

AD A 030845

UNITED STATES ARMY AVIATION TEST BOARD  
Fort Rucker, Alabama 36362

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(12) 14P.  
(11) 11 MAR 1964

STEBG-TD

SUBJECT: Report of Test, (USATECOM ~~Project No. 4-4-6010-01~~)  
Service Test of Helmet, Flying, Fragmentation Protective

TO: Commanding General  
US Army Test and Evaluation Command  
ATTN: AMSTE-BG  
Aberdeen Proving Ground, Maryland 21005

1. References. A list of references is attached as inclosure 3.

2. Authority.

a. Directive. Letter, AMSTE-BG, Headquarters, US Army Test and Evaluation Command, 9 August 1963, subject: "Directive for Service Test of Helmet, Flying, Fragmentation, Protective, USATECOM Project No. 4-4-6010-01."

b. Purpose. <sup>→ THIS STUDY WAS DONE</sup> To determine the suitability of the Helmet, Flying, Fragmentation Protective, as a replacement for the standard APH-5 Helmet now in use.

3. Background.

a. The Army has a need for protective headgear for aircrewmen. This headgear must give impact, acoustic, and ballistic penetration protection and have provisions for attachment of respiratory equipment. Additionally, the aircrewman must be permitted to perform his duties efficiently.

b. The APH-5 is the current standard aircrewman headgear. This helmet was designed by the Navy and adapted for Army use with modifications. The APH-5 was designed primarily for crash protection and possesses minimal ballistic protective qualities.

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c. In September 1961, a Task Group was established to study the problem associated with aircrewman headgear and to make recommendations to provide a helmet with the required characteristics. The Task Group recommended that an interim replacement helmet for the APH-5 be provided as soon as possible, incorporating appropriate state-of-the-art improvements and fragmentation protection. The test item was designed by the US Army Natick Laboratories to fulfill this interim aircrewman headgear requirement.

c. The test helmets were received by the US Army Aviation Test Board (USAAVNTBD) on 4 September 1963. The helmets were furnished in two sizes--medium and large.

4. Description of Materiel. The helmet is made of ballistic-resistant nylon laminated with 35 to 40 percent modified phenolic resin. It has an energy-absorbent liner made of expanded plastic and soft, resilient foam sizing pads for size adjustment. Integrated with the helmet is a retractable visor, communication equipment, nape strap with pad, and chin strap with pad.

5. Test Objectives. To determine the extent to which the test item meets the proposed Qualitative Materiel Requirement for aircrewman protective headgear by evaluating the following:

a. Physical characteristics (weight, size, restriction of peripheral vision, and glare attenuation).

b. Durability.

c. Degree of user comfort or discomfort.

d. Ease of fit, donning, and doffing.

e. Stability on the user's head.

f. Ambient noise suppression.

g. Compatibility with existing aviator CBR protective equipment, aircraft oxygen, ejection seats, and communication systems.

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h. Maintenance requirements.

6. Scope. The service test was conducted by USAAVNTBD personnel at Fort Rucker, Alabama, during the period 18 October 1963 through 18 November 1963. The test consisted of use of the helmet for 30 days and approximately 250 flying hours by USAAVNTBD and US Army Aviation School (USAAVNS) personnel. The US Army Aero-medical Research Unit (USAARU), the US Army Aviation Human Research Unit (USAAHUMRU), and the US Army Board for Aviation Accident Research (USABAAR) participated in the test.

7. Findings. (Details of test are contained in inclosure 1.)

a. The internal size and shape of the helmet were unsatisfactory for the reasons explained in paragraphs c and d below. Weight of the test helmet was acceptable.

b. The helmet was sufficiently durable for general use.

c. The inside shape of the helmet was such that it caused extreme discomfort on the pilot's forehead after approximately 30 minutes' wear. Most pilots found two hours to be the limit of their endurance even after periodically repositioning the helmet. Various arrangements of the sizing pads were tried, but no successful arrangement was found.

d. It was extremely difficult to achieve a proper fit with the spacing material provided. Poor fit caused discomfort, contributed to instability, and led to poor retention. No difficulty was experienced in donning and doffing.

e. Instability and poor retention were major deficiencies of the helmet. The pad suspension system allowed compression of the pads by a very small static or dynamic loading and subsequent loosening of the chin and/or nape strap by an equivalent amount. The strap then slipped over the chin and the helmet was easily removed. With poor stability and retention characteristics, there is little or no crash protection.

