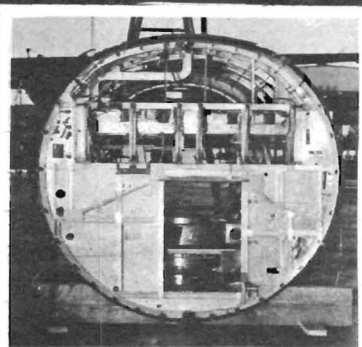
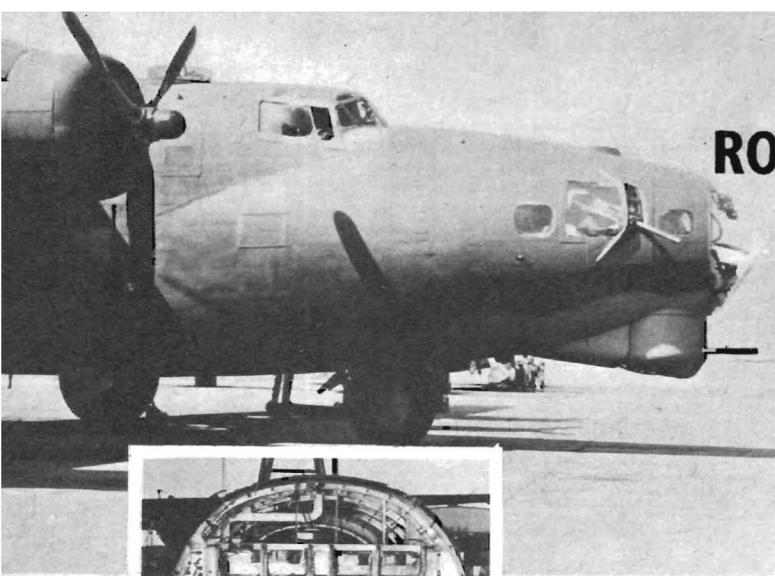


ROUND PEG IN A SQUARE HOLE



The B-24J fitted with a B-17G nose turret is shown in the pictures above, below and on the opposite page. Inset, above and below, are views of the B-17 nose cross section, and the B-24 fuselage cross section showing the wide variation which had to be faired in.

WHEN the B-24 Liberator first became available in operational numbers during World War II it was superior to its USAAF stablemate, the B-17 Flying Fortress, in several vital performance characteristics. Most important of these were range and bomb load. However, by early 1944 the addition of a nose turret and additional armour had increased the weight and drag of the the Liberator to the extent that these advantages over the Fortress had been lost and the service ceiling of the aircraft, never as high as the B-17's, had been reduced to an altitude considered less than desirable for operations over Europe. Moreover, the B-24 nose turret installation had seriously reduced forward visibility from the flight deck and bombardier's station, and made it necessary for the navigator to function in badly cramped quarters.

This general deterioration in B-24 operational suitability was of understandable concern to the USAAF, and a priority project to improve Liberator performance was undertaken by the Material Command. Known as the "B-24 Weight Reduction Program", its objectives included greater speed and altitude for the aircraft as well as solutions to the crowded quarters and poor visibility problems in the nose compartment.

Meeting at Wright Field on March 3, 1944, the Weight Reduction Committee considered a variety of changes that might aid in solving the Liberator's shortcomings. Among them were the incorporation of more powerful turbo superchargers to improve the service ceiling, a faired Bell power boost tail turret and single fin to "pick up an additional 10 mph (16 km/h)", plus numerous suggestions on how to increase forward visibility and room in the nose.

Inasmuch as the B-17 nose configuration was more streamlined, provided adequate space for the navigator and excellent visibility for the bombardier, it was taken as the standard by which any B-24 modification would be measured. Thus it probably was inevitable that during the discussions someone would pose the obvious question: "Why not try a Fortress nose on the Liberator?"

Why not indeed? On May 26, 1944 the Material Command issued a directive for the experiment, assigning it a First Priority Project rating.

Fitting a B-17G nose to a war-time B-24J Liberator was no simple task. The complete story is told here for the first time by Allan G Blue

A preliminary study of the problems involved in making the installation was undertaken by the Material Command Engineering Division at Wright Field. Although the participating personnel reported that an all-new nose design for the B-24 appeared to be a little more practicable, the study reported the hybrid idea feasible and actual conversion was scheduled to take place during June at the Air Service Command's Middletown, Ohio, Depot.

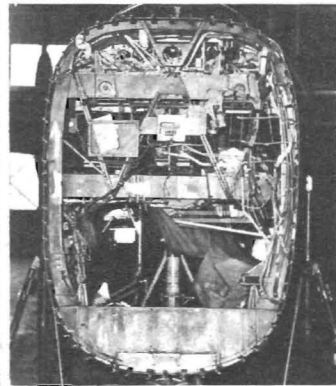
A B-24J (Serial 42-73130) was made available for the project by Aircraft Test Control, and was flown to Middletown on June 5th. The next day the airplane was weighed and work began immediately on stripping the nose back to station 1.0 and fabricating a mock-up mating structure.

