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AVERAGE CASUALTY RATES FOR WAR GAMES,
BASED ON HISTORICAL COMBAT DATA

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Research Analysis Corporation

McLean, Virginia 22101

Area Code 703
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January 5, 1972
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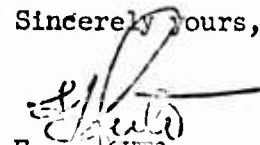
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AVERAGE CASUALTY RATES FOR WAR GAMES,
BASED ON HISTORICAL COMBAT DATA

A Report prepared for the Research Analysis Corporation
under Subcontract FY 67-ARO1-6-1,
dated 26 October 1966

A subcontract of RAC Prime Contract DA 44-188-ARO-1

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15 February 1967

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SUMMARY

This study compares casualty figures of both opposing forces in 37 engagements, representing five basic defense postures-- defense of a fortified position, defense of a prepared position, defense of a hastily prepared position, delay, and withdrawal-- and the corresponding attack postures. The results are presented graphically, plotting daily casualty rates in percent of unit strength for each posture against the force ratios, using the force ratio product (manpower ratio times firepower ratio) as the basis of comparison. The data has been analyzed at the level of the division or equivalent.

Information on strengths and casualties was derived from US sources entirely for selected operations in Okinawa and Korea and from German as well as US records for selected operations in the European Theater in World War II. Where records were inadequate or ambiguous, available figures have been expanded or modified on the basis of professional military and historical judgment. (This was particularly necessary for German data, since all of the most relevant German records have been returned to West Germany without having been microfilmed.)

For each engagement analyzed in this study there is a brief description of the setting, the situation, and the course of operations. For both forces the total manpower present has been established. Firepower has been calculated, using a relative index of lethality for each weapon employed that is derived from its rate of fire, number of targets per strike, relative effect per strike, effective range, accuracy, and reliability. The sum of the lethality indices of all the weapons known to have been standard equipment of the unit concerned is used as an assessment of its total firepower capability. It has been impossible in this study to modify this theoretical figure on the basis of expenditure of ammunition, a refinement which is highly desirable. Manpower and firepower ratios of the two forces in each engagement have been calculated, and multiplied to give a force ratio product for the engagement for plotting against the daily percentage of casualties. The quantitative relationship thus derived between relative firepower and casualties, while not necessarily precise, is in each case a true relationship within reasonable parameters of error.

The exceptional superiority in firepower of the US forces over the Japanese and the North Koreans has made it impractical in some cases to draw curves on a single graph representing all the engagements in a given posture in the three theaters of war that have been analyzed. Examination of a larger number of engagements in each theater would provide a more satisfactory basis for drawing separate posture curves for each, and for drawing a mean curve representing overall combat experience in each posture.

Because of limitations of time and availability of material, no consideration has been given in this study to the influence on casualties of the many intangible or qualitative elements in a combat situation. The data which has been developed, however, does suggest that with further research it may be possible to arrive at realistic quantitative values, or ranges of values, for such things as combat effectiveness, leadership, morale, terrain, and weather.

The results of this study clearly establish the validity of the hypothesis that the historical approach to records of conflict will yield casualty data expressible as quantitative inputs for wargaming. Inputs have been derived in terms of combat posture, forces present, types of force, forces engaged, and casualties.

A more extensive study including a search of records in West German archives for information comparable to that available for US forces, and a search of all sources for precise information on ammunition expenditures on which to achieve a more realistic calculation of relative firepower, should produce very reliable game inputs of a kind and quality not otherwise obtainable.

PREFACE

This study, "Average Casualty Rates for War Games, Based on Historical Combat Data," has been performed by the Historical Evaluation and Research Organization (HERO) for the Research Analysis Corporation (RAC), as a subcontract in support of RAC's study "Revised Theater Battle Model (TBM-68)."

Listed below are the participants in the study, including individuals who served in a review or consultant status:

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Coordination and surveillance of the professional effort in the study was performed initially by Col. A.M. Fraser, USMC, Ret., who was replaced as Coordinator in December by Mrs. Grace P. Hayes.

None of the participants, individually or collectively, should be held responsible for any portion of this report. As Executive Director of HERO, the undersigned assumes primary responsibility for its contents.


T. N. Dupuy
Executive Director

Washington, D. C.
15 February 1967

I. INTRODUCTION

The purpose of this study was "to develop average casualty rates for use in war game models of modern, nonnuclear war, based upon loss experience in World War II and the Korean War." Data on strengths and casualties for American units in a variety of engagements, already compiled by the Historical Evaluation and Research Organization (HERO),* was to be compared with similar data to be obtained on enemy strengths and casualties, analyzed, and presented in a form that would be useful as input for war gaming by the Research Analysis Corporation (RAC).

The original proposal (see Appendix E) included a description of the form tentatively envisaged for the report, but it clearly "emphasized . . . that the results derived from analysis of the data, and from further study of the problems of presenting this data, may suggest a different approach to presentation of the data. Whatever form it is presented in, however, will be designed to present the kind of information suggested above, in a form most suitable to RAC purposes." Subsequent correspondence between RAC and HERO more specifically defined the sort of information desired by RAC, and the study has been developed with those details in mind.

As will be seen, the quality of data available to the study participants, and the analysis of that data, have necessitated some modification of the original plan, while yielding results responsive to the requirement and which HERO feels will provide useful inputs to the RAC war games. These results indicate considerable promise of much highly useful, and perhaps critical, input data exploitable through more detailed research than was possible within the time limits of this study.

*Data compiled in connection with HERO's study, "Historical Analysis of Wartime Replacement Requirements; Experience for Selected Major Items of Combat Equipment."

Enemy records now available in the United States rarely include data for units below division level, and those for US combat elements available for this study were limited in quality and level of resolution by the purpose for which they were originally compiled. As a result, it has been impossible in this study to provide calculations for organizations smaller than divisions, except in those few instances where individual regiments were independently engaged for limited periods. More highly detailed figures could probably be acquired by thorough investigation of the records of US units down through battalions to the extent that such records are still available. Should it be determined that low-echelon records are no longer available in adequate quantities, it is believed that useful approximations for regimental, battalion, and company losses can be derived from division records by an extension of methodologies developed during the course of this study.

Because of the nature of warfare as well as the nature of the records, it has proved impossible to provide meaningful figures on an hourly basis. Some information is available on the intensity and duration of combat on certain days, but it is no more possible to ascertain the distribution of casualties by category or time than it is valid to assume that they were spread evenly over the duration of the combat.

The actions considered in this study occurred under widely varying conditions of terrain and climate, the former ranging from broad treeless plains to rugged and almost impenetrable mountains, the latter from the temperate climate of Northwest Europe to the semi-tropical monsoon climate of Okinawa. While it is most certainly true that the nature of the terrain was significant in many instances, and particularly when it was rugged, as in Okinawa and Italy, it has not proved practical from available data to isolate cases for study on the basis of a certain type of terrain, or to identify a type as "average." Rather it has been assumed that the variety of terrain represented in the several actions herein presented, by ranging from one extreme to the other, in fact produces a gamut of types that will yield a more accurate representation of actual combat conditions than would restriction to a single type, be it the one which most significantly affected combat or that which had the least influence on its development.

Fairly early in the analysis it became clear that in modern warfare force ratios are dependent not only on firepower capabilities, but to an even greater extent upon volume of fire actually delivered in a combat situation. In the time available for this study, it would be impossible to estimate what these volumes were

in the various engagements analyzed without exhaustive research of logistical records, shell reports, situation reports, and the like.* Thus the force ratios shown in this study, based upon numbers and capabilities, are to some extent distorted. Offsetting this, however, is the fact that the relative capabilities of different opposing national forces to some extent provided an inherent reflection of the respective logistical capabilities of the opposing forces. In any event, the conclusions of the report suggest that allowances can and should be made for this factor in future casualty assessments.

While historical and military judgment have been applied in the interpretation of the records, no effort has been made in this study to evaluate the various qualitative influences on the data derived and presented. It is important, however, that these influences not be ignored in the development of realistic combat models--such influences, for example, as leadership, doctrine, morale, and logistical support. To some extent we believe that these factors and considerations have cancelled themselves out in the development of the average figures in the report. The extent to which they have done so is open to some question, however. Not only for analytical purposes, but for the purpose of improved war gaming, it is important to attempt to evaluate in some fashion the influence of such intangibles on the outcome of combat. (See Section IV, below.)

*One possible exception is Anzio, where it has been estimated that the volume of American artillery fire was between 13 and 20 times as great as that of German fire. But, since the Germans were clearly more selective in choice of targets, this does not mean that US artillery fire was 13 times as effective.

II. METHODOLOGY

Since HERO was not aware of any similar study of comparable scope ever having been undertaken, a large proportion of the time allotted to this study had to be spent in evolving a methodology both for obtaining source material and for most effectively analyzing it.

As was indicated in the original study proposal, extensive figures on strengths and casualties of US forces were already available at HERO. These pertained to:

- The 45th Division in Italy and Northwest Europe;
- The 28th Division in Northwest Europe;
- The 2nd and 25th Divisions in Korea;
- The 7th and 96th Divisions on Okinawa.

It was necessary, therefore, to procure similar information for the enemy units which these US forces opposed, first identifying those units from intelligence reports, enemy records, historical narratives of units, and other similar sources.