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- f. Ambient noise suppression qualities of the helmet were satisfactory.
- g. The helmet was compatible with existing aviator CBR protective equipment, ejection seats, and aircraft communications systems.
- h. Only minor repairs were required.
- i. The earcup assembly mounts and the lower edge of the visor were safety hazards.

8. Discussion.

a. Although a minimum number of helmet sizes is logistically and economically desirable, it is imperative that a sufficient number of correctly shaped sizes be available so each crewman is fitted for maximum stability. With properly sized helmet shells, less padding will be required.

b. With poor stability and retention characteristics, there is little or no crash protection. Rotation of the helmet on the crewman's head can expose critical areas of the head or cause loss of the helmet. While logistical simplicity, low initial procurement cost, ballistic penetration protection, and comfort are important factors, it must be remembered that the helmet is primarily for crash protection.

c. There should be no metal between the helmet shell and the crewman's head. The earcup assembly mount was a safety hazard and negated any advantages this earcup and assembly might otherwise have had over those in the APH-5 helmet.

d. Each hole in the shell weakens its integrity. It appears feasible to run the communications cord under the lower left side of the helmet and eliminate the hole where it now passes through the shell. The microphone mounting bracket causes the microphone boom to protrude so that it could become a snagging point to twist the head or displace the helmet. The bracket should be removed and the boom attached directly to the helmet, as on the APH-5. This would result in a cleaner overall configuration and eliminate another shell hole.

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9. Conclusion. The fragmentation protective flying helmet, in its present configuration, is unsatisfactory as a replacement for the standard APH-5 Helmet now in use.

10. Recommendations. It is recommended that:

- a. The deficiencies listed in inclosure 2 be corrected.
- b. The helmet be retested after the deficiencies listed in inclosure 2 are corrected.
- c. The shortcomings listed in inclosure 2 be corrected as technically and economically feasible.



A. J. RANKIN  
Colonel, Armor  
President

- 4 Incl  
1. as  
2. as  
3. as  
4. Photographs

USATECOM PROJECT NO. 4-4-6010-01

SERVICE TEST OF HELMET, FLYING,

FRAGMENTATION PROTECTIVE

TEST DATA

1. Physical Characteristics.

a. Weight. The weight of the test helmet was within user tolerance. However, weight reduction is highly desirable for increased stability and comfort.

b. Size. One size (large) had to be padded to fit all crew members since no one was found who could wear the medium helmet with the recommended minimum of two pads. The consequence was instability and poor retention because of an excess of large soft pads or discomfort and reduced protection due to a lack of space for the proper pads.

c. Restriction of Peripheral Vision. No objectionable restriction to peripheral vision was noted.

d. Glare Attenuation. The glare attenuation qualities of the visor were satisfactory.

e. Visor and Housing. The lower edge of the visor was sharp and would be a potential hazard to the nose if the helmet rotated forward during a crash or an ejection. Although the visor housing was quite durable it was heavy and contributed to a top-heavy condition.

f. Earcup Assembly Mount. The earcup assembly was mounted too far forward within the helmet. Discomfort was often experienced even after full rearward adjustment. The large metal hinge, spring, and rod which constitute the mount created an extreme hazard due to their close proximity to the carotid, posterior, and auricular arteries and would be likely to cause severe lacerations during a crash sequence.

g. Communications Cord. The self-coiling communications cord allowed greater freedom of movement within the cockpit than the straight cord. It passes through the left side of the helmet about one inch from the lower edge. This location, when using an ejection seat,

INCLOSURE 1

was an improvement over the central location because it did not come between the helmet and the headrest.

h. Microphone. The microphone cancelled out background noise quite effectively. Its small size and light weight reduced the forward center of gravity to a minimum. The probability of breakage or causing facial lacerations during a crash is reduced because of its shorter length.

i. Microphone Boom. The double-jointed boom appeared fragile; however, the only trouble experienced was constant loosening of the screw in the center of the microphone boom.

j. Microphone Mounting Bracket. The microphone mounting bracket was unnecessary since the microphone boom could be attached directly to the helmet. Elimination of the bracket would reduce the possibility of the boom's becoming a snagging point.

k. Styrofoam Liner. The liner was cut away on the lower side to accommodate the earcup assembly; consequently, no energy-absorbing protection was afforded substantial portions of the temporal and parietal skull.

l. Pads. Nine pads (three front, three top, and three rear) were furnished with each helmet. The inner set of pads provided bump and buffeting protection. Its unyielding nature made it hard and uncomfortable to wear directly against the head. Therefore, at least a second set of pads was necessary. A third set of pads was provided for sizing if the helmet was still too loose; however, this contributed to instability because the pads were soft and easily compressed.

