Royal Navy should be maintained during war at a rate somewhat similar to the peace-time practice. It was evident that an establishment must be formed which was sufficiently isolated from enemy air attack, where full training and recreational activities could carry on without interference. A suitable place was found in the Isle of Man.

The three seamen boys' training establishments at the outbreak of war were situated in H.M.S. *Caledonia* at Rosyth (the ex-Cunard White Star Liner *Majestic*), H.M.S. *St. Vincent* at Gosport, and H.M.S. *Ganges* in Suffolk. It was realised that the two former would be subjected to early enemy action, and the boys were removed with all despatch to the Isle of Man, where H.M.S. *St. George* was commissioned in September 1939.

This establishment was divided into two camps:

(*a*) Howstrake Camp, two miles outside Douglas.

(*b*) Cunningham Camp, in upper Douglas.

Howstrake Camp was used as a new entry camp, in which boys joining H.M.S. *St. George* underwent the preliminary part of their course, which lasted six weeks. Boys arrived in batches of 180 every three weeks, and their dental conditions on entry were charted on Forms M. 227. The dental routine during these weeks was directed towards the removal of all unserviceable teeth, so that when the boys joined Cunningham Camp for their further training the conservative treatment could proceed without interruption.

Cunningham Camp comprised two camps, an upper and a lower, which at first absorbed boys from *St. Vincent* and *Caledonia* respectively. The subsequent closing of H.M.S. *Ganges* as a boys' training establishment necessitated further accommodation in H.M.S. *St. George*, and this complicated the dental routine in that some boys arrived partially trained who had already undergone preliminary treatment. To meet this new commitment another camp was opened in the Majestic Hotel in Douglas, named Majestic Camp. When the situation resolved, the new-entry boys were absorbed into Cunningham Camp, and Howstrake was formed into a training establishment for boys and personnel of the R.N. School of Music. Boy entries were, by 1942, reduced to batches of 180, six times per year. Overflow accommodation for school and training purposes was established in the Ballakermeen School, and a dental surgery was built into this for the sake of convenience, and on the condition that the Manx Education Authority would take it over after the war, which proposal was subsequently implemented.

The complexity of this organisation, and the absolute necessity for careful charting and full conservative treatment of young personnel, led to very considerable problems in the matter of dental department administration.

Another establishment, H.M.S. *Valkyrie*, was opened in the Isle of Man to deal with the Part II training of certain communication ratings. The Senior Dental Surgeon of H.M.S. *St. George* was eventually appointed as Senior Dental Surgeon, Isle of Man, in order that dental facilities on the island could be deployed to the maximum benefit of all concerned. The Senior Dental Surgeon had four dental officers in H.M.S. *St. George* and two in H.M.S. *Valkyrie*. Denture work was processed in the Laboratory of the R.N. Dental Centre, Liverpool.

DENTAL CONDITION OF RECRUITS

The following statistics of recruits into the Royal Navy are representative of the prevailing conditions in the two age groups 19 to 25, and 25 to 33, and give a fair and comprehensive assessment of the commitments to be met in these training establishments. In the older

age groups it is recorded that 35 per cent. of personnel were in possession of full upper and lower dentures, many of which were of no practical use and required renewal.

These figures were taken from a representative group of 5,000 recruits, and the statistical findings per 1,000 were as follows:

AGE GROUPS 19 TO 25 YEARS

Number of recruits dentally fit on entry	55 per 1000	
Average per 1,000 *recruits*		
Number of sound teeth	23,580	(including credit for unerupted third molars).
Number of saveable teeth	2,937	
Number of unsaveable teeth	1,700	
Dentures worn by 1,000 *recruits*		
Number of recruits wearing dentures	51	
Total number of full dentures worn	27	Total 64
Total number of partial dentures worn	37	
Dentures required per 1,000 *recruits*		
Number of recruits requiring dentures	50	
Total number of full dentures required	11	Total 58
Total number of partial dentures required	47	
Standard of oral hygiene per 1,000 *recruits.* (*General cleanliness only, irrespective of treatment required.*)		
Good	240	
Fair	599	
Bad (gross oral sepsis)	161	
Dental treatment undergone prior to entry, per 1,000 *recruits*		
Regular dental treatment	47	
Occasional dental treatment	150	
No conservative treatment	803	

AGE GROUPS 25 TO 33 YEARS

Number of recruits dentally fit on entry	111 per 1,000	
Average per 1,000 *recruits*		
Number of sound teeth	18,380	
Number of saveable teeth	2,370	
Number of unsaveable teeth	1,718	
Number of missing teeth	9,532	
Dentures worn per 1,000 *recruits*		
Total number of full dentures worn	239	Total 344
Total number of partial dentures worn	105	
Dentures required per 1,000 *recruits*		
Number of recruits requiring dentures	230	
Total number of full dentures required	68	Total 310
Total number of partial dentures required	242	

(It may be noted here that of the recruits wearing dentures on entry, 26 per 1,000 required additional denture work.)

Standards of oral hygiene per 1,000 *recruits.* (*General cleanliness only, irrespective of treatment required*).

Good	242
Fair	522
Bad (oral sepsis)	236

Dental treatment undergone before entry, per 1,000 *recruits*

Regular dental treatment	82
Occasional dental treatment	133
No conservative treatment	785

It will be observed that, with the exception of establishments built specifically for the purpose, dental departments were placed in converted civilian, school, or private accommodation. In many cases the main dental departments would have one or more satellites, in order that treatment might be most conveniently deployed. Whereas this system would cause administrative inconvenience for the Senior Dental Surgeon in that he would have to divide his attention between each department, the upkeep of dental records, issue of stores, and laboratory work, etc., would also cause complications. It will be noted, however, that in these establishments the over-riding factor of importance was the saving of instructional time of personnel during their very full syllabus of training.

The flood of recruits and the policy of achieving the maximum treatment during the few crowded weeks of training, necessitated continual supervision by the Senior Dental Surgeon and a close and happy liaison with the other departments in the establishment. Dental personnel had to work long hours at the chair-side and the very character of the work was intensive, stereotyped and irksome. It was therefore essential to ensure that dental personnel would receive adequate leave and recreation from their duties, and appointments to these billets were seldom of more than eighteen months' duration.

It was necessary to bring dental treatment to a cross-section of the population who were previously ignorant of the value of dental health and hygiene, and who were, in about 50 per cent. of cases, uninitiated in dentistry of any description. In view of the numbers and the poor dental condition of the majority, treatment was apportioned on the policy of the greatest good for the greatest number.

Early opportunities were taken to instruct trainees in dental hygiene by lectures, films and careful chair-side explanations. One or two establishments introduced the system of admission to hospital for dental treatment, whereby one officer would carry out oral surgery, another conservations, and so on. This was never an acknowledged success owing to the importance of the personal factor, for even the most ignorant patient would demand his 'own dentist'. Experiments

were made in the apportioning of, for example, denture work to the duty dental officer, so that a different officer carried out each stage of the prosthesis. This also proved a failure.

The dental condition of recruits presented a vast problem to the dental services as a whole, since it was found that an entry rate of 100 recruits per week required a minimum staff of five dental officers, or one to 20. The attainment of a high standard of dental fitness would appear neither to be practicable nor, in fact, from the point of view of economy of dental man-power, to be desired, but the rudiments of dental health which were taught were of infinite value to the patient in the future.