No Japanese, North Korean, or Chinese Communist records are available. Consequently figures on casualties and strengths of those forces were procured entirely from the reports of the opposing US units, and must be viewed with considerable caution. Following World War II the major portions of the official records of the German Army were brought to Washington. They were retained in what is now the Federal Records Center for several years and available for research to historians and others. It was finally decided, however, that the records should be returned to the German government. Before their release, many of the documents were microfilmed and the microfilm stored in the National Archives. Unfortunately for the purposes of this study, no one foresaw the usefulness of the personnel records included in this material, and virtually none of them was microfilmed. It happened, however, that some documents reporting strengths and casualties were included in appendix material and otherwise enclosed with microfilmed records of operations, intelligence, etc. It is from these that the information used in this study was obtained. Unfortunately, there was no way of predicting where such material would be found

within the microfilmed records. Hence a great deal of time was spent fruitlessly looking through records of units known to have opposed the US forces under survey. After about 200 hours of searching microfilm (140 rolls, representing 15 units), it became necessary to abandon consideration of the 28th Division in northwest Europe (August to December 1944), since no pertinent German casualty figures were available. Because of a chance discovery of information on two other German Divisions (16th Infantry and 21st Panzer) during the Lorraine Campaign (September 1944), it was decided to search out figures for the US 79th Division, which opposed those divisions at that time, but which had not been included in the earlier study. Hence the 79th Division and its combat with these two German divisions has been added to the original list. For lack of information on German units, the action of the 45th Division in northwest Europe also had to be dropped. Also omitted from the study as originally envisaged was the 2nd Division in Korea, because time did not suffice to search out the records.

Types of Statistical Material

The statistical material on US forces was adequate, but some of it, having been gathered for a study with a different objective, was not fully adaptable to the requirements of this one. With more time for review of primary sources this problem could probably be eliminated. One serious instance of conflicting and contradictory records for an American division was found, raising some doubts as to the reliability of other records for that division.

Although there was in no case as much information available on German strengths and casualties as would have been desirable, that which was used was deemed adequate for the purposes of this brief study, and certainly for proving the validity of the methodology employed. US records contain day-by-day reports of strengths and casualties at the division level for virtually all units engaged in Europe, and at least some lower echelon reports are also available. In only a few instances were daily reports of German strengths and losses found, and these covered isolated periods of a few days. Much of the material was in the form of monthly reports at the corps or army level. In some cases information pertaining to the same period was found in different forms, although frequently conflicting, necessitating evaluation, and application of professional judgment.

While limitation of time and funds precluded going beyond data already available, save for the 79th Division as indicated above, the feasibility of another and more rewarding approach to the problem addressed by this study was clearly indicated. This approach would, in effect, reverse that employed here. First the availability of detailed records of German units under various combat postures would be determined from West German sources, and microfilm or other copies of these obtained. Then records of opposed US units would be researched and data compiled for comparison at the lowest possible levels of resolution.

Information on enemy strengths and losses in North Korea and Okinawa came from US intelligence reports, based primarily on interrogations of prisoners and identification of enemy dead. These reports were normally made on a daily basis and are readily available.

Interpretation and Use of the Material

Manpower strengths for each unit in each engagement were derived directly from documentary sources, with additional assistance from historical sources, and particularly the series of volumes on the History of World War II prepared by the Office of the Chief of Military History. In the calculations and analyses made of the data the average unit strength during the engagement was normally used. When daily strengths were not available, figures representing the strength at each end of the period, normally a month, were usually at hand, and from these an average daily figure was derived.

Casualty figures were available in various forms, but most often in some sort of breakdown. For purposes of this study casualties were interpreted as including Killed in Action, Wounded in Action, Missing, Captured, Prisoner of War, and any variation of these.

In cases where the only German casualty figures available were those accumulated for a stated period, usually ten days or one month (16th Panzer Division at Salerno, 16th Infantry Division and 21st Panzer Division in Lorraine), a daily breakdown of casualties was estimated, based upon knowledge of the situation existing, the nature of the combat in which the units were engaged throughout the period, the intensity of the combat indicated by casualty figures of US forces, knowledge of the course of operations, and experience with similar forces in similar situations.

Enemy strength figures also were not always as complete as desired, and sometimes were available only on a month's-end basis. Again, casualty figures and outside information as to the units engaged and the type of action made it possible to estimate with considerable confidence the average strengths of the forces engaged.

Japanese casualty figures on Okinawa, derived solely from US sources, included only killed, broken down into several categories, including estimated dead as well as counted dead and estimated numbers sealed in caves. While every Japanese soldier on the island ultimately became a casualty, the accuracy of these daily figures is impossible to validate. There are no figures at all on Japanese wounded. On the assumption that Japanese wounded were 3-4 times as great as their killed, but bearing in mind the Japanese practice of holding positions at all costs until all--including previously wounded--were dead, while at the same time recognizing that numbers of wounded must have been evacuated during the kind of combat which took place on Okinawa, it was found that doubling the number of counted dead, while ignoring other estimated categories, gave the most plausible total for dead and wounded.

For Korea, two sets of estimates of enemy casualties are available in US records: those of the engaged US unit, in its daily reports, and subsequent estimates of Far East Command, based upon examination, analysis, and correlation of all casualty reports received. It is believed that these FEC estimates were, in turn, correlated with reasonably accurate intelligence of initial strengths of major enemy units, and of the replacement which reached them from China and North Korea. Accordingly, we have accepted the FEC figures, as providing a reasonable estimate of all enemy casualties. These evidently do include prisoners of war. It is not certain whether they include estimates of wounded. We have assumed they do, since the application of any standard relationship of killed to wounded, ranging from 1:1 to 1:3, would result in an overall casualty total that we believe would be unrealistically high. We think, however, that this question of enemy casualties should be investigated more thoroughly than was possible in the time available for this study.

Organization and Analysis of Data

The Calculation of Force Ratios

Calculation of manpower strength on each side in each engagement was based upon figures obtained from contemporary records,

adjusted in accordance with reports of specific units engaged at a given time. Thus when, in the first day at Salerno, it was known that only two of the three regiments of the 45th Division had landed, the strength in manpower was placed at the strength of two regiments rather than three, and without the availability of most division support units (other than artillery). Again, when the German 16th Panzer Division was conducting a delaying action between September 17 and 25, it was assumed that only half of the division would have remained in contact with the 45th US Division, since approximately half of the entire German force was presumably engaged in preparing for defensive action north of Naples.

For more effective use in war gaming, RAC requested that the calculations of this study be based not upon manpower strength alone, but upon manpower plus weapons. This would have been necessary in any case. While some data for determining the relative firepower of weapons is presented in USCONARC Pamphlet, "War Gaming Handbook," September 1961, we do not have available any indication of how these data are applied to a range of specific weapons, or of the validity of the resulting relationships. In an earlier study, "Historical Trends Related to Weapon Lethality," HERO developed a relatively simple method of calculating the relative firepower or lethality of all weapons, ranging from the sword to the atomic bomb. The theoretical results appear to relate validly to each other, although they do not reflect the effects of terrain or other frequently unquantifiable circumstances of combat. Recognizing this shortcoming, HERO has used the method in this study to develop fully comparable figures for relative lethality, or firepower, of weapons, since nothing else as reliable is available.

With this method, calculation of the inherent lethality of a weapon involves the following elements: (1) rate of fire in effective strikes per hour under ideal conditions; (2) number of potential targets per strike, assuming the target to consist of men in massed formation; (3) relative incapacitating effect of each strike; (4) effective range; (5) accuracy; and (6) reliability. In the case of tanks and other mobile weapons systems mobility and vulnerability are also considered. Multiplication of the factors representing each of these elements for any given weapon results in a figure which represents the relative lethality of the weapon. (A fuller discussion of this method is included in Appendix F.)

The lethality index of the weapons employed in the actions considered in this study has been calculated by this method (see Appendix G). Using Tables of Equipment (T/E) or other sources for numbers of each type of weapon authorized for, or actually employed by, the units involved, the total firepower--in terms of lethality

indices--for each of the forces has been calculated. The ratio of these totals and the ratio of manpower strengths have been multiplied to give a force ratio product for the attacker and defender in each action. (This is quite an arbitrary procedure, and it may be that further analysis will reveal that greater weight should be applied either to numerical strength--because of ground-covering or maneuvering capabilities--or to firepower capabilities; or that some other relationship should be developed.) The force ratio products have been plotted on the accompanying graphs against the casualties per day per hundred men (casualties per day as a percent of strength). It must be stressed that this method of calculating firepower capabilities does not allow for substantial differences in logistical capabilities, or for doctrine in the employment of weapons or ammunition.

The figures thus produced are believed to be accurate within an acceptable degree of error. They could, and should, however, be further refined. First, a search should be made in Germany for more complete records of German strengths and casualties. It is believed that these records are available and access to them should not be difficult to obtain. Second, the records on both sides should be thoroughly explored for figures on expenditure of ammunition in these engagements. Since this information was not included in the data readily available for this study, it has been necessary to base firepower calculations entirely on the weapons each side was authorized or known to have possessed. The presence of the weapons does not insure, however, that they were actually used, nor does it suggest the extent to which they were used. A rifle that is fired is infinitely more effective than a howitzer that is present but silent because of lack of ammunition. Thus it must be recognized that the results of this study do not take into consideration the actual use, but only the potential use, of the weapons at hand on each side.

In the case of the North Koreans and the Communist Chinese, although knowledge of the weapons actually at hand is incomplete, there is information as to the usual number and variety of weapons authorized for various units. Since the weapons were a miscellaneous assortment from various nations, their firepower and the total firepower of the forces have been estimated on the basis of comparable weapons used by US or German forces. Additional research might make it possible to refine the figures further, but no significant modification could be anticipated without access to the records of the enemy forces. This was true to a much less extent of the Japanese who, at Okinawa, still maintained a close to normal level of organization and equipment. The nature of the campaign, moreover, which resulted in capture of the entire island, made it

possible for US forces to count and record the weapons that were left by the departed Japanese. Again, a more thorough study of the record than has been possible in the limited time for this study would probably produce some modification of the figures used in the calculation of force ratios.

The firepower of US units, as stated above, is based on authorized T/E. It has not been deemed necessary in most instances to vary the firepower figures for a unit to reflect manpower losses, or excess personnel over T/O. Thus a full division has always been considered at full T/E strength for weapon lethality firepower purposes. Similarly enemy units, except when only a portion is known to have participated in an action, or when they are known to have been short of major armament, are calculated at full strength. The basis for this is the assumption based on professional experience that a military unit will normally maintain its heavy and crew-served weapons in combat as long as possible and that reductions in personnel represent primarily losses in hand weapons (rifles or carbines), and these predominantly in noncombat assignments. Thus, until they become extensive, personnel shortages have relatively little effect on the total firepower figure for the unit.