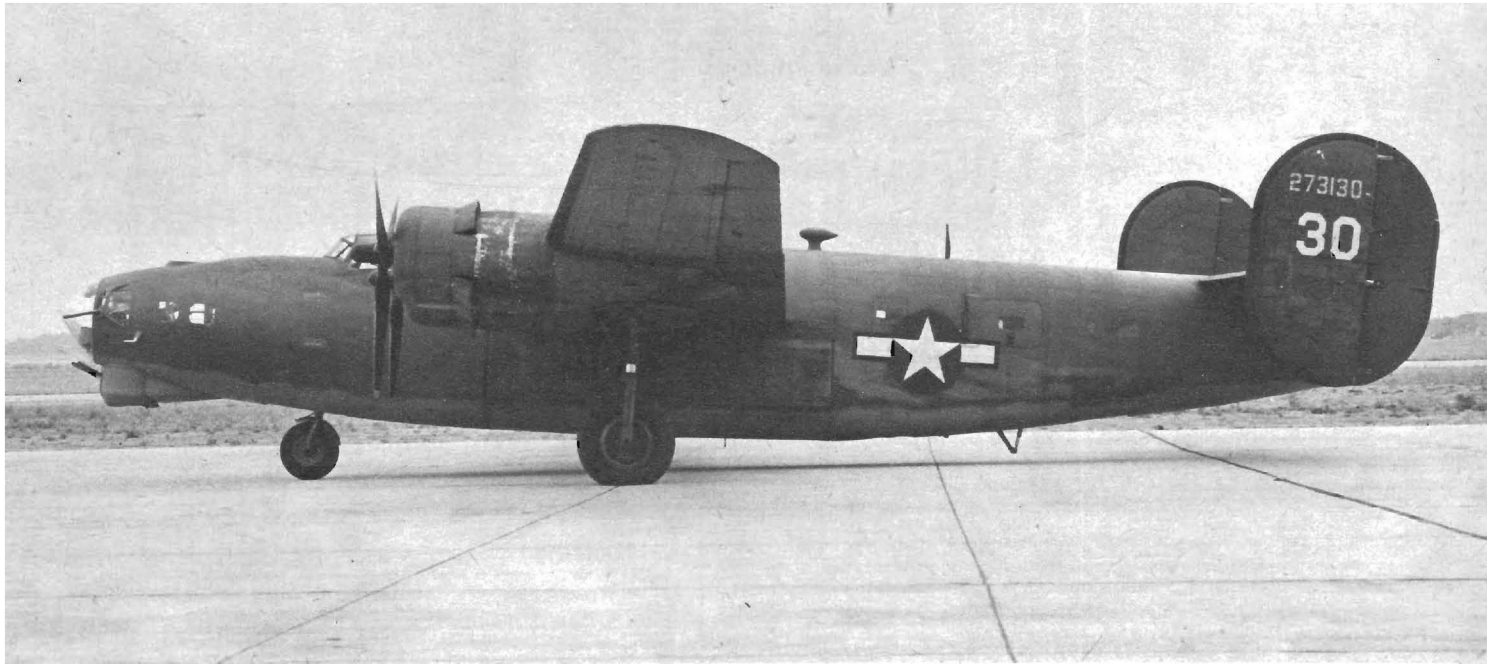
It had been arranged for a new B-17G nose section to be shipped from the Douglas plant at Long Beach, California, and a conference with Middletown Air Depot personnel on June 6th agreed that the project could be finished 20 days after receipt of the B-17 nose section. In this connection, however, investigation into the possibilities of completing the work more expeditiously revealed that a recent accident at Langley Field, Virginia, had resulted in considerable damage to a B-17G (Serial 42-97772) but the nose section forward of station 3 was still in pretty good shape. Arrangements were made to obtain this nose section and it arrived at Middletown on June 11, 1944. The nose section ordered from the West Coast arrived at the depot five days later. It was originally planned to trade this one for the one taken from Langley Field but, as this proved unnecessary, it was used instead to supply certain damaged parts on the first nose section.

CONVERSION DETAILS

Mating the nearly circular Fortress cross-section with the slab-sided B-24 was literally a "square peg in a round hole" problem. Because of the interference with installed equipment no joining of sections as proposed in the original study was considered feasible. However, through main structural fairings, one at the top and one on each side, were used as originally planned. The two side structural fairings terminated at B-24 station 2.1 forward of the jack points. Aft of this point the new skin was pure fairing in nature, with provisions for access to the jack points, and ended approximately one foot forward of the bomb bay doors.