DENTAL ARRANGEMENTS IN THE NAVAL COMMANDS

The responsibilities of the Dental Branch in war have been described, and the degree to which they can be accepted. Whereas it was not found possible to give complete treatment to each individual, it was proved that the maximum good could be effected for the majority by careful organisation and responsible supervision. In war the fullest effort is expected from everyone in the Fighting Services, and it was therefore necessary that 'round the clock' dental facilities should be available in all busy establishments.

In several commands a minimum number of hours per week for sedentary workers was laid down by Commanders-in-Chief (53 hours over 7 days) in order that economy might be achieved in shore-based man-power. In each case this was not made to apply to dental departments, since the irksome and specialised type of work mitigated against such set rulings. This did not mean, however, that the dental department would work always and strictly to surgery hours, but that the dental officer should make himself available at all hours of the day and night to meet any urgent case. In isolated stations he made his movements clear to the appropriate authority, in order that his services could be obtained at short notice when required. In war, such small units as escort forces would frequently call into port for a few hours to refuel or for some minor adjustment, and a toothache or acute oral lesion could be treated where an efficient dental organisation appeared in the Port Orders.

It was often difficult for a dental surgeon, who had conducted his private practice for many years by strict appointments, to adapt himself to the elastic working hours dictated by Service requirements. This matter, however, was absolutely essential, and no orders or routines for dental departments could ever be made without full consultation and co-operation with the executive authorities concerned, and the concurrence and sanction of the local Senior Naval Officer.

In order to supply full 'round the clock' dental services a 'dental guard' was maintained at all the principal manning ports and training

establishments. This was a matter of considerable importance, particularly at the main drafting depots, since the services of a dental officer were always required to examine the dental condition of incoming and outgoing drafts, and frequently these would pass through at late hours of the night. The Command or Senior Dental Surgeon would nominate a list of officers to carry out these duties, and this list would be displayed at the regulating office, sick bay, or other responsible authority in order that the officer could be traced with a minimum of delay. In the large Commands, outside establishments carrying dental facilities would lend their dental officers for these duties, and they would be accommodated for the night in the duty dental officer's cabin in the main depot.

For the first few years of the war there was an acute shortage of dental equipment and accommodation, and the supply of newly recruited dental officers exceeded the billets available for them. It was necessary therefore to appoint dental officers to the larger depots and training establishments, where the tremendous influx of dentally unfit personnel necessitated their services. Officers would be put to work sharing a surgery and equipment on a shift system, whereby the same compartment and equipment would be used by two or even three operators each day.

The routines employed in dental departments were affected by the operational, drafting or training nature of the commitment. Normally establishment or instructional hours were worked, but certain classes of patients would be treated during the dog-watches or at specified times.

In the Tropics it was normal to work tropical routine, whereby an early forenoon would be worked, and the afternoon's work would be carried out in the dog-watches. Such routines would commence at 0800 hours daily.

The following routines were found the most efficient for the several establishments named:

A. New Entry Training Establishments

A high degree of efficiency was required in these training establishments to meet the weekly influx of approximately 500 new entries, the large majority of whom had never received dental treatment before. All ratings were examined by the Senior Dental Surgeon, who would categorise the patients as 'immediate', 'not immediate' and 'no treatment required'. Each dental officer would be allocated a class list and the category would be marked against the name. 'Immediate' patients would be given priority.

The Senior Dental Surgeon would keep a copy of each class list, and it was the duty of each officer to erase the patients' names from his own class list and that of the Senior Dental Surgeon when treatments were completed. The Senior Dental Surgeon would then know when

to bring forward another class for treatment. Changes of class had to be carefully noted on each list.

Patients would attend for treatment on an average of three per hour from 0900 until 1500 hours. Where the shift system was employed they would be appointed at 0800, 0900, 1030, 1130, 1400, 1500 and 1700 hours.

A duty dental officer was appointed, and he would deal with all fresh volunteer and urgent cases during and after working hours.

Since the period of training was only of ten weeks' duration, and the patients would only be available for the first seven weeks, much intensive work had to be done early in the training to remove septic teeth, so that at least a temporary denture might be fitted before the patient went to sea. A separate list was kept by the Senior Dental Surgeon of men requiring dentures, in order that they would not be drafted to sea in an edentulous condition.

B. Royal Naval Barracks

The routine of the dental department of a Royal Naval Barracks during war was complicated by the presence of incoming and outgoing drafts, large male and female ship's companies, and new entry and other trainees all mixed together and divided among several mushroom establishments around the port. It was a common occurrence for a rating to be drafted through the Naval Barracks and one or another camp two or three times during twenty-four hours, and he received a dental examination on each occasion.

These examinations, however, were essential in order to keep a check on men suffering from a gross oral lesion, and the Senior Dental Surgeon was empowered to stop a draft where remedial treatment was essential to the man's health and fighting efficiency. Such 'stop drafts' were noted in the man's pay book and on his barracks station card, and the responsible drafting authority was informed at once, with an appreciation of the length of time of treatment and when the treatment was completed and the man dentally fit for draft.

Where new entries were concerned, similar routines to that of the main training establishments were employed, and fresh and volunteer cases were delegated each day to surgeries by the duty examining dental officer, who was usually the Senior Dental Surgeon.

C. Other Establishments

In all establishments, at home and abroad, details of the dental facilities were included in the local port, fleet, flotilla or other standing orders. These stated clearly the type of personnel who should attend the dental surgery for treatment and an exact description of the whereabouts of the department with its telephone number. Details were given of the hours of work of the department, and the method to be employed

to obtain appointments (whether by signal, telephone or boat message). Routine for obtaining urgent attention for pain cases out of working hours was made quite clear.

In all anchorages, fleets and establishments it was the duty of the Senior Dental Officer present to advise the Senior Naval Officer on the best allocation of personnel for treatment, and to assume this responsibility whenever the Staff Dental Officer was absent.

In a Command or Fleet the proper distribution of dental arrangements depends upon the activities of the Command, Fleet or Staff Dental Surgeon, and the foundation of this is his close liaison with his Staff colleagues, and his Chief of Staff or Captain of the Fleet in particular. Such is the cornerstone of Dental Branch policy, and it is the duty of the Senior Dental Surgeon in any port, establishment or fleet anchorage to identify himself with the Senior Naval Officer present, in order that a proper routine may be laid down for that particular commitment.

At home it was a relatively straightforward matter for the Command, Fleet or Staff Dental Surgeon to supervise dental affairs within the sphere of his authority, and only occasionally did Commands overlap. This was most evident in the case of the Air Command, which administered all establishments of the Fleet Air Arm irrespective of their situation territorially within the sphere of influence of another Command. The Staff Dental Surgeon, whether Fleet or Command, had infinite difficulty in keeping track of his widespread commitments, especially since dental officers were appointed to specific billets by the Admiralty. It very frequently happened that, by the time of their arrival on the station, these billets had sailed away to other oceans or fleets, or, due to the vicissitudes of a campaign, were no longer in existence. Dental officers would thus travel from one transit camp to another endeavouring to find their place of duty, with a consequent wastage of their services, and in full view of Senior and Staff Dental Surgeons who were eager for extra personnel but unable to make use of them even temporarily. Similar difficulties were evident with drafting of sick berth staff (D/M) and (D), and it was not until the later stages of the war that dental personnel were appointed to 'pools' under the jurisdiction of the Command Dental Surgeon whereby their services could be utilised to the maximum benefit of all concerned.