Data for Units below Division Strength

For reasons discussed above, all of the data developed for this study related to operations of divisions, or comparable units. With more time, in a more comprehensive study, it is possible that detailed data regarding combat experience of smaller units might be similarly developed. It would first be necessary, however, to ascertain the availability of records of German or other opposing forces at lower levels, as well as availability of suitable US records.

Meanwhile, the data herein derived for division actions is probably applicable to combat of smaller units for war game purposes through an appropriate numerical factor. The following factors are suggested:

Regiment. The T/O&E strength of the American divisions engaged in Korea was 18,180 men. The regimental strength was 3,662 men. Thus a regiment comprised 20.4% of the strength of a division. In World War II a regiment of 3,207 was 22.8% of the division strength of 14,032. Thus we can assume that in relation to the data available for this study, a regiment was approximately

21.4% of the numerical strength of a division. Approximately 90% of a division's casualties in combat are incurred by infantry regiments committed to action. The normal method of commitment is two regiments in the line and one in reserve. Thus in order to ascertain the rate of regimental loss, in combats such as those dealt with in this study, the division casualties should be divided by .214 and in turn multiplied by .45, resulting in a factor of 2.10, to be applied against the casualty percentage rate which can be derived from the division graphs.

Battalion. There is a similar relationship between the strengths of the individual battalions and the regiments in both the Korean War and World War II organizations. The battalion consisted of approximately 30% of the numerical strength of the regiment. It can arbitrarily be assumed that approximately 80% of the casualties of a regiment engaged in direct combat would be incurred by the two battalions which would normally be in the line. Thus the factor of 2.10 derived above for the regiment should be divided by .30 and multiplied by .40, resulting in a factor of 2.80.

Company. In World War II and Korea the average rifle company was approximately 25% of the strength of an infantry battalion. As in the case of the battalion, it can be assumed that approximately 80% of the battalion's casualties would have been incurred by the two rifle companies in the line. Thus the factor for the infantry rifle company would be that for the battalion derived above, divided by .25, and multiplied by .40, resulting in a factor of 4.47.

III. COMPILATION OF CASUALTY EXPERIENCE

Part One: The Engagements

11 (a)

The Engagements

World War II--Italy

1. Salerno, September 11, 1943--Attack from the Beachhead. Attack by US 45th Division from the beachhead against hasty defense by the German 16th Panzer Division.
2. Salerno, September 12-14, 1943--German Counterattack. German 16th Panzer Division counterattack against hasty defense by the US 45th Division.
3. Salerno, September 17-25, 1943--Advance to Naples. Advance to Naples by US 45th Division against delaying action by German 16th Panzer Division.
4. Volturno, November 6-13, 1943--Attack in the Mountains. Attack in mountains by US 45th Division against prepared positions of the German 26th Panzer Division.
5. Anzio, February 7-9, 1944--Moletta River Defense. Initial hasty beachhead defense by elements of the US 45th Division against elements of the German 65th Infantry Division.
6. Anzio, February 11-12, 1944--Aprilio Counterattack. Counterattack by US 45th Division against prepared defenses of the German 715th Infantry Division (reinforced).
7. Anzio, February 16-19, 1944--German "Bowling Alley" Offensive. The major German offensive, German Combat Group Greiser (approximately three divisions) against prepared defenses of the US 45th Division.
8. Anzio, February 21-23, 1944--German Beachhead Defense Line Offensive. Continued offensive by the German 114th Infantry Division (reinforced) against the US 45th Division.
9. Anzio, February 21-23, 1944--Allied Beachhead Counterattack. US 45th Division counterattacks (as a part of overall Allied counterattack) against prepared positions of the German 114th Infantry Division. (Note--Engagements 8 and 9 are identical; see discussions.)

World War II--France

10. Lorraine, September 13-16, 1944--Advance to the Moselle River. Attacks by the US 79th Division against hasty defense by the German 16th Infantry Division.

11. Lorraine, September 19-23, 1944--Advance to the Meurthe River. Attacks by the US 79th Division against delaying action by the German 21st Panzer Division.

World War II--Okinawa

12. Advance from the Beachhead, April 1-4, 1945. Advance of the US 96th Division against delaying action by the Japanese 1st Specially Established Regiment.

13. Machinato Offensive--I, April 5-12, 1945. Attack by the US 96th Division against Japanese 12th and 13th Battalions in fortified positions.

14. Machinato Offensive--II, April 19-23, 1945. Attack by the US 96th Division against the Japanese 62nd Division in fortified positions.

15. Shuri Line Offensive, May 10-25, 1945. Attack by the US 96th Division against Japanese 24th Division in fortified positions.

16. Advance from the Shuri Line, May 31-June 5, 1945. Attacks by the US 96th Division against delaying action by the Japanese 24th Division.

17. Final Yuza Offensive, June 6-17, 1945. Attack by the US 96th Division against Japanese 24th Division in fortified positions.

18. Advance from the Beachhead, April 1-4, 1945. Advance by US 7th Division from beachhead against delaying action by Japanese 1st Specially Established Regiment.

19. Machinato Offensive--I, April 5-8, 1945. Attack by US 7th Division against Japanese 12th and 14th Independent Battalions in fortified position.

20. Machinato Offensive--II, April 9-23, 1945. Attack by US 7th Division against Japanese 63rd Brigade in fortified position.

21. Advance to the Shuri Line, April 24-May 3, 1945. Attack by US 7th Division against Japanese 24th Division in a delaying action.

22. Japanese Counterattack, May 4, 1945. Counterattack by Japanese 24th Division against US 7th Division in hastily prepared position.

23. Shuri Line Offensive, May 5-8, 1945. Attack by US 7th Division against Japanese 24th Division in fortified position.

24. Advance from the Shuri Line, May 22-30, 1945. Attack by US 7th Division against Japanese miscellaneous units in a delaying action.

25. Advance to the Escarpment Redoubt, May 31-June 8, 1945. Attack by US 7th Division from Shuri Line against Japanese 63rd Brigade in a delaying action.

26. Final Escarpment Offensive, June 9-18, 1945. Attack by US 7th Division against Japanese 63rd Brigade in fortified position.

Korean War

27. Pusan Perimeter Defense, September 16-18, 1950. Defense of prepared positions by the US 25th Division against attacks of the 6th and 7th North Korean Divisions.

28. Offensive from Pusan Perimeter, September 18-21, 1950. Attacks by the US 45th Division against withdrawal from hasty defense by the 6th and 7th North Korean Divisions.

29. Nam River Operation, September 22-24, 1950. Attack by the US 25th Division against delaying action of 6th and 7th North Korean Divisions.

30. Pursuit through Kunson, September 25-30, 1950. Attacks by US 25th Division against 6th and 7th North Korean Divisions in withdrawal from hasty defense.

31. Crossing of the Han River, March 7-9, 1951. Attack by the US 25th Division against prepared defenses of the 38th and 50th Chinese Communist Forces Army.

32. Attack toward "Butte" Line, February 3-7, 1951. Attack by the US 25th Division against hasty defenses of the 50th Chinese Communist Forces Army and II North Korean Corps.

33. Attack toward the Chan River, April 3-5, 1951. Attack by the US 25th Division against hasty defenses of the 26th Chinese Communist Forces Army.

34. Withdrawal to "Kansas" Line, April 23-27, 1951. Delaying action by the US 25th Division against attacks by the 60th and 12th Chinese Communist Forces Army.

35. Attack toward Line "Pierce," May 20-23, 1951. Attack by the US 25th Division against hasty defenses by the 64th and 65th Chinese Communist Forces Army.

36. Iron Triangle Defense, June 1-2, 1951. Defense of hasty defense positions by the US 25th Division against attacks by the 63rd Chinese Communist Forces Army.

37. Attack toward Line "Bayonet," June 3-5, 1951. Attack by the US 25th Division against prepared defenses of the 63rd Chinese Communist Forces Army.

III. COMPILATION OF CASUALTY EXPERIENCE

Part Two: Tabular Presentation of Casualty Data

15 - (a)

TABULAR PRESENTATION OF CASUALTY DATA

This presentation of the casualty data is intended to summarize, in tabular form, all of the basic statistics compiled for each of the 37 engagements analyzed in the study, all of the comparisons and correlations required for accomplishing the objectives of the study, and other potentially useful comparative data for possible future analysis.

The summary lists the number of postures analyzed as follows:

Attack	37
Defense of fortified position	9
Defense of prepared position	8
Hasty defense	11
Delaying action	10
Withdrawal from action	4

A total of 42 defense postures are listed because, in five instances, two defensive postures are indicated for the following reasons:

a. Engagement No. 4, German defense in the mountains north of the Volturno River, was originally considered to be an example of defense of a prepared position. Because of the nature of the terrain, however, as well as the extremely well-prepared defenses, it is believed that this should also be considered as defense of a fortified position.

b. In Engagements 10, 28, 29, and 30, the defender had planned either a defense or a delaying action; the attacker's success, however, forced the defender in these engagements to attempt a withdrawal in action, since he was unable to accomplish his original mission.

The more successful side in each of these engagements is indicated by a circle drawn around the posture indicator.

Intensity of conflict has been indicated on the basis of percentage of casualties, as described in Section IV.

The figures on the table have been used to plot the accompanying graphs.