2. Durability. The helmets were worn during the test period by aircrewmen in various Army aircraft. The helmets were exposed to normal handling and usage during training and operational flights. The helmets were sufficiently durable for general use.

3. Degree of User Comfort or Discomfort. The inside shape of the helmet was such that it caused extreme discomfort on the crewman's forehead after approximately 30 minutes' wear. This was partially a result of the styrofoam liner extending approximately 3/4 inch lower in the front of the test helmet than in the APH-5 helmet. Protection is highly desirable in the area above the crewman's eyebrows, but provision must be made for this interior protection in the outer helmet shell

design. Various arrangements of the sizing pads were tried in attempt to relieve the excessive pressure on the forehead. No satisfactory arrangement was discovered.

4. Ease of Donning and Doffing. Test personnel experienced no objectionable difficulty in donning and doffing the helmet once they were familiar with it. The two-piece chin strap was an aid in both instances.

5. Stability. The helmet was unstable and could be rotated easily about all axes of the crewman's head even with the chin strap tightened to the point of intolerance for prolonged wear.

6. Ambient Noise Suppression. The noise suppression qualities of the helmet were satisfactory.

7. Compatibility with Existing Equipment. The helmet was compatible with the M24 Pilot's Protective Mask, the E45 Hood, the Martin-Baker Ejection Seat, and current Army aircraft communications systems. It had no oxygen mask retention fittings and was not tested for compatibility with aircraft oxygen systems. This requirement was eliminated by Quartermaster Research and Engineering Command (reference 4).

8. Maintenance Requirements. Crewmembers made minor repairs such as tightening the screw in the microphone boom and replacing ear-cup cushions which tended to slip out of place. Some cracked paint was noted on visor covers, but repainting was not required.

## DEFICIENCIES AND SHORTCOMINGS

1. The following deficiencies were noted:

<u>Deficiency</u>	<u>Suggested Corrective Action</u>
a. The internal size and shape were unsatisfactory, resulting in poor stability and retention characteristics.	Redesign the helmet so that it may be properly fitted.
b. The helmet was furnished in two sizes--only one of which was usable.	Furnish wider range of sizes.
c. The metal earcup assembly mounts presented a safety hazard because of their close proximity to carotid, posterior, and auricular arteries.	Replace earcup assemblies and mounts with the APH-5 type.
d. Absence of styrofoam liner on lower insides of helmet left portions of the skull without proper protection.	Provide styrofoam liner on lower insides of helmet.
e. Lower edge of the visor was a potential safety hazard.	Burnish or cover the lower edge of the visor.

2. The following shortcomings were noted:

<u>Shortcoming</u>	<u>Suggested Corrective Action</u>
a. The microphone boom screw continually loosened.	Stabilize the microphone boom screw.
b. The external microphone mounting bracket presented a snagging point.	Eliminate the bracket and attach the microphone boom directly to the helmet.
c. Weight of the visor cover was excessive.	Provide a lighter weight cover.

INCLOSURE 2

Shortcoming

d. Chin strap attached to exterior of helmet contributed to poor stability and retention characteristics.

Suggested Corrective Action

Attach chin strap to inside of helmet.

### LIST OF REFERENCES

1. Letter, AMSTE-BG, Headquarters, US Army Test and Evaluation Command, 9 August 1963, subject: "Directive for Service Test of Helmet, Flying, Fragmentation, Protective, USATECOM Project Number 4-4-6010-01."
2. Letter, AMXRE-COP, Headquarters, Quartermaster Research and Engineering Command, 19 July 1963, subject: "QMR&E Command 64003. Service Test of Helmet, Flying, Fragmentation, Protective."
3. Proposed Qualitative Materiel Requirement, US Army Combat Developments Command Aviation Agency, 25 June 1963, title: "Qualitative Materiel Requirement for Aircrewman Protective Headgear."
4. Letter, AMXRE-COP, Headquarters, Quartermaster Research and Engineering Command, 5 November 1963, subject: "Service Test of Helmet, Flying, Fragmentation, Protective, USATECOM Project Number 4-4-6010-01," and 1st Indorsement, Headquarters, US