It may be noted that only in very exceptional cases did a Fleet exist as a purely sea-going command. The duties of a Commander-in-Chief almost invariably embraced land and sea commitments. Each Command delegated local responsibility to Sub-Commands, which in turn were administered by Flag Officers or Naval Officers-in-Charge. Where the dental commitments were of particular importance in a Sub-Command, a Staff Dental Surgeon was appointed on the staff of the Flag Officer concerned.

HOME COMMANDS

The different Home Commands were:
Portsmouth, Nore and Plymouth,
Rosyth,
Orkneys and Shetlands,
Western Approaches,
Air,
Home Fleet.

PORTSMOUTH COMMAND

This Command embraced the coastline between Portland and Rye. Major dental lesions were treated in the Royal Naval Hospitals at Haslar, Portland and Sherborne.

NORE COMMAND

The Nore Command covered the coastline from Rye as far as Hull. Major dental lesions were treated in the Royal Naval Hospital at Chatham and the R.N. Sick Quarters at Shotley.

PLYMOUTH COMMAND

The Plymouth Command stretched from Lyme Regis around Land's End to Bristol and Milford Haven, and the responsibility of the South Coast of Wales was taken over at one time by the Western Approaches Command. Major dental lesions were treated in the Royal Naval Hospitals at Plymouth and Barrow Gurney.

ROYAL NAVAL BARRACKS

Common to each of these Commands, and indeed the centre of many of their principle activities, were the three Royal Naval Barracks. These were situated at Portsmouth, Chatham and Devonport respectively, and they provided the main drafting and regulating organisation for naval personnel in these Commands. In addition to these main commitments the Barracks, and their many 'mushroom' establishments, were responsible for the training and accommodation of large numbers of different types of male and female naval personnel and, in particular, housed and distributed the drafting pools of the large numbers of 'hostilities only' trainees from the training establishments.

In order to maintain a check on the dental condition of personnel passing through the Barracks, a strict and efficient dental examination routine was organised, and major oral lesions were diagnosed and treated. The three barracks were subjected at various times to enemy action, but in spite of this it was possible to keep the main dental departments and offices within the original barracks premises, although it was necessary to requisition many buildings within a few miles of the barracks to house certain training and transient personnel.

A Command Dental Surgeon was carried in each barracks, and in addition to his direct administrative responsibilities to the Commander-in-Chief he was also the Senior Dental Surgeon of the R.N. Barracks. He supervised the large dental departments and laboratories of the Barracks, and usually delegated these responsibilities to his two assistant officers of the rank of surgeon commanders (D) who became known as the Deputy Senior Dental Surgeon, and Officer-in-Charge of Dental Laboratory respectively.

The Deputy Senior Dental Surgeon was responsible for the examination of incoming and outgoing drafts, and for the apportioning of treatment throughout the Dental Department. He could decide on the necessity for the stopping of the draft of any patient due to a serious dental defect, and arrange the dental guard within the port. He also assisted with the training of new entry dental officers and sick berth staff (D).

The Officer-in-Charge of the dental laboratory supervised the dental mechanics, and would arrange the training of newly entered 'improvers'. He personally inspected all the denture work, and would usually have a dental surgeon at his disposal for the treatment of difficult or urgent prosthetic cases.

The warrant wardmaster was borne for general duties with the Command Dental Surgeon, and acted as the regulating and disciplinary authority for the sick berth staff (D) and dental mechanics. He relieved the Senior Dental Surgeons of many Service commitments in liaison with the other departments and establishments within the Royal Naval Barracks.

From the point of view of dental personnel, the busy dental departments had to meet the upsets of continual drafting movements of dental officers and sick berth staff (D). The accurate maintenance of records and follow-up of patients caused much extra work, and this was complicated by the shortage of suitable clerical staff. There were frequently more operators than could be supplied with dental surgeries and equipment, and it was necessary to resort to the shift-system routine. The Command Dental Surgeon was always able, however, to effect local drafting of personnel around the establishments commanded by the Commodore, whereas outside these limits Admiralty appointments had to be made.

The continued threat of air-raid attack upon the three main depots materially affected the work of the dental departments, and during air raids dental officers and attendants were appointed to first-aid parties. The dental department of the Royal Naval Barracks, Portsmouth, was completely destroyed by air attack on the night of April 17-18, 1941.

The dental department, situated on the floor above the petty officers' mess and in a temporary structure on the roof of the block, included eleven fully equipped dental surgeries, offices, store and the dental

mechanic's laboratory where the construction and repairs, etc., of dentures for personnel of the Portsmouth Division were undertaken. The department was completely wrecked and the contents of eight surgeries and most of the stores were buried in the wreckage. The three remaining surgeries were seriously damaged. One S.B.A. (D) was missing, presumed killed, and another was injured.

The destruction of this dental centre temporarily put out of action all facilities for the dental treatment of depot personnel, including recruits under training. A considerable portion of the expensive electrical equipment, furniture and stores was lost or damaged beyond repair, and its replacement under existing conditions was most difficult. The main portions of the laboratory equipment and stores were saved and sorted out for use elsewhere. The majority of records were lost or destroyed.

The destruction of this centre and its general effect on the dental organisation emphasised the desirability of providing more liberal facilities at centres less exposed to enemy action, and also in H.M. Ships. It also suggested the inadvisability of concentrating the dental arrangements of any large establishment in one building, the destruction of which must result in the loss of expensive and valuable equipment.

ROSYTH COMMAND

The responsibilities of the Rosyth Command grew from that of Flag Officer Commanding the Coast of Scotland, with his headquarters at Rosyth, to that of a vast area stretching from Cape Wrath on a line more or less midway through Scotland, down the Pennine Chain, and along the River Humber to Hull. Sub-divisions of the long coastline were commanded by Naval Officers-in-Charge at Thurso, Invergordon, Aberdeen, Montrose, Methil, Leith, Granton, Blyth, Sunderland and the Tees, and Flag Officers-in-Charge in the Tyne area.

The dental facilities grew from the small dental department in Rosyth Dockyard, which had been formed when the artificers training establishment, H.M.S. *Caledonia*, was removed from the dockyard area. The first dental department was built in the guard house of this establishment. The importance of the Rosyth dockyard as a refitting centre, and of the many small ports along the coast, was very soon realised in the considerable increase in naval personnel, and dental arrangements with both surgery and laboratory facilities had to be provided. The duties of the Senior Dental Officer at Rosyth were developed into those of a Senior Dental Surgeon, Rosyth and Coast of Scotland, and later he was appointed with the full responsibility of a Command Dental Surgeon on the staff of the Commander-in-Chief, Rosyth. A large and efficient laboratory was built in Rosyth, and denture work for the Command was dealt with there.