A. ENGAGEMENT	B. DATE	C. NO. OF DAYS	D. E. F. G. H. I. POSTURES							J. FORCE DESIGNATION	K. ATTACKER'S CHAR.	
			D	E	F	G	H	I	Manpower		Strength	
			A	D F	D P	D H	D l y	W / D				
<u>WORLD WAR II--ITALY</u>												
1. Salerno-I	11 Sep 43	1	x				⊗			US 45th Inf.Div.	8,388	
2. Salerno-II	12-14 Sep 43	3	x				⊗			Ger. 16th Pz.Div.	14,229	
3. Salerno-III	17-25 Sep 43	9	x					⊗		US 45th Inf.Div.	15,576	
4. Volturno	6-13 Nov 43	8	x	⊗	⊗					US 45th Inf.Div.	15,579	
5. Anzio-I	7-9 Feb 44	3	x				⊗			Ger. 65th Inf.Div.	7,312	
6. Anzio-II	11-12 Feb 44	2	x		⊗					US 45th Inf.Div.	11,212	
7. Anzio-III	16-19 Feb 44	4	x		⊗					Ger. Combat Group, 2 Inf. Div., 1 Armored Div.	26,421	
8. Anzio-IV	21-23 Feb 44	3	x		⊗					Ger. 114th Inf.Div.+	15,265	
9. Anzio-V	21-23 Feb 44	3	x		⊗					US 45th Inf.Div.	15,807	
<u>WORLD WAR II--FRANCE</u>												
10. Lorraine-I	13-16 Sep 44	4	⊗				x		x	US 79th Inf.Div.	13,758	
11. Lorraine-II	19-23 Sep 44	5	⊗						x	US 79th Inf.Div.	13,386	
<u>WORLD WAR II--OKINAWA</u>												
12. Okinawa-I *	1-4 Apr 45	4	⊗						⊗	US 96th Inf.Div.	20,796 (12,677)	
13. Okinawa-II **	5-12 Apr 45	8	⊗	x						US 96th Inf.Div.	19,893 (12,677)	
14. Okinawa-III	19-23 Apr 45	5	⊗	x						US 96th Inf.Div.	20,137 (12,921)	

1

ATTACKER'S CHARACTERISTICS

DEFENDER'S CHARACTERISTICS

POSITION	Strengths		Cas. / Day	Cas./day as % of Strength	Intensity
	K. Manpower	L. Firepower			
		8,388	472.810	251	2.99
	14,229	334.118	240	1.687	Int.
	15,576	284.871	42.9	.276	Int.
	15,579	284.871	82	.526	Mod.
lv.	7,312	58.601	112	1.531	Mod.
	11,212	533.086	84	.749	Mod.
ap, 2 Inf. Div.	26,421	601.076	561.8	2.126	Int.
Div.+	15,265	148.243	166.7	1.092	Mod.
	15,807	257.764	218.3	1.381	Mod.
	13,758	150.564	76.25	.554	Mod.
	13,386	150.564	112.8	.843	Mod.
	20,796 (12,677)	509.965	80	.631	Mod.
	19,893 (12,677)	509.965	200.6	1.583	Mod.
	20,137 (12,921)	509.965	180	1.392	Mod.

FORCE DESIGNATION	Strength	
	Q. Manpower	R. Firepower
Ger. 16th Pz.Div.	7,325	162.
US 45th Inf.Div.	8,388	771.
Ger. 16th Pz.Div.	6,702	169.
Ger. 26th Pz.Div.	8,165	86.
US 45th Inf.Div.	5,310	86.
Ger. 715th Inf.Div.+	13,319	136.
US 45th Inf.Div.	15,797	728.
US 45th Inf.Div.	15,807	257.
Ger. 114th Inf.Div.+	15,265	148.
Ger. 16th Inf.Div.	4,219	9.
Ger. 21st Pz.Div.	5,632	63.
J. 1st Sp.Est.Reg.(-)	1,400	4.
J. 12th & 13th Battalions	2,900	22.
J. 62nd Div.	13,923	54.

2

DEFENDER'S CHARACTERISTICS

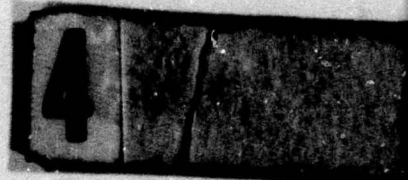
COMPARISONS AND CORRELATIONS

	Q.		R.	S.	T.	U.	V.	W.	X.	Y.	Z.	AA.
	Strengths		Cas. / Day	Cas./Day as % of Strength	Inten- sity	Man- power Ratio	Fire- power Ratio	Force Ratio Product	Force Ratio Product	A C/D as % D. Strength	D C/D as % A. Strength	
	Manpower	Firepower										
	7,325	162.961	100	1.368	Mod.	1.145	2.901	3.322	.301	3.42	1.195	
	8,388	771.669	134	1.60	Int.	1.696	.433	.734	1.361	2.86	.942	
	6,702	169.141	16	.239	Mod.	2.324	1.684	3.914	.256	.640	.103	
	8,165	86.884	30.1	.369	Mod.	1.908	3.278	6.254	.160	1.005	.194	
	5,310	86.961	32	.602	Mod.	1.377	.674	.928	1.077	2.107	.438	
	13,319	136.959	103	.773	Mod.	.842	3.892	3.277	.305	.632	.918	
	15,797	728.040	343.8	2.171	Very Int.	1.674	.826	1.382	.724	3.556	1.301	
	15,807	257.764	218.3	1.381	Int.	.966	.575	.555	1.802	1.055	1.432	
	15,265	148.243	166.7	1.092	Int.	1.037	1.739	1.800	.555	1.432	1.055	
	4,219	9.316	670.5	15.89	Very Int.	3.261	16.163	52.71	.019	1.807	4.874	
	5,632	63.753	51.6	.916	Int.	2.377	2.362	5.644	.178	2.003	.386	
	1,400	4.381	462	33.0	Very Int.	14.854	116.704	1733.521	.00058	5.72	2.22	
Lions	2,900	22.615	599.8	20.68	Very Int.	6.859	22.55	154.67	.0065	7.12	3.01	
	13,923	54.027	532	3.82	Int.	1.446	9.439	13.649	.0733	1.295	2.64	

3

COMPARISONS AND CORRELATIONS →

V. t	W. At	X. At	Y. Df	Z.	AA.	BB.	CC.	DD.
er	Fire-	Force	Force	A C/D	D C/D	A %	D %	A% C/D
rio	power	Ratio	Ratio	as % D.	as % A.	C/D	C/D	D% C/D
	Ratio	Product	Product	Strength	Strength	DFRP	AFRP	
45	2.901	3.322	.301	3.42	1.195	9.933	4.104	2.185
96	.433	.734	1.361	2.86	.942	1.238	2.178	1.055
24	1.684	3.914	.256	.640	.103	1.080	.061	1.155
908	3.278	6.254	.160	1.005	.194	3.289	.059	1.425
377	.674	.928	1.077	2.107	.438	1.420	.648	2.543
842	3.892	3.277	.305	.632	.918	2.454	.236	.969
574	.826	1.382	.724	3.556	1.301	2.938	1.572	.979
966	.575	.555	1.802	1.055	1.432	.606	2.488	.791
037	1.739	1.800	.555	1.432	1.055	2.488	.606	1.262
261	16.163	52.71	.019	1.807	4.874	29.2	.302	.035
377	2.362	5.644	.178	2.003	.386	4.76	.163	.920
854	116.704	1733.521	.00058	5.72	2.220	1093.852	.0191	.0191
859	22.55	154.67	.0065	7.12	3.016	244.8	.134	.077
446	9.439	13.649	.0733	1.295	2.642	18.97	.280	.364



10. Lorraine-I	13-16 Sep 44	4	⊗			x		x	US 79th Inf.Div.		
11. Lorraine-II	19-23 Sep 44	5	⊗					x	US 79th Inf.Div.	13,386	1
WORLD WAR II--OKINAWA											
12. Okinawa-I *	1-4 Apr 45	4	⊗					⊗	US 96th Inf.Div.	20,796 (12,677)	5
13. Okinawa-II **	5-12 Apr 45	8	⊗	x					US 96th Inf.Div.	19,893 (12,677)	5
14. Okinawa-III	19-23 Apr 45	5	⊗	x					US 96th Inf.Div.	20,137 (12,921)	5
15. Okinawa-IV	10-25 May 45	16	⊗	x					US 96th Inf.Div.	21,734 (12,677)	5
16. Okinawa-V	31 May-5 June 45	6	⊗					x	US 96th Inf.Div.	20,911 (12,990)	5
17. Okinawa-VI	6-17 Jun 45	12	⊗	x					US 96th Inf.Div.	20,424 (12,305)	5
18. Okinawa-VII **	1-4 Apr 45	4	⊗					x	US 7th Inf.Div.	20,510 (12,391)	4
19. Okinawa-VIII **	5-8 Apr 45	4	⊗	x					US 7th Inf.Div.	19,860 (12,212)	4
20. Okinawa-IX	9-23 Apr 45	15	⊗	x					US 7th Inf.Div.	19,473 (11,354)	4
21. Okinawa-X	24 Apr-3 May 45	10	⊗					x	US 7th Inf.Div.	19,252 (11,133)	5
22. Okinawa-XI	3-4 May 45	1	⊗					x	J. 24th Div.	16,430	9
23. Okinawa-XII	5-8 May 45	4	⊗	x					US 7th Inf.Div.	19,135 (11,016)	5
24. Okinawa-XIII **	22-30 May 45	9	⊗					x	US 7th Inf.Div.	20,214 (12,095)	5
25. Okinawa-XIV **	31 May-8 Jun 45	9	⊗					x	US 7th Inf.Div.	19,503 (11,384)	5
26. Okinawa-XV *	9-18 Jun 45	10	⊗	x					US 7th Inf.Div.	18,958 (10,839)	5
KOREAN WAR											
27. Korea-I	16-18 Sep 50	1.5	x					⊗	6th & 7th NKD	10,960	1
28. Korea-II	18-21 Sep 50	4	⊗					x	US 25th Inf.Div.	16,626 (15,000)	10
29. Korea-III	22-24 Sep 50	3	⊗					x	US 25th Inf.Div.	16,286 (14,660)	10
30. Korea-IV	25-30 Sep 50	6	⊗					x	US 25th Inf.Div.	16,221 (14,595)	10