The side structure was formed by a continuation aft, from station 3.0 of the B-17, of right





and left longitudinal stiffeners and longerons. Decreasing numbers of the stiffeners tied into structural extensions of B-24 bulkheads at stations 1.0, 1.1, 1.2 and 2.1. A structural bulkhead extension was accomplished by riveting an inboard extruded angle through the skin to the B-24 bulkheads at the various stations, adding a sheet metal web and, finally, an outboard extruded angle of the proper contour to carry the skin aft from the sides of the B-17 nose section. Triangular webs were installed radially from longitudinal stiffeners at B-17 station 3.0 to B-24 station 1.0. Aft of B-24 station 1.0, webs were installed radially between the B-24 fuselage and outer skin at each B-17 stringer to transfer the load to the B-24 skin. Non-structural webs serving as formers were attached to B-24 stations 3.0 and 3.1 to carry pure fairing aft of station 2.1 to the area ahead of the bomb bay doors where the new fairing joined the B-24 skin. For the top structural fairing, the upper B-24 longitudinal stiffeners were extended forward and tied into the B-17 nose structure in approximately the same manner.

The modification was completed on July 2nd. The final configuration, while not qualifying the ship for any beauty prize, did represent a somewhat better aerodynamic package than the standard B-24J. One problem, however, was immediately apparent. The B-17 nose section, longer by over two feet, actually increased the weight of the aircraft by 437 lb (198 kg).

The aircraft was returned to Wright Field on July 6th, where a brief check-out flight was conducted by the Flight Section of the Material Command. With a take-off gross weight of 56,000 lb (25 400 kg) and speed, power and stability tests conducted at 10,000 ft (3 048 m), the test crew found the Liberator to have stability and handling characteristics "essentially the same as other B-24 airplanes", while the air speed was "apparently 8.5 mph (13.7 km/h) faster." The aircraft was then routed to the AAF Proving Ground at Eglin Field, Florida—by way of Bolling Field in Washington DC so that it could be given the once-over by Pentagon representatives.

During World War II the AAF Proving Ground Command at Eglin Field represented the final testing agency for all types of AAF equipment intended for introduction into operational service. As such, its examinations were designed to simulate, as closely as possible, the actual conditions under which each weapon of war would be used.

FLIGHT TESTING

Three flights were scheduled for the modified aircraft. The first, at low altitude, was to obtain air speed and other instrument calibration and to allow the crew to become familiar with the 30 ton hybrid. The second and third missions were to be identical in profile, varying only in weight of bombs carried. Weight data for the second flight were as follows:

Basic aircraft weight	38,648 lb (17 530 kg)
Gasoline (2,700 US gallons)	16,200 lb (7 348 kg)
Oil	900 lb (408 kg)
Crew (ten)	2,000 lb (907 kg)
Ammunition (5,130 rounds)	1,640 lb (744 kg)
Bombs	6,000 lb (2 721 kg)
Total take-off weight	65,388 lb (29 658 kg)

On the third flight bomb load was increased to 8,000 lb (3 629 kg), the full military load for the B-24J, resulting in a total take-off weight of 67,388 lb (30 566 kg).

The missions were flown as briefed during August, 1944. On both altitude flights a maximum ceiling of only 18,500—19,000 ft (5 638-5 791 m) could be obtained. At that point, with the engines pulling 40 inches of mercury at 2,400 rpm, cylinder head temperatures went over the red line and it was necessary to open the cowl flaps. This in turn dropped the air speed and prevented any additional altitude gain, as well as setting up a mild tail buffeting.

Lack of longitudinal stability at altitude was very apparent. The pilot, Major Julian A Harvey, found it extremely difficult to hold the indicated air speed within plus or minus five miles per hour during climb and cruise conditions. At altitude, directional stability also was poor; the aircraft had a tendency to yaw, was slow in recovery from turns, and, in the opinion of the test crew, would have been "very difficult to fly in tight formation".

Not surprisingly, the Eglin Field Report found the modified aircraft "operationally unsuitable", citing the weight increase, stability problems, unsatisfactory ceiling, and generally poor performance of the aircraft. It recommended that further development be discontinued.

With both the Wright and Eglin Field test results before it, the Engineering Division of AMC did a bit of hedging in its final report before recommending that the B-17/24 conversion be dropped and the existing B-24J nose be redesigned to obtain the desired objectives. To begin with, of course, no weight reduction had been achieved and the additional weight of the basic installation had grown to a third of a ton (mostly due to 0.50 in calibre ammunition for the nose and cheek guns) in the combat condition simulated at Eglin. Then there was the apparent disagreement on the stability question. Here the final report agreed with Major Harvey at least in part: "Since the installation of the B-17 nose extended the length of the B-24, approximately 24 in (60 cm), it is to be expected that the directional stability would be decreased somewhat due to the added forward fin area. Longitudinal stability would also be decreased for the same reason. In the latter case, however, the greater portion of the decrease would tend to be balanced out by the improved centre of gravity position resulting from the added weight forward."

On the vital question of service ceiling, however, the report took issue with Eglin. "From power settings given in the Eglin Field Report it appears that the airplane was climbed at reduced powers necessitated by the high head temperatures encountered. Service ceiling was consequently limited as noted. The Air Technical Service Command cannot agree, however, with the implication that the high head temperatures and the consequent reduction in service ceiling was in any way the fault of the B-17 nose installation. Reports received by Air Technical Service Command indicate that similar conditions have frequently been encountered in standard B-24J airplanes."

One thing everybody did agree on, however—working room and visibility for the bombardier and navigator were excellent. Just as in the nose of any other B-17G!