Apart from the considerable refitting potential of the Dockyard at Rosyth, this Command was responsible for a very large number of small craft which kept the sea lanes open from the North of Scotland to the South of England. From time to time the responsibilities of the Commander-in-Chief, Rosyth, were exchanged with those of the Commander-in-Chief, Western Approaches. There were Royal Naval Hospitals at Kingseat and Port Edgar for the reception of major dental lesions, and maxillo-facial injuries were received at the Emergency Medical Services Hospital at Bangour.

ORKNEYS AND SHETLANDS

In the first three years of the war the large anchorages at Scapa Flow provided the main base for the Home Fleet under its Commander-in-Chief, and dental facilities were provided to meet requirements of ships not carrying dental facilities. The Senior Dental Surgeon of H.M.S. *Proserpine* was appointed to the staff of the Admiral Commanding Orkneys and Shetlands and had a large dental department and laboratory at Lyness. Dental officers were distributed around the Islands for duties with ships and the different Air Stations, and dental officers under this Command were carried afloat in the Depot Ship *Dunluce Castle* (also a laboratory) and H.M.S. *Iron Duke*.

WESTERN APPROACHES

Apart from a number of training establishments, the Western Approaches covered the numerous and intricate establishments connected with the Battle of the Atlantic, the protection of convoy rendezvous, and the training of submarine and anti-submarine personnel. Furthermore, the many sea lochs of Scotland and the deserted shores and mountainsides of Wales provided excellent training grounds for combined operations personnel. The Command was sub-divided into Flag Officers' Commands at Greenock, Glasgow, Northern Ireland, Belfast, Liverpool, Milford Haven and Cardiff, and Naval Officers-in-Charge at Aultbea, Stornoway, Oban, Campbeltown, Ardrossan, Londonderry, Larne, Stranraer, Barrow, Isle of Man, Holyhead, Swansea and Avonmouth.

The Command Dental Surgeon was borne in the headquarters of the Commander-in-Chief in Derby House, Liverpool, and his dental departments stretched from Aultbea in the North of Scotland to the South of Wales. Large training establishments such as H.M.S. *St. George*, H.M.S. *Glendower* and H.M.S. *Scotia*, were in the Command, and various laboratory facilities were provided. The Command Dental Surgeon also had a small dental centre in Derby House with a dental laboratory to meet requirements of the many dental departments in the Mersey area and the Royal Naval College at Eaton Hall, Chester. To keep in touch with these commitments the Command Dental Surgeon

had to travel many hundreds of miles by land, sea and air. There was a Royal Naval Hospital at Rainhill and Woolton in Liverpool, and at Kilmacolm in Scotland. There were two smaller specialist hospital units at Cholmondeley Castle and Southport which also required dental facilities.

AIR COMMAND

The Air Command commenced the war as the youngest and smallest of the other Home Commands, and grew as the years passed by into the largest and busiest of them all. This involved the rapid training of many types of air crew and maintenance personnel, and training stations and new entry establishments sprang up all over the country from the Orkneys and Shetlands to the West of England. These organisations were commanded solely by the Flag Officer Air, at Lee-on-Solent, and were independent of the Command in which they were placed. He had a Staff Dental Surgeon on his staff, who was also borne as the Senior Dental Surgeon (dental department and laboratory) of the Royal Naval Barracks, at Lee-on-Solent. After the war this appointment was raised to the position of Command Dental Surgeon.

HOME FLEET

At the outbreak of the war the Commander-in-Chief, Home Fleet, had a Fleet Dental Officer on his staff within the Flagship and it was his duty to arrange dental treatment among the large number of ships at Scapa Flow. There were no laboratory facilities afloat in the Fleet, and all denture work was attended to by the Senior Dental Surgeon in H.M.S. *Dunluce Castle*, which was later supplemented by *Proserpine*.

COMMANDS ABROAD

The very considerable development of naval land and sea forces abroad raised new problems in the administration of dental facilities which were not at first visualised. During the last two years of the war more than half of the personnel of the Dental Branch were oversea. At home the different Senior Dental Surgeons had ready access to their Staff or Command Dental Surgeons, or even by telephone to the Admiralty, for the solution of problems and interchange of personnel. Abroad the situation was quite different, and, until the Command and Fleet Dental Surgeons became a *sine qua non* of each operational staff, the dental officer had to fend for himself as best he could.

In compiling suitable material for this History, it is unfortunate that the description of many important establishments must be omitted in order not to confuse the essential picture of the development and organisation of dental facilities and Dental Branch policy. There were indeed many small dental departments abroad which provided the mainstay of dental treatment in a fleet or campaign, whether by virtue

of their location, or the technical or surgical skill of their personnel, or in the possession of a dental laboratory. Careful staff work on the spot and choice of personnel frequently effected the maximum of efficiency in these organisations, and the contribution of any one such as these was as important to the war effort as a major command organisation.

It is difficult to present the full story of a Command without entering into great detail, since so many changes took place in the territorial responsibilities of Commanders-in-Chief in the unfolding of operational strategic campaigns.

MEDITERRANEAN PRE-1939

In pre-war years the Royal Navy maintained a large Fleet in the Mediterranean, which was composed of battleship and cruiser squadrons and all types of naval vessels including destroyers and submarines. With the exception of the dental department and laboratory at the Royal Naval Hospital, Bighi, Malta, dental treatment was given by dental officers afloat. These were distributed on the ratio of one dental officer to a battleship or cruiser squadron, one (eventually) to the aircraft carrier squadron, and the needs of smaller craft were met by a dental officer in the destroyer repair-ship and submarine depot ship (H.M.S. *Resource* and H.M.S. *Cyclops* respectively). The Abyssinian crisis of 1935 caused a large concentration of the Mediterranean Fleet in Alexandria Harbour with considerable reinforcements from the Home Fleet. Here it may be said that for the first time the urgency for proper dental facilities in a Fleet afloat was recognised. A handful of dental officers had to meet the requirements of a huge battle fleet, and the one dental mechanic at Bighi was expected to cope with a rush of denture work from a distance of a thousand miles. Only urgent dental treatment could be effected, and this, by order of the Commander-in-Chief, was confined to ratings. There was no Staff Dental Surgeon appointed to the staff of the Commander-in-Chief, and there was no dental department in the Flag Ship (H.M.S. *Queen Elizabeth*). In the Mediterranean generally, the Senior Dental Surgeon at Bighi automatically became the 'mentor' of the dental officers afloat, but he was powerless to interfere in squadron or ship matters.

MEDITERRANEAN 1939–43

This haphazard state of affairs existed until early in 1939, when a Fleet Dental Officer was appointed to the staff of the Commander-in-Chief, Mediterranean. He was not borne in the Flag Ship, but was appointed to H.M.S. *Sussex* for ship's duties, and on the outbreak of war this vessel was detached through the Suez Canal into the Indian Ocean, taking with her the Fleet Dental Officer. Since *Sussex* operated for some months in these waters, he was therefore lost to the Mediterranean, and in fact he himself never had a chance to return.