13,758	150.564	76.25	.554	Mod.	Ger. 16th Inf.Div.	4,219	9.316
13,386	150.564	112.8	.843	Mod.	Ger. 21st Pz.Div.	5,632	63.753
20,796 (12,677)	509.965	80	.631	Mod.	J. 1st Sp.Est.Regt.(-)	1,400	4.381
19,893 (12,677)	509.965	200.6	1.583	Mod.	J. 12th & 13th Battalions	2,900	22.615
20,137 (12,921)	509.965	180	1.392	Mod.	J. 62nd Div.	13,923	54.027
21,734 (12,677)	539.965	132.8	1.049	Mod.	J. 24th Div.	16,430	70.656
20,911 (12,990)	539.965	37.5	.289	Light	J. 24th Div.	8,250	35.328
20,424 (12,305)	539.965	60.4	.491	Light	J. 24th Div.	8,250	35.328
20,510 (12,391)	489.099	67.5	.545	Mod.	J. 1st Sp.Est.Regt.(-)	1,400	4.381
19,860 (12,212)	489.099	65	.532	Mod.	J. 12th & 14th Ind.Bns.	2,900	22.614
19,473 (11,354)	489.099	101.7	.896	Mod.	J. 63rd Brigade	4,731	37.961
19,252 (11,133)	519.099	80	.718	Mod.	J. 24th Div.	16,430	97.286
16,430	97.286	3164	19.257	Very Int.	US 7th Inf.Div.	12,757 (7,294)	252.842
19,135 (11,016)	519.099	105	.953	Mod.	J. 24th Div.	14,000	85.000
20,214 (12,095)	519.099	69.5	.574	Mod.	J. Miscellaneous Units	4,000	31.580
19,503 (11,384)	519.099	55	.483	Light	J. 63rd Brigade	4,000	31.580
18,958 (10,839)	519.099	86.5	.798	Mod.	J. 63rd Brigade	2,500	20.00
10,960	125.672	320	2.92	Int.	US 25th Inf.Div.	15,158	719.66
16,626 (15,000)	1043.751	93.7	.625	Mod.	6th & 7th NKD	10,250	126.30
16,286 (14,660)	1043.751	77	.526	Mod.	6th & 7th NKD	8,960	100.53
16,221 (14,595)	1043.751	17.33	.119	Light	6th & 7th NKD	7,085	67.00

	4,219	9.316	670.5	15.89	Very Int.	3.261	16.163	52.71	.019	1.807	4.
	5,632	63.753	51.6	.916	Int.	2.377	2.362	5.644	.178	2.003	.
t.(-)	1,400	4.381	462	33.0	Very Int.	14.854	116.704	1733.521	.00058	5.72	2.
ttalions	2,900	22.615	599.8	20.68	Very Int.	6.859	22.55	154.67	.0065	7.12	3.
	13,923	54.027	532	3.82	Int.	1.446	9.439	13.649	.0733	1.295	2.
	16,430	70.656	592.1	3.604	Int.	1.323	7.642	10.110	.099	.809	2.
	8,250	35.328	321.7	3.899	Very Int.	2.523	15.284	38.561	.026	.455	1.9
	8,250	35.328	300.3	3.64	Int.	2.475	15.284	37.85	.0264	.732	1.
t.(-)	1,400	4.381	192	13.714	Very Int.	14.65	111.641	1635.541	.000612	4.821	.9
d.Bns.	2,900	22.614	530	18.276	Very Int.	6.848	21.627	148.102	.0068	2.240	2.6
	4,731	37.961	426	9.025	Very Int.	4.117	12.884	53.043	.0188	2.15	2.1
	16,430	97.286	426.8	2.59	Very Int.	1.171	5.336	6.248	.160	.487	2.2
	12,757 (7,294)	252.842	150	2.056	Int.	1.294	.385	.497	2.009	2.48	.9
	14,000	85.000	482	3.44	Int.	1.367	6.106	8.347	.1198	.750	2.5
Units	4,000	31.580	371.7	9.295	Very Int.	5.053	16.437	83.059	.012	1.738	1.6
	4,000	31.580	309.1	7.727	Very Int.	4.876	16.437	80.152	.0125	1.376	1.5
	2,500	20.000	1,104	44.16	Very Int.	7.583	25.955	196.817	.0051	3.46	5.
	15,158	719.667	75.2	.497	Mod.	.723	.175	.1263	7.918	2.112	.
	10,250	126.300	235	2.295	Int.	1.622	8.264	13.404	.0746	.914	1.
	8,960	100.537	547	6.11	Very Int.	1.818	10.381	18.873	.0530	.859	3.
	7,085	67.025	225	3.18	Int.	2.289	15.557	35.610	.0281	.245	1.

7

Very Int.	3.261	16.163	52.71	.019	1.807	4.874	29.2	.302	.035
Int.	2.377	2.362	5.644	.178	2.003	.386	4.76	.163	.920
Very Int.	14.854	116.704	1733.521	.00058	5.72	2.220	1093.852	.0191	.0191
Very Int.	6.859	22.55	154.67	.0065	7.12	3.016	244.8	.134	.077
Int.	1.446	9.439	13.649	.0733	1.295	2.642	18.97	.280	.364
Int.	1.323	7.642	10.110	.099	.809	2.724	10.61	.357	.291
Very Int.	2.523	15.284	38.561	.026	.455	1.538	11.14	.101	.074
Int.	2.475	15.284	37.85	.0264	.732	1.47	18.58	.096	.135
Very Int.	14.65	111.641	1635.541	.000612	4.821	.936	891.37	.084	.0397
Very Int.	6.848	21.627	148.102	.0068	2.240	2.669	78.790	.1243	.029
Very Int.	4.117	12.884	53.043	.0188	2.15	2.19	47.527	.1697	.0993
Very Int.	1.171	5.336	6.248	.160	.487	2.217	4.486	.414	.277
Int.	1.294	.385	.497	2.009	2.48	.913	9.571	4.131	9.366
Int.	1.367	6.106	8.347	.1198	.750	2.519	7.975	.4121	.277
Very Int.	5.053	16.437	83.059	.012	1.738	1.839	47.676	.1115	.0617
Very Int.	4.876	16.437	80.152	.0125	1.376	1.585	38.713	.0959	.0625
Very Int.	7.583	25.955	196.817	.0051	3.46	5.824	157.06	.225	.0181
Mod.	.723	.175	.1263	7.918	2.112	.686	.369	3.935	5.875
Int.	1.622	8.264	13.404	.0746	.914	1.415	8.38	.171	.272
Very Int.	1.818	10.381	18.873	.0530	.859	3.362	9.927	.324	.0861
Int.	2.289	15.557	35.610	.0281	.245	1.389	4.238	.0894	.0375

22. Okinawa-XI	3-4 May 45	1	⊗		x		J. 24th Div.	16,430	
23. Okinawa-XII	5-8 May 45	4	⊗	x			US 7th Inf.Div.	19,135 (11,016)	
24. Okinawa-XIII **	22-30 May 45	9	⊗			x	US 7th Inf.Div.	20,214 (12,095)	
25. Okinawa-XIV **	31 May-8 Jun 45	9	⊗			x	US 7th Inf.Div.	19,503 (11,384)	
26. Okinawa-XV *	9-18 Jun 45	10	⊗	x			US 7th Inf.Div.	18,958 (10,839)	
<u>KOREAN WAR</u>									
27. Korea-I	16-18 Sep 50	1.5	x		⊗		6th & 7th NKD	10,960	
28. Korea-II	18-21 Sep 50	4	⊗			x	US 25th Inf.Div.	16,626 (15,000)	
29. Korea-III	22-24 Sep 50	3	⊗			x	US 25th Inf.Div.	16,286 (14,660)	
30. Korea-IV	25-30 Sep 50	6	⊗			x	US 25th Inf.Div.	16,221 (14,595)	
31. Korea-V	7-9 Mar 51	3	⊗		x		US 25th Inf.Div.	25,516 (15,792)	
32. Korea-VI	3-7 Feb 51	5	⊗			x	US 25th Inf.Div.	29,006 (16,282)	
33. Korea-VII	3-5 Apr 51	3	⊗			x	US 25th Inf.Div.	26,021 (16,297)	
34. Korea-VIII	23-27 Apr 51	5	x			⊗	CCF 60th & 12th Armies	35,136	
35. Korea-IX	20-23 May 51	4	⊗			x	US 25th Inf.Div.	27,861 (18,137)	
36. Korea-X	1-2 Jun 51	2	x			⊗	CCF 63rd Army	37,000	
37. Korea-XI	3-5 Jun 51	3	⊗		x		US 25th Inf.Div.	13,660	

*Not plotted on graph.

**Attack not plotted on graph.

9

f.Div.	19,860 (12,212)	489.099	65	.532	Mod.	J. 12th & 14th Ind.Bns.	
f.Div.	19,473 (11,354)	489.099	101.7	.896	Mod.	J. 63rd Brigade	4,731
f.Div.	19,252 (11,133)	519.099	80	.718	Mod.	J. 24th Div.	16,430
iv.	16,430	97.286	3164	19.257	Very Int.	US 7th Inf.Div.	12,757 (7,294)
f.Div.	19,135 (11,016)	519.099	105	.953	Mod.	J. 24th Div.	14,000
f.Div.	20,214 (12,095)	519.099	69.5	.574	Mod.	J. Miscellaneous Units	4,000
f.Div.	19,503 (11,384)	519.099	55	.483	Light	J. 63rd Brigade	4,000
f.Div.	18,958 (10,839)	519.099	86.5	.798	Mod.	J. 63rd Brigade	2,500
NKD	10,960	125.672	320	2.92	Int.	US 25th Inf.Div.	15,158
nf.Div.	16,626 (15,000)	1043.751	93.7	.625	Mod.	6th & 7th NKD	10,250
nf.Div.	16,286 (14,660)	1043.751	77	.526	Mod.	6th & 7th NKD	8,960
nf.Div.	16,221 (14,595)	1043.751	17.33	.119	Light	6th & 7th NKD	7,085
nf.Div.	25,516 (15,792)	1245.819	83.3	.528	Mod.	CCF 38th & 50th Armies	27,000
nf.Div.	29,006 (16,282)	1373.950	60	.367	Light	CCF 50th Army and II NK Corps	30,200
nf.Div.	26,021 (16,297)	1348.950	50.3	.308	Light	CCF 26th Army (-)	12,532
& 12th Armies	35,136	282.068	1145.6	3.262	Int.	US 25th Inf.Div. +	26,849 (17,075)
nf.Div.	27,861 (18,137)	1348.950	42.5	.234	Light	CCF 64th & 65th Armies	38,000
Army	37,000	253.667	700	1.893	Int.	US 25th Inf.Div.	13,790
nf.Div.	13,665	729.630	78.7	.576	Mod.	CCF 63rd Army	35,500

10

2,900	22.614	530	18.276	Int.	6.848	21.627	148.102	.0068	2.240	2.669	78.790
4,731	37.961	426	9.025	Very Int.	4.117	12.884	53.043	.0188	2.15	2.19	47.527
16,430	97.286	426.8	2.59	Very Int.	1.171	5.336	6.248	.160	.487	2.217	4.486
12,757 (7,294)	252.842	150	2.056	Int.	1.294	.385	.497	2.009	2.48	.913	9.571
14,000	85.000	482	3.44	Int.	1.367	6.106	8.347	.1198	.750	2.519	7.975
4,000	31.580	371.7	9.295	Very Int.	5.053	16.437	83.059	.012	1.738	1.839	47.676
4,000	31.580	309.1	7.727	Very Int.	4.876	16.437	80.152	.0125	1.376	1.585	38.713
2,500	20.000	1,104	44.16	Very Int.	7.583	25.955	196.817	.0051	3.46	5.824	157.06
15,158	719.667	75.2	.497	Mod.	.723	.175	.1263	7.918	2.112	.686	.36
10,250	126.300	235	2.295	Int.	1.622	8.264	13.404	.0746	.914	1.415	8.38
8,960	100.537	547	6.11	Very Int.	1.818	10.381	18.873	.0530	.859	3.362	9.92
7,085	67.025	225	3.18	Int.	2.289	15.557	35.610	.0281	.245	1.389	4.23
27,000	266.800	2038.3	7.549	Very Int.	.945	4.669	4.412	.2265	.309	7.99	2.32
30,200	313.550	3161	10.466	Very Int.	.960	4.382	4.207	.2377	.199	10.9	1.54
12,532	96.840	519.3	4.143	Int.	2.076	13.93	28.919	.0346	.402	1.996	8.90
26,849 (17,075)	1348.950	93.2	.546	Int.	1.309	.2092	.2737	3.653	4.27	.265	.89
38,000	304.401	1194.3	3.143	Int.	.733	4.431	3.248	.3079	.1119	4.29	.76
13,790	699.630	76	.551	Mod.	2.69	.363	.9746	1.026	5.08	.205	1.8
35,500	240.993	1051.7	2.962	Int.	.385	3.027	1.165	.8583	.0222	7.696	.67

.65	111.641	1635.541	.000612	4.821	.936	891.37	.084	.0397
5.848	21.627	148.102	.0068	2.240	2.669	78.790	.1243	.029
1.117	12.884	53.043	.0188	2.15	2.19	47.527	.1697	.0993
1.171	5.336	6.248	.160	.487	2.217	4.486	.414	.277
1.294	.385	.497	2.009	2.48	.913	9.571	4.131	9.366
1.367	6.106	8.347	.1198	.750	2.519	7.975	.4121	.277
5.053	16.437	83.059	.012	1.738	1.839	47.676	.1115	.0617
4.876	16.437	80.152	.0125	1.376	1.585	38.713	.0959	.0625
7.583	25.955	196.817	.0051	3.46	5.824	157.06	.225	.0181
.723	.175	.1263	7.918	2.112	.686	.369	3.935	5.875
1.622	8.264	13.404	.0746	.914	1.415	8.38	.171	.272
1.818	10.381	18.873	.0530	.959	3.362	9.927	.324	.0861
2.289	15.557	35.610	.0281	.245	1.389	4.238	.0894	.0375
.945	4.669	4.412	.2265	.309	7.99	2.329	1.710	.0699
.960	4.382	4.207	.2377	.199	10.9	1.544	2.488	.0351
2.076	13.93	28.919	.0346	.402	1.996	8.907	.1433	.0744
1.309	.2092	.2737	3.653	4.27	.265	.893	1.995	5.974
.733	4.431	3.248	.3079	.1119	4.29	.760	.968	.0744
2.69	.363	.9746	1.026	5.08	.205	1.845	.565	3.435
.385	3.027	1.165	.8583	.0222	7.696	.671	2.542	1.945

III. COMPILATION OF CASUALTY EXPERIENCE

Part Three: Graphical Presentation of Casualty Data

Graphical Presentation of Casualty Data

The attached graphs present daily casualty rates (in per cent of unit strength) for each posture as a function of force ratios, using the force ratio product (manpower ratio times firepower ratio) as the basis of comparison. It should be emphasized that these graphs represent analysis of combat at the level of the division, or equivalent. The following graphs are attached:

- Attack against Fortified Position
- Attack against Prepared Position
- Attack against Hasty Defense
- Attack of Delaying Action
- Attack against Withdrawal from Action
- Defense of Fortified Position
- Defense of Prepared Position
- Hasty Defense
- Delaying Action
- Withdrawal from Action

In most of these graphs there are enough plots of sufficient engagements, with considerable diversity, to permit the drawing of curves which would represent mean values of casualties per day in relation to force ratios. This has not been done, however, since HERO believes that, in the light of the basic data from which these plots were made, there should possibly be two or three different curves. This is because of the exceptional superiority in firepower capability which American forces had over those of the Japanese and North Koreans. For this reason, we believe that it would be necessary to have more engagements analyzed, to include a larger proportion of examples from combat in the European Theater, before either the separate curves or a mean can be plotted with sufficient assurance. On the other hand, without more such data on hand, RAC may decide that curves based upon these plots are adequate for immediate requirements.

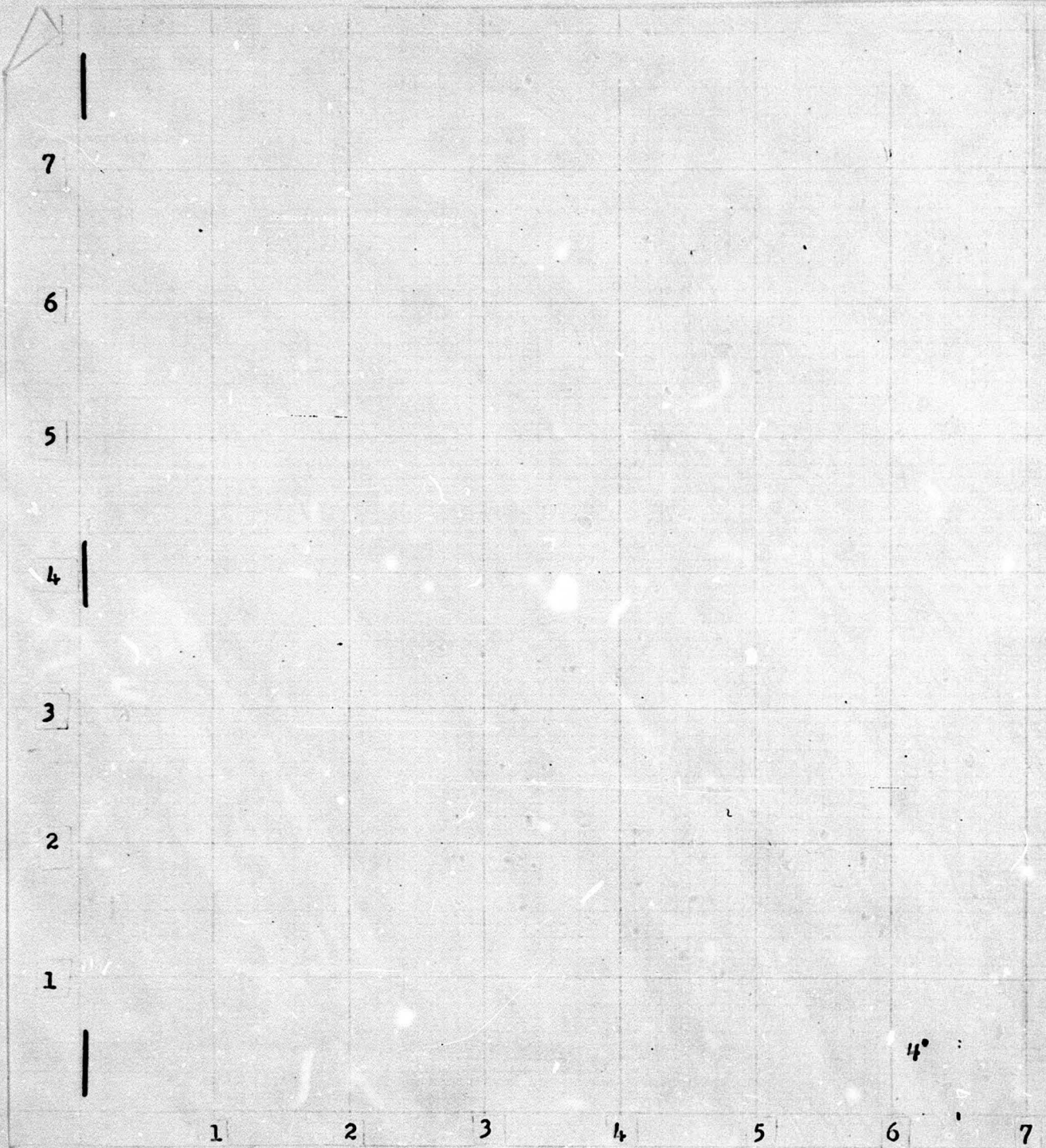
Because of the differences existing in the nature of the combat in the several theaters, and because of the differences in reliability of the data, the origin of each plot can be determined by the following key:

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Operations in Italy: •
Operations in France: o
Operations on Okinawa: x
Operations in Korea: -¼-

Where the plot represents success in the posture indicated, it is circled. No circles are shown for delaying action or withdrawal postures, however, since it is perfectly possible for each side to accomplish its mission in an engagement in one of these postures, and there are several such examples in this data.