As soon as the threat of Italian intervention became apparent, the Commander-in-Chief, flying his flag in H.M.S. *Warspite*, concentrated a large fleet of fighting and auxiliary ships in Alexandria. The story of Malta is too well known to be repeated here, but the dental officer at Bighi was left with another dental officer and his mechanic to look after affairs as best he could during the siege. To treat the large collection of ships at Alexandria under full battle conditions, and under repeated air attacks, there were six dental officers (H.M.H.S. *Maine*, H.M. Ships *Malaya*, *Valiant*, *Illustrious*, *Medway*, *Woolwich*). There was no Staff Dental Officer or dental laboratory. Approach was made to the officers of the Army Dental Corps at 64 General Hospital, and to the Royal Air Force Station at Aboukir, as a result of which assistance was given with laboratory work.

The dental officer of the Hospital Ship *Maine* became styled 'Fleet Dental Officer' (in the rank of surgeon lieutenant commander (D)), and eventually, in 1941, a Fleet Dental Officer, of commander's rank, was appointed to the staff of the Commander-in-Chief. The newly appointed Fleet Dental Officer arrived, but there was no accommodation for him in the flagship, and he was lodged instead in the Ras-el-Tin Naval Headquarters.

As the situation in the Western Desert was resolved, and as the strategic importance of the Eastern Mediterranean lapsed, so the dental facilities grew and improved, and an efficient dental department was eventually established in Alexandria, and in the Nile Delta and Palestine. A mobile dental unit functioned around the Canal Area.

The concentration of naval forces, however, was moved slowly westwards, and the Commander-in-Chief moved his headquarters to Algiers, which had now fallen, and massed his seaborne forces for the attack on Sicily and Italy. The Fleet Dental Surgeon remained at Alexandria and became the Staff Dental Surgeon to the Admiral Commanding the Levant and Eastern Mediterranean, and in addition to Alexandria, he placed dental officers at Beirut, Haifa, Port Said and Kabret.

MEDITERRANEAN 1943–45

Although a few dental officers were appointed to Algiers and the North African ports to render treatment to the forces in occupation, there was now once again no Fleet Dental Officer on the staff of the Commander-in-Chief, Mediterranean. Eventually, in March 1944, a Fleet Dental Surgeon was so appointed, and he arrived in Algiers after Sicily had been occupied and the invasion of Italy had begun. At this time dental treatment was urgently required in the ports of Sicily and Italy in the wake of our advancing armies.

One of the major problems of this campaign was the difficulty of moving dental officers into newly occupied ports without denuding other ports of all their dental facilities. As the new ports opened others

already occupied reduced their numbers but did not close, so that commitments stretched further and further.

During these months the Fleet Dental Surgeon maintained a close and happy liaison with the D.D.D.S. of the Army Dental Corps, and mutual arrangements were made to the convenience of all concerned.

The liberal use of the trailer type mobile dental unit became a feature of the dental policy in this campaign. One of these started in North Africa, and travelled through the full length of Italy as far as Venice. The Fleet Dental Surgeon would supervise the movements of the mobile unit and, since he was stationed at headquarters, he was able to make sure that his dental officers were in the advance parties which entered every port, and the best available accommodation was obtained.

On July 31, 1944, the Commander-in-Chief's Staff transferred to Allied Force Headquarters at Caserta, Italy. This movement of the staff was carried out as an operation, and the heavy gear was sent ahead in L.C.Ts. The staff finished their work in Algiers one evening, flew the next day in a fleet of Dakotas to Naples, and were ready to start work the following morning. At this time the Fleet Dental Surgeon was given the acting rank of surgeon captain (D).

In the meantime the build-up for the Far Eastern campaign was bringing much traffic through Gibraltar and the Mediterranean, which necessitated an increase of dental facilities on the Rock.

At peak the number of dental personnel in the Mediterranean was:

An Acting Surgeon captain (D).	1
Surgeon commanders (D)	4
Surgeon lieut. commanders (D) R.N.	4
Surgeon lieut. cdrs. (D) R.N.V.R.	34
Surgeon lieutenants (D) R.N.V.R.	34
Dental mechanics	14
Dental attendants S.B.P.O. (D), L.S.B.A. (D) and S.B.A. (D)	55

WEST AFRICA

The principal factor in the provision of dental facilities at Freetown was the lack of suitable accommodation on shore. Dental officers were carried in the Royal Naval Barracks, King Tom (H.M.S. *Eland*) and afloat in the Depot Ship H.M.S. *Edinburgh Castle* (with dental laboratory), in H.M.S. *Vindictive* and H.M.S. *Philoctetes*; H.M. Hospital Ship *Tjitjalengka* was also available for some time.

In H.M.S. *Eland* a portion of a hut was allocated for dental equipment and the ceiling fans were at the other end of the hut. Shortly afterwards a further dental officer was added to the complement, and more facilities were provided. The Senior Dental Surgeon in H.M.S. *Edinburgh Castle* was appointed as Port Dental Officer.

The dental officers eventually moved into the accommodation vacated by the Americans at Kissi Barracks, and here they were concentrated with a complement of one surgeon commander (D) and three dental officers with a laboratory. This establishment also provided an officer on loan to treat naval personnel at Takoradi and Lagos, and there were reciprocal arrangements between the Army and Royal Air Force in these districts.

EAST AFRICA

Conditions of work and the dental organisation in Kilindini were very similar to those prevailing in Freetown. The dental officers were accommodated ashore in a department constructed of rattan huts in H.M.S. *Tana*, the local barracks, and there was a dental laboratory. Visiting ships, and reciprocal arrangements between dental officers of the Army and Royal Air Force and the South African Union Defence Force also helped with the general treatment.

SOUTH AFRICA

Dental facilities for the treatment of British naval personnel in South Africa had existed previously only at the Royal Naval Hospital, Simonstown. In other ports treatment was given by the dental officers of the South African Union Defence Force. Further facilities eventually became necessary in H.M.S. *Assegai*, a training establishment for 20,000 naval and marine personnel, nine miles from Durban.

The Staff Dental Surgeon to the Rear Admiral Training Establishments was sent with instructions to design and build a dental clinic to house a complement of two administrative dental officers, fifteen dental officers of junior rank for essentially chair-side duties, and a laboratory for eight dental mechanics. Plans were laid in consultation with officers of the Union Defence Force and civilian dental practitioners, in order that the best arrangements should be made to combat the extremes of climate which are indigenous to that part of South Africa.

In the meantime, the nucleus of personnel to man this establishment were arriving from home and lived in transit camps, where the first two naval dental officers were employed in surgeries lent by the Union Defence Force, both in Pietermaritzburg and Durban. A dental officer was appointed also to H.M.S. *Gnu* in Capetown, and occupied a surgery lent by a private practitioner there.

The contract for the camp construction was in the hands of the Lewis Construction Company of Australia, and a most helpful Superintending Civil Engineer and his department in Durban was in charge of the project. The Staff Dental Surgeon, therefore, had a completely free hand in design of buildings and fittings, and it was possible to incorporate into them many essential dental requirements which were unobtainable due to economy and shortage at home. It says much for

the Superintending Civil Engineer and the contractors concerned, that these buildings were fitted out and ready for the dental equipment within three months of the plans being made.

The dental department and dental laboratory were laid out in two separate adjoining buildings, in such a way that the direct sun never penetrated the surgeries of the operators, and the prevailing winds were caught and adequate ventilation brought to the laboratory.