As indicated under "Remarks" on the Tabular Presentation, in a few instances engagement data has not been plotted. This is when it involves obviously extreme cases of force ratios or casualty rates, which would not contribute to the objectives of the study if plotted.



19(a)

ATTACK AGAINST FORTIFIED POSITION

23 ⊗

15 ⊗

14 ⊗

8

9

10

11

12

13

14

15

16

21

Graph 1

14 ⊗

13

14

15

16



37

17 ⊗



20 ⊗

53

3

ATTACK OF PREPARED DEFENSE

8

7

6

5

4

3

2

1

1

2

3

4

5

6

7

27

7°

9°

8°

6°

4°



37

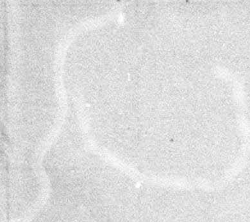


31

19 (4)

1

BACK OF PREPARED DEFENSE



31

4'

4 5 6 7 8 9



1

20

17

22^x



16

15

14

13

12

11

10

9

7

11

10

9

8

7

6

5

4

3

2

1

Latitude

36 -
2° 5'

1°

35 ⊕

32 ⊕

Face Ruler 1 2 3 4 5 6 7 8

19 (e)

ATTACK AGAINST HASTE DEFENSE

Handwritten scribbles and marks on the grid paper.

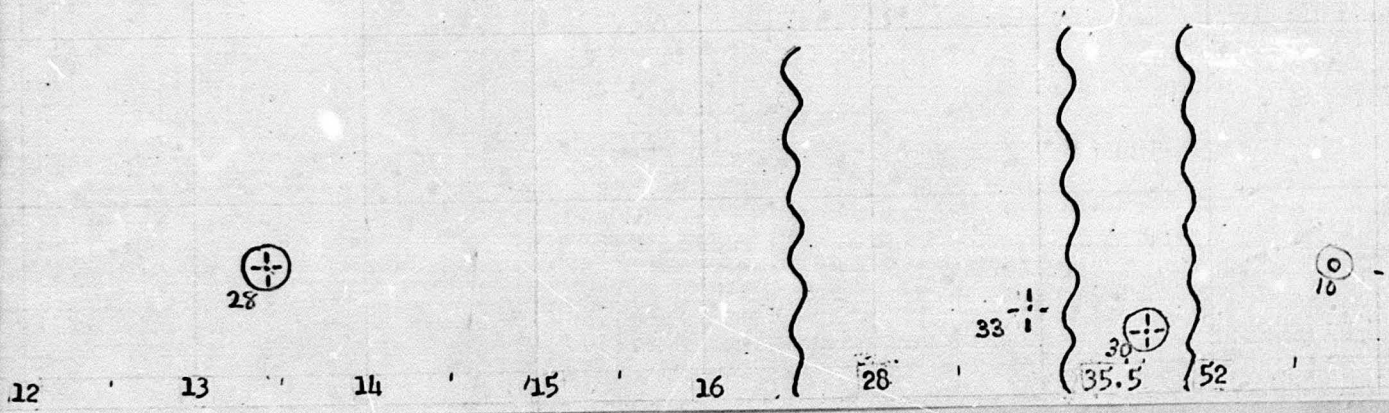
28 ⊕

7 8 9 10 11 12 13 14 15

3

3

Graph 3



8

7

6

5

4

3

2

1

+

34

11°

21°

3°

1

2

3

4

5

6

7

19-(d)

ATTACK OF DELAYING ACTION

8

9

10

11

12

13

14

15

16

2

Graph 4

29
+
16^x

14 15 16 17 18 38

3

ATTACK AGAINST WITHDRAWAL

8

7

6

5

4

3

2

1

12

13

14

15

16

17

18

19

25

27

19 (e)

1

ATTACK AGAINST WITHDRAWAL

16

17

18

19

21 $\frac{1}{1}$

35

30 $\frac{1}{1}$

52

10²

2

(e)

21

13^x

20

19

18^x

18



14

13

12

11

10

20^x

8

7

11

10

9

8

7

6

5

4

3

2

1

20*

x
17

x
14

.01

.02

.03

.04

.05

.06

.07

.08

19 (f)

3

DEPARTMENT OF PORTFOLIO INVESTOR

14^x

15^x

23^x

.06

.07

.08

.09

.1

.11

.12

.13

.14

3

Graph 6

.13

.14

.15

4 ⊙

.16

.17

.18

.19



8

7

6

5

4

3

2

1

31

7

9

6

4

.1

.2

.3

.4

.5

.6

.7

14-(g)

37

70

7

8

9

1.0

1.1

1.2

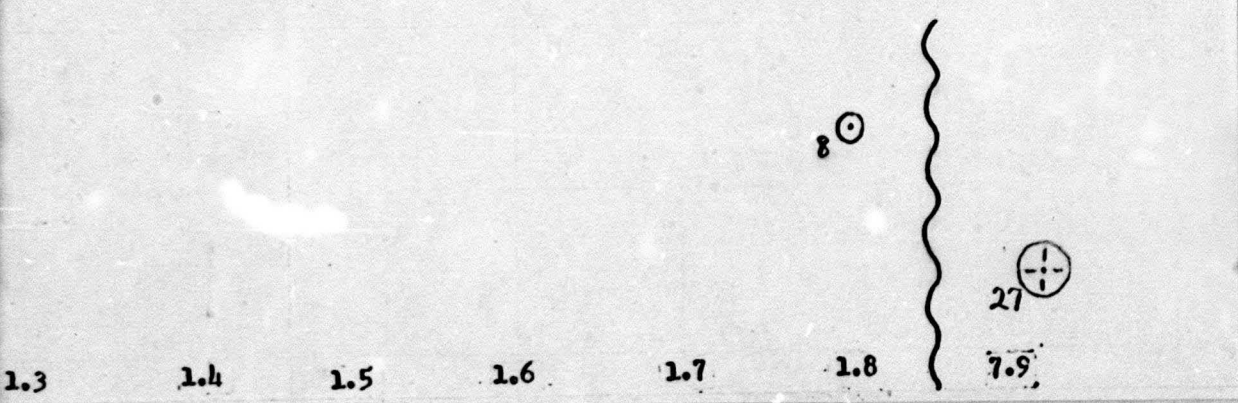
1.3

1.4

1.5

2

Graph 7



3

16 °
10

15

14

13

12

11

32⁺

10

9

8 |

11

32⁺

10

9

8

7

6

5

4

33⁺

3

30⁺

35⁺

2

28⁺

1

10

.1

.2

.3

.4

.5

.6

.7

19 (2)

3

HASTY DEFENSE

2[⊙]

⊕
36

⊙
5

.7

.8

.9

1.0

1.1

1.2

1.3

1.4

1.5

3

3

Graph 8

1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0

2.0

22



14

X
18

13

12

11

10

X
24

9

8

X
25

7

6

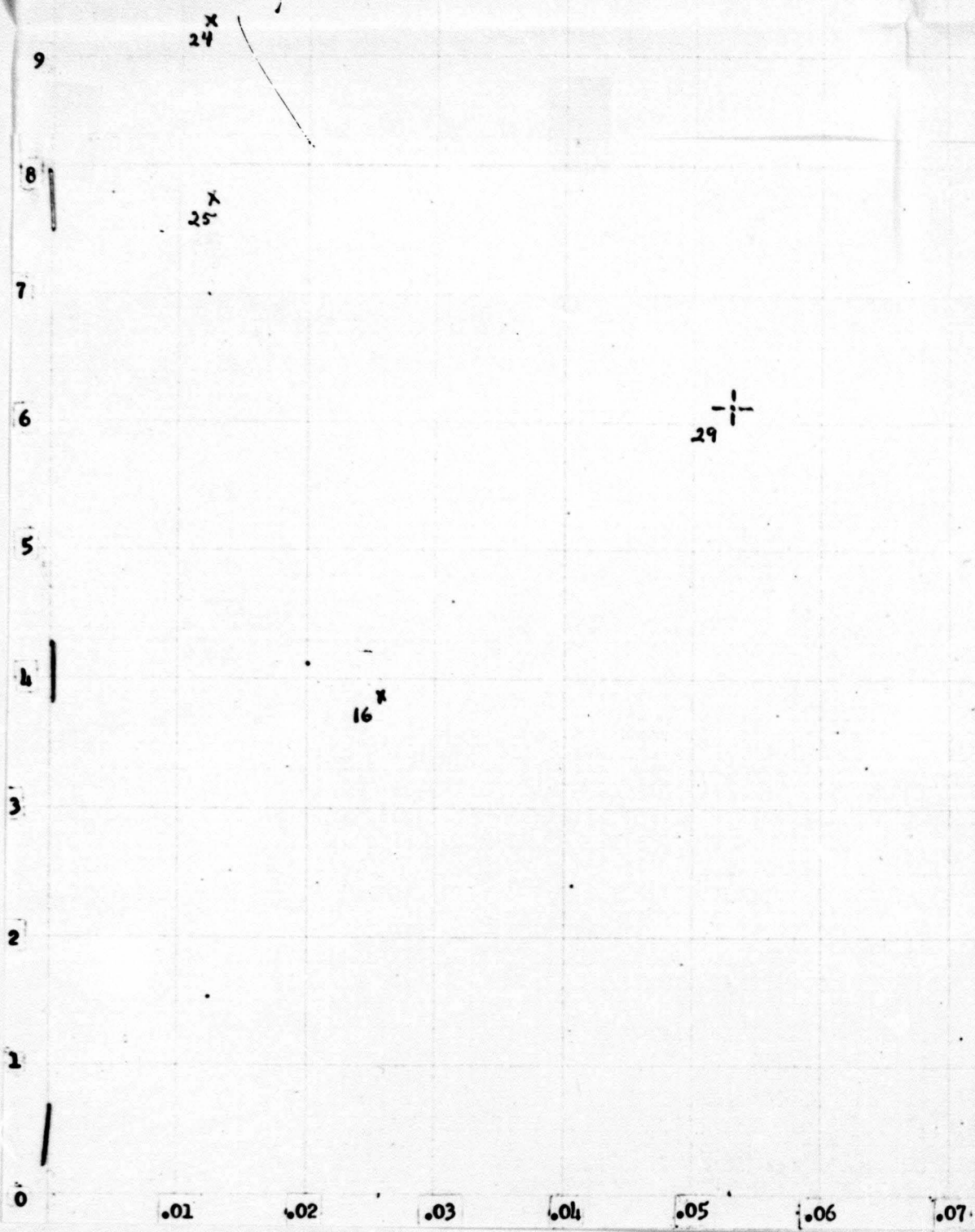
29 +

5

1

16 X

3



19(i)