The dental department was designed around a central rating's waiting verandah which communicated with the large administrative office and officer's waiting room, and the Senior Dental Officer's office was near at hand. There were separate compartments for sick berth staff (D), dental officer's retiring room, stores and wash places, X-ray and dark rooms, and a feature was the draft and examining room which, situated at one end of the building, kept the incoming and outgoing draft personnel separate from the routine waiting patients.

Whereas the surgeries were situated on the south side of the building, the offices were on the north, and the waiting verandah divided the accommodation used for ratings and store rooms, etc., from those occupied with administration and officers.

The dental laboratory was carefully designed to allow of maximum light and breeze; convenient fittings for all types of laboratory administration and work were designed. The dental officer in charge of the laboratory had his own dental surgery for essentially prosthetic work, which could be lent to a visiting dental surgeon from a ship to effect his denture work in the minimum of time with all facilities at hand.

Simultaneously, dental arrangements had to be made in Durban itself (H.M.S. *Kongoni*), to meet the very considerable requirements of visiting ships. Premises previously owned by a civilian dental surgeon were commandeered and a department of two surgeries was opened.

Throughout these months a close liaison existed with the dental officers of the Union Defence Force, who were at all times most helpful and co-operative. They allowed our officers to attend courses in maxillo-facial injuries at their hospitals at Brenthurst, Johannesburg, which proved a happy and instructive tour of duty for each available dental officer.

With the victory in the Mediterranean, Durban slowly lost its importance. H.M.S. *Assegai*, however, was comparable in size and scope to a Home Manning Depot for some twelve months after its commissioning, and during this period nine more dental officers and three dental mechanics were borne. The Senior Dental Surgeon was appointed to the Staff of the Commander-in-Chief, South Atlantic, and was responsible to him for the supervision of the various dental departments on the station.

By 1945 the following establishments in South Africa carried dental officers:

H.M.S. *Assegai*, Durban	9
H.M.S. *Kongoni*	2
R.N.A.H. Durban	1
H.M.S. *Gnu*	1
R.N.A.S. *Wingfield*, Cape Province	1
R.N. Hospital, Simonstown	1

UNITED STATES, RUSSIA AND EUROPE

The considerable refitting and building programme undertaken for the Royal Navy by the United States Naval Yards caused a number of naval personnel to be stationed in barracks lent for this purpose by the Americans. At first their dental treatment was effected by the United States Dental Corps, helped by naval dental officers, when available, who were borne in ships refitting in the Yards. In April 1942, however, the burden on the United States authorities became too great, and it was found necessary to establish a dental department ashore in New York, and the dental officer of H.M.S. *Glasgow* was moved into the base ship H.M.S. *Saker*, where he was given a surgery in the U.S. Receiving Barracks, Brooklyn. H.M.S. *Saker* was the depot ship for all British naval shore establishments.

Commitments grew as the lend-lease arrangements increased, and R.N. personnel were distributed in widely separated localities in Baltimore, Boston, Charleston, Norfolk, Philadelphia, Saker (New York and Peekskill) and Washington. On the western seaboard, arrangements had to be provided in San Francisco and Seattle. In certain of these places work was carried out by private practitioners or by the United States Public Health Department through the lend-lease agreement. At Brooklyn there was a dental department of four dental officers.

In 1943 it was found necessary to establish a transit camp and barracks for the increasing numbers of personnel, in particular T. 124 ratings and personnel from the Mersey and Scottish fishing ports, who had received very little treatment on call-up, and who were sent to man the large number of escort vessels under construction in the U.S. Naval Yards. This establishment (commissioned H.M.S. *Asbury*) was placed in a seaside resort called Asbury Park on the coast of New Jersey State, about 60 miles south of New York City. It consisted of two large hotels in adjacent blocks, 'The Berkely Carteret' and the 'Monterey'. A dental department of one surgeon commander (D) as Senior Dental Surgeon, with four dental officers and a laboratory of three dental technicians was formed. All equipment and stores were supplied by, and subsequently returned to, the United States authorities.

H.M.S. *Asbury* eventually paid off in February 1944, but some of the dental staff remained to assist in *Saker*, in New York, which establishment was still busy, and had been obliged to lose two dental officers, one to Boston and one to a small base set up at Victoria on Vancouver Island in Western Canada. Another *Asbury* dental officer was appointed to *Saker* for duty at an United States Naval Air Base in Southern Greenland.

RUSSIA

In 1942 an Auxiliary Naval Hospital was established at Vaenga, on the Kola Inlet, some fifteen miles from Murmansk. A dental officer was appointed to this hospital where, in the face of uncertain electric supplies, he had to improvise as best he could. The temperature of his surgery was almost always at freezing point, which necessitated short working hours.

In addition to his dental duties, the dental officer was employed on other Service activities, which included charge of the berthing party in the harbour.

During the winter months, the dental officer moved to Moscow for a period and then on to Archangel. In these places there were somewhat more attractive surroundings, and he was able to meet one or two Russian colleagues.

Portable dental surgery and laboratory equipment was principally used, and the dental officer was responsible to the Fleet Dental Officer, Home Fleet, for administrative purposes.

EUROPE

The liberation of Europe necessitated dental arrangements of a mobile character. As ports and towns were occupied, so dental facilities had to be provided and stone buildings were at a premium. In Kiel, for example, there was not one house which had not been damaged in one way or another.

Various experiments had been made with mobile equipment in such organisations as the Mobile Naval Base Defence Organisation, and other mobile units, but the equipment for this campaign had to be of a type readily moveable. Mobile equipment for surgeries and laboratories was therefore established in several of the invasion depot ships and arranged so that their dental personnel and equipment could be landed without difficulty. This movement was under the administration of a Senior Dental Surgeon. Dental officers with surgeries were carried afloat in *Thysville*, *Ascanias* and *Cap Touraine*. The Senior Dental Surgeon was in *Southern Prince* with a portable surgery equipment and laboratory for two mechanics.

The course of events may well be described in diary form as they unfolded themselves after D-day.

1944

June 8. Depot Ships H.M.S. *Southern Prince* (with S.D.S.) off the beaches in the British assault area, the surgery being already in operation.

June 12. Senior Dental Surgeon proceeded ashore at Courseulles. Suitable accommodation was found at Arromanches, where a surgery was opened on July 17, and remained in operation until December 1944.

July 27. The surgery from *Thysville* was landed at Courseulles, and a second surgery was formed.

September 3. A further dental officer arrived with naval party 1645 and opened a surgery at St. Germain.

September 4. One surgery at Courseulles was transferred to Rouen.

September 9. The Senior Dental Surgeon found accommodation in Dieppe and moved the second surgery from Courseulles, and the dental laboratory at the latter was sent to Arromanches.

October 17. The Senior Dental Surgeon transferred himself and his laboratory to Antwerp.

December 11. The surgery in Arromanches was closed and opened in Antwerp.

December 27. The surgery in Rouen was closed and transferred to Calais.

Following these movements, naval affairs were consolidated under a Flag Officer, Western Germany. The activities of naval personnel, however, were still unsettled, and dental facilities were provided at Kiel (H.M.S. *Royal Harold*) to cover Sylt and Travemunde—Hamburg, H.M.S. *Royal Edgar*—Wilhelmshaven, H.M.S. *Royal Rupert*, and Cuxhaven, H.M.S. *Royal Charlotte*. During these activities the mobile equipment supplied by the Admiralty was frequently augmented by very satisfactory German equipment and a German mobile unit was used in the Kiel area.