2

DELAYING ACTION

.07

.08

.09

.1

.11

.12

.13

.14

.15

3

DELAYING ACTION

21 x

11°

3

.14

.15

.16

.17

.18

.19

.20

.21



.2 .21 .22 .23 .24 .25 .26

3



Graph 9



+

34

3.65

.23

.24

.25

3

.26



16

10°

15

14

13

12

11

10

9

|

8

1

11

10

9

8

7

6

5

4

3

2

1

.01

.02

.03

.04

.05

.06

.07

29 $\frac{1}{4}$

30 $\frac{1}{4}$

28 $\frac{1}{4}$

19 (j)

12

WITHDRAWAL FROM ACTION

29 $\frac{1}{4}$

28 $\frac{1}{4}$

.04

.05

.06

.07

.08

.09

.10

2

3

IV. OTHER INFLUENCES AFFECTING CASUALTIES

For reasons discussed at some length above, the factors and data developed in this study are not precise, even as averages. They could be refined and confidence in them heightened by further study. Part of this refinement should include consideration of qualitative and less obvious quantitative influences. The purpose of this section is briefly to suggest some of the considerations involved in such refinement, as revealed by the research and analysis in this study.

Intensity of Conflict

The data produced in this study confirms observations which have been made repeatedly by students of military combat statistics. Casualties are unquestionably a function not only of force ratios, but of intensity of conflict. Intensive conflict, in turn, depends upon a number of factors, and is not readily quantified. In a previous study,* HERO rather arbitrarily assumed that the intensity of conflict is reflected in the daily casualties as a percent of strength of an organization in combat. This study has tended to confirm the validity of that assumption. For division strength units the scale of intensity used in the other study has been somewhat modified, as indicated below. Although this appears valid in view of the additional data obtained in this study, the scale is still tentative and both the assumption and the factors should be studied further.

*"Historical Analysis of Wartime Replacement Requirements; Experience for Selected Major Items of Combat Equipment."

<u>Posture</u>	<u>Intensity</u>	<u>Casualties per day as percent of strength</u>
Attack	Very intense	5.0 or more
	Intense	1.6 to 4.99
	Moderate	0.5 to 1.59
	Light	0.0 to 0.49
Defense or Withdrawal	Very intense	5.0 or more
	Intense	0.9 to 4.99
	Moderate	0.3 to 0.89
	Light	0.0 to 0.29
Delaying Action	Very intense	1.0 or more
	Intense	0.5 to 0.99
	Moderate	0.2 to 0.49
	Light	0.0 to 0.19

To some extent, intensity of conflict is merely a reflection of other intangibles such as: the morale of the forces engaged; the tenacity, skill, and determination of the leaders; the nature of the terrain in relation to the posture of one or both of the engaged forces; and the doctrines--or interaction of the doctrines --of the engaged forces.

For instance, the side which is numerically inferior, or which is at a strategic disadvantage, may be willing to take greater risks or to fight more desperately in a given situation than a force which is in an apparently more favorable situation. Furthermore, it can never be proved that a successful force has been pressed to the limit of its endurance. While a defeat or a withdrawal might indicate that the limit of courage or determination has been reached by the defeated side, it has not necessarily reached the limit of its endurance, nor fought with the desperation or intensity of which it is potentially capable. To a considerable extent the intensity of conflict frequently will reflect, on one side or the other, the individual characteristics of the top leadership; one leader may react to a level of casualties incurred in quite a different fashion from another leader, even in the same army.

Combat Capability

Combat capability is a reflection of a number of factors, most of which defy precise quantification. It includes the quality of leadership. It certainly reflects the state of morale of the troops, their collective combat experience, the nature and thoroughness of their training, and the like.

There is clearly a fruitful area for further investigation with respect to the interaction of tactical doctrines. For instance, comparison of the available records of US casualties incurred on Okinawa with those incurred against German forces in Italy and France shows substantial differences in the distribution of casualties over the zone of action. In the operation of American forces against the Japanese, forward infantry units evidently absorbed a higher percentage of total casualties; the division rear area was relatively safer than comparable support areas of units engaged against the Germans. A detailed examination of this phenomenon could probably produce interesting material for evaluation of American tactical concepts, as well as for refinement of war game models and inputs.

The Influence of Terrain

Terrain is influential in combat to the extent that its uses are understood by commanders, and acted upon by trained and experienced troops; and conversely as unprepared forces are subject to it as an obstacle or to skillful employment of it by the enemy to his advantage. Through the Germans' appreciation of the terrain in Italy and application of the principle of economy of force, they were able to control defiles, and to make maximum use of superior observation. The result was a high price paid by Allied forces for their advances, and controlled German withdrawals which avoided desperate last stands and entrapments. This also permitted the Germans, with considerably inferior quantities of ammunition reserves, to make relatively more effective employment of what they had. It is clear that the value which is to be placed upon terrain in the prediction of combat losses, or in structuring combat models, is a function of the enemy against whom operations are anticipated as well as of the combat posture.

The Influence of Time

It was not possible in this study to give any consideration to the influence of time or duration of combat on numerical results of the study. It is very clear, however, that the time factor is significant in the evaluation of casualties. (There are some interesting notations to this effect in RAC--TP-185, by Robert J. Best, "Casualties and the Dynamics of Combat".) In the latter stages of a lengthy period of sustained combat, the rate of casualties clearly falls off. Although the reasons for this cannot yet be precisely evaluated they include: declining eagerness on the part of the troops, regardless of how their morale may otherwise be affected by the duration of the engagement; decreased tempo of the combat as a result of exhaustion on both sides; probable reduction of firepower for similar reasons, or possibly for lack of ammunition. There is, then, need for further study of the interaction of the number of casualties sustained by a unit, and the various manifestations of the time factor. Such a study should consider a variety of examples.

Meteorological Influences

Earliest historical reports of combat demonstrate that weather, as well as routine meteorological conditions (such as tides, length of daylight hours, moonlight) often affected military operations, sometimes decisively. As a matter of principle, combat analysts normally assume that the meteorological factors will affect both sides more or less equally, save in such obvious exceptions as amphibious or airborne operations. It is doubtful, however, if such an assumption is valid. Clearly further investigation is desirable.

Quantification of Independent Variables

In the Replacement Requirements study, HERO suggested a new approach to the development of a mathematical formula which would result in at least partial quantification of influences which are qualitative and whose effect is significant. HERO believes that there is great merit in the possibility of developing factors mathematically which--when applied with the conditioning effect of historical judgment--can be relied upon as reliable and relatively precise. HERO visualizes the possibility that, in the analysis of combat experience for the purpose of constructing realistic

combat models, the historian and the analyst working together should be able to develop reliable computer inputs which would give proper weight to the combinations of circumstances which are unique to every battle.

Areas for Future Exploration

HERO is unaware of any comprehensive or authoritative study which undertakes reliable compilation of relevant combat data for 20th-Century conflicts in the fashion of Thomas L. Livermore in Numbers and Losses in the Civil War, or G. Bodart in his famous, Militar-historisches Kriegs-Lexikon. This fact has been noted in a valuable article in the September-October 1966 issue of Operations Research, "Combat Models and Historical Data: the U.S. Civil War," by Herbert K. Weiss. As Weiss says, there is need for such a survey of recent conflict for historical purposes, and above all for the development of realistic and useful combat models for analytical and predictive purposes for current combat, and for the development of war game inputs.

A first step in any such modern analysis could be a comprehensive review of the three sources cited in the previous paragraph. Additional sources which should be studied include several documents produced by RAC, particularly: RAC--TP-185, "Casualties and the Dynamics of Combat," by Robert J. Best; RAC--T-445, "Distribution of Combat Casualties by Causative Agents," by Geoffrey A. Burt, Janice T. Engleman, et. al.; and ORO--T-261, "The Structure of a Battle," by Robert J. Best. A number of British Army Operations Research Group documents should also be studied, including, "Battle Wastage Rates of Personnel in War," by H.G. Gee.

V. OBSERVATIONS

Experience acquired in the course of research and analysis suggests the following observations:

1. Despite the inadequacy of the German records now available in the United States, the results of this investigation clearly establish the validity of the hypothesis basic to this study: that the historical approach to the records of conflict will yield data expressible as quantitative inputs for wargaming. Inputs can be derived in terms of combat effectiveness, combat posture, forces present, types of force, forces engaged, and casualties.

2. The quantitative relationship between relative firepower and casualties in six different postures, as derived in the study, while not necessarily precise, is in each case a true relationship within reasonable parameters of error. Further study, including a search of records that were not immediately available, may be expected to refine the figures to a much greater degree of preciseness at lower levels of resolution, but probably without significant variation in relationships.

3. Before mean casualty rate curves can be drawn with confidence, there should be enough data from each of several theaters, with differing combat conditions, to permit first drawing separate curves for each of these theaters. These can be compared and, if desired, mean casualty rate curves or other compilations can be derived from the separate theater curves.

4. A more prolonged study, including (a) a search of records in the West German archives to obtain information comparable to that available for US forces, and (b) a search of US and German sources for precise information on ammunition expenditures to achieve a more realistic calculation of relative firepower, should produce game inputs of a kind and quality not otherwise obtainable.