No doubt in view of the essentially mobile nature of these naval parties, only one or two of the reports of dental officers are in any degree full, and much information and comment on mobile units, which would have been of much value to record, is not described.

EAST INDIES

In pre-war days a dental officer was carried in Colombo, Ceylon, and early in 1940 it was evident that this complement would need to be increased. He became styled the Senior Dental Surgeon and the one surgery in the P & O building in Colombo was doubled, and a very attractive dental department of two surgeries and a laboratory was installed in the R.N. Auxiliary Hospital, Colombo. At the same time dental facilities had to be provided in India, and a dental department of three officers and a laboratory was opened in Bombay.

Whereas there was a Senior Dental Surgeon in Ceylon on the staff of the Flag Officer, Ceylon, there was also a Staff Dental Surgeon appointed to the Rear Admiral, Naval Air Stations. These were, from an administrative point of view, in more or less watertight compartments. The many dental officers in visiting and base ships at Trincomalee really had no staff officer to whom they could present their troubles, and the dental departments on shore in this large Naval Base operated more or less independently. With regard to dental stores and equipment, the shore establishments were, in the main, provided with excellent lend-lease equipment, but the surgeries afloat were obliged to look to the Medical Director-General for their requirements, which would arrive sporadically from month to month.

It was not until the appointment of a Command Dental Surgeon to the Staff of the Commander-in-Chief, East Indies, that it was possible to take all these different units under one control, and arrange the supply and distribution of equipment evenly and fairly around the Command which, at peak, carried 67 officers.

Apart from the seagoing ships which carried dental officers, the following shore establishments in the East Indies Command carried dental facilities:

Ceylon.	
Royal Naval Auxiliary Hospital	2 dental officers and 4 mechanics.
P. and O. Buildings	3 dental officers.
R.N. Barracks	1 dental officer.
R.N. Transit Camp (Chatham Camp)	1 dental officer, in mobile dental caravan.
R.N. Auxiliary Hospital, Diyatalawa	1 dental officer.
Kandy (H.Q. South East Asia Command)	1 dental officer.
R.N. Base, Trincomalee	3 dental officers.
India.	
Bombay	5 dental officers and 2 mechanics.
Cochin (Chinkara)	1 dental officer.
Mandapam	2 dental officers.
Vizagapatam	1 dental officer.
Arabia.	
Aden	1 dental officer.
East Africa.	
Kilindini	3 dental officers and 2 mechanics.
Eritrea.	
Massawa and Asmara	1 dental officer.

R.N. Air Stations.

Ceylon.

Colombo (H.M.S. *Bherunda*)	2 dental officers and 1 mechanic.
Katu Karunda (H.M.S. *Ukussa*)	1 dental officer.
Puttulam (H.M.S. *Rajaliya*)	1 dental officer.
China Bay (H.M.S. *Bambara*)	1 dental officer.

India.

Coimbatore (H.M.S. *Garuda*)	1 dental officer.
(H.M.S. *Vaire*)	1 dental officer.
Tambaram	1 dental officer.

The Command Dental Surgeon made official visits to these centres, which proved of inestimable value.

BRITISH PACIFIC FLEET

The British Pacific Fleet organisation was divided into five main administrative categories:

1. The Commander-in-Chief, British Pacific Fleet, Sydney (C.-in-C., B.P.F.)
2. The Vice Admiral Administration, British Pacific Fleet (V.A.(Q)), at Melbourne.
3. The Rear Admiral Fleet Train (R.A.F.T.)
4. The Vice Admiral, Second-in-Command, British Pacific Fleet (B.S.1.)
5. The Flag Officer, Naval Air, Pacific. (F.O.N.A.P.)

In a Fleet organisation of this description the ancillary services of the Royal Navy became even more important in their contribution to the welfare and amenities of personnel, and the control of dental health in a climate where dental lesions flourished, was of the utmost necessity in the maintenance of fighting efficiency. At peak the personnel of the Fleet numbered 237,000 officers and men. To attend the dental requirements of these there were 53 dental officers, an average of one officer to approximately 4,400 patients. Of these, 37 were carried in ships at sea. The remainder were in stations under F.O.N.A.P., the Royal Naval Hospital, Herne Bay, Sydney, H.M.S. *Golden Hind*, in Melbourne and eventually Brisbane. With the exception of H.M.S. *Golden Hind* (the Royal Naval Barracks, at Warwick Farm Racecourse, New South Wales), each of these establishments carried one dental officer. This department, under a senior dental surgeon, was built to accommodate five dental officers and a dental laboratory. Since it was situated 25 miles from Sydney, it was never able to lend any appreciable help to the Fleet, and the Naval Barracks always carried sufficient personnel to keep it fully employed.

Each hospital ship carried a dental officer, but owing to the movements of these vessels, two or three of which spent part of their time in dockyard hands, the dental officers were unable to bear their full

share of the dental responsibilities which fell so heavily on their colleagues in the fighting ships. The average statistical statement over a year per ship-borne officer is therefore most satisfactory when the low output of these ships is explained:

Average per Month per Dental Officer

No. of days employed	No. rendered dentally fit	No. fitted with new dentures	No. treated for ulcerative gingivitis	No. of teeth conserved	No. of teeth extracted	No. of scalings
24	45	3·5	3	111	33	27

When refits, leave periods and days lost due to battle stations and rough weather are taken into consideration, the time spent by officers in their surgeries during the extreme heat is most satisfactory.

The Royal Australian Navy had dental departments in Melbourne, Townsville, Brisbane and New Guinea, which were fully occupied with their own personnel. They gave all the help they could, but it is evident that there were no adequate shore dental amenities to meet the tremendous dental requirements of this huge Fleet. Nor had the dental officers of the forward areas any immediate hospital or hospital ship accommodation to receive their serious cases, with the result that all forms of dental surgery had to be undertaken at sea with strictly ship facilities.

From an administrative viewpoint, dental officers were directed by the Fleet Dental Surgeon on the staff of the Commander-in-Chief. He also supervised the arrangements of the F.O.N.A.P., whose air maintenance yards and mobile Naval Bases were so intimately connected with the Fleet Train and the forward area. Staff dental surgeons were also carried by V.A. (Q) and R.A.F.T. The organisation of full and maximum dental treatment to a Fleet deployed all over the Pacific Ocean brought with it a number of administrative problems, not only in dental treatment, but with questions of supply of stores and prosthetic work. When portions of the Fleet found themselves in an anchorage or port for any length of time, it was inevitable that responsibilities had to be undertaken by the Senior Dental Surgeon in company at the time. The Commander-in-Chief's memorandum on dental treatment gave these officers full powers to take the initiative on any of these matters wherever they found themselves. The way in which they assumed their responsibilities was at all times most satisfactory, and the eventual result was that the best dental service possible was given by them all to the Fleet.

With the complex disposition of the ships at sea, much thought had to be given to future events, and arrangements had to be made to meet difficulties usually before they presented themselves. When therefore units of the forward area arrived in a base in Australia, after three

months at sea with no prosthetic facilities, full arrangements had to be made to meet these most urgent requirements. The help given by our Australian colleagues, Naval, Army and Royal Australian Air Force, was magnificent. They gave their laboratory facilities over to us completely during these periods, and many hundreds of dentures were processed for us in the shortest possible time.

Whereas the major units of the Fleet were well supplied with dental officers (i.e. battleships, aircraft carriers, cruisers and repair ships), a continual and very great problem was how to bring treatment to destroyers and escort vessels in the forward screen. These, with ship's companies of over two hundred in many cases, used to pass their urgent dental patients to ships which carried dental surgeries when in the fuelling area at sea. This system, although very satisfactory, only touched the fringe of requirements, and no organised conservative or prosthetic treatment was given. Destroyers and escort vessels, in common with the rest of the Fleet, spent three months at sea, and had three weeks of rest and replenishing periods in ports in Australia. During this time half of the ship's company was on leave, the other watch being fully employed on board. They were, therefore, unable to receive any organised treatment.

Approval was eventually obtained to carry dental officers with mobile equipment in ships of the screen in the forward area. This suggestion was passed to the Australian Commonwealth Naval Board who readily complied, and a dental officer was appointed to their Destroyer Flotilla. In the British units it was not possible, owing to the lack of personnel, to implement this expedient immediately and the Japanese capitulation intervened. The fact that this idea was an immediate success, however, is reflected in the following extract from a report by the Captain (D):

> 'It has been demonstrated that a dental officer can work effectively in a destroyer under operational conditions in the Tropics. H.M.A.S. *Napier* has been at sea 35 days of the 40 that the dental officer has been on board.'

No picture of their endeavours would be complete without a short description of the working conditions of these dental officers at sea. During these protracted periods of operational vicissitudes, they had to work in surgeries where the ventilation arrangements and siting of compartments left much to be desired. Temperatures of tropical heat and humidity prevailed throughout, and the long periods at sea with the ship battened down day and night made the practice of dental surgery at all times uncomfortable and not a little irksome. The splendid returns of work, and the treatment given to their large ship's companies, obtained for them much praise and respect during this period.

No less irksome was the rôle of the officers in the Fleet Train. Their efforts to meet their difficulties were really remarkable. Many of them effected considerable success in prosthetic work with ship-made contrivances, and their exertions to meet their difficulties displayed in no uncertain way the adaptability and ingenuity of dental officers under conditions of war.

Dental officers attached to H.M.S. *Golden Hind* had much pioneer work to effect in strange surroundings. Before the main dental department was built, treatment was carried out in the Jockey's Hospital of Warwick Farm Racecourse, and the officers' mess was situated in the Grandstand. Other officers in shore billets found themselves in huts on tropical islands, or, if they were lucky, in service accommodation previously occupied by officers of the Royal Australian Navy or the American Navy. A mobile dental unit was constructed and built on a trailer by Royal Marine engineers to attend to the requirements of their unit. This was fitted with running water and electric power and was specially designed to resist tropical heat and was mosquito-proof.

The adventures of dental officers in this theatre of war would indeed fill a book. It will be appreciated that transport over thousands of miles, usually by air, brought many untoward excitements. Several officers joined ships at sea by breeches buoy. Suffice it to say that it was all a tremendous experience for those concerned, and it showed how mobile and adaptable dental facilities could be made.

As our position consolidated, new dental departments were opened, and the first of these was at Manus, in the Admiralty Islands. The abrupt end of hostilities and the surrender of Hong Kong necessitated the immediate re-opening of that colony and the innumerable responsibilities which followed the deprivations of enemy occupation presented themselves. The Fleet Dental Surgeon flew there from Sydney and the original dental department in Hong Kong Dockyard was quickly earmarked for our use. The compartment originally used as a chapel was also obtained and converted into a dental laboratory. The Staff Dental Surgeon of R.A.F.T. was placed ashore to take over the department. Here the immediate problem was the dental care and attention of prisoners-of-war and civilian internees. A Commander-in-Chief's directive was issued that everything possible was to be done for them, and much good work was effected, particularly by officers afloat in the aircraft carriers. In these ships patients were returned home, or taken to Australian ports for screening, onward passage and often hospitalisation. At this time a Command Dental Surgeon was appointed to the staff of the Commander-in-Chief, and his became the responsibility of meeting the problems which followed the dispersal of personnel under the age and service group system. He moved his office to Hong Kong, and the staff appointment eventually also carried the duties of Senior Dental Surgeon, Hong Kong.

COMMENTARY

So closes a chapter in the History of the Dental Branch, in which the resource, adaptability, initiative and hard work of dental personnel were tested to the utmost under difficult circumstances of Fleet movements and tropical heat. Many lessons were learned and much experience gained. No report of their endeavours, however, would be complete without an appreciation of the help and co-operation displayed by the Australian Commonwealth Naval Board through the dental officers of the Royal Australian Navy. All the equipment and consumable stores for this very large number of dental departments was supplied through them. Their dental officers in ships always helped with the routine work of the Fleet, as did the officers of the Royal New Zealand Navy and Royal Canadian Navy, and those in harbour did what they could in spite of very heavy commitments of their own. These were frequently our sheet anchor in outlying Australian ports where we could not supply personnel of our own.

DENTAL BRANCHES OF THE ALLIED AND DOMINION NAVIES

The unexpected demand for dental facilities by Royal Naval personnel in this war, and the scattered deployment of the Royal Navy all over the world, necessitated the provision of facilities where it would have been impossible to supply our own dental officers owing to the shortage of man-power at home. A very considerable amount of dental treatment was therefore effected by Allied and Dominion authorities, in whose countries our men were stationed for one reason or another. Apart from their naval dental personnel, this treatment was given also by Army and Air Force authorities and civilian dental surgeons under contract.

DEMOBILISATION

The termination of hostilities in 1945 found the Dental Branch at the height of its potential both in organisation and personnel. At home the training establishments and depots were fully manned and the mushroom commitments which had been opened to meet the requirements of coastal defence and the European campaign became redundant. In Europe valuable work was being carried on in enemy occupied territories, and in the Far East dental facilities were being stretched to their limit of mobility. The problem of treating personnel in destroyers and small craft was at last being solved, and dental officers were being carried afloat with mobile units with excellent results.

From the point of view of administration of dental facilities, one marked advance had been permanently made, and the dental officer staff appointment became a reality. Dental officers were appropriately represented on the staffs of Commanders-in-Chief by a member of their own cloth. This must be the first key to an expansion or control of dental facilities whether in peace or war.

In order to effect a fair roster for demobilisation of personnel the Age and Service Group system was introduced in 1944. The programme of releases was promulgated from time to time in Admiralty Fleet Orders. Groups were released as Service exigencies permitted, but the Dental Branch in fact lagged behind with the Medical and Supply Branches in this respect. Anyone volunteering, however, for an extended service commission or to remain until the end of the emergency would have his release deferred.

The vicissitudes of war brought many new adventures and experiences to those who attended to the dental treatment of personnel, whether at the chair-side, in the surgery, or the dental laboratory. One factor which coloured their Service life at all times was their gratitude for the kindnesses shown by so many officers and men and for the privilege afforded them of doing their best for the Royal Navy in those long and difficult years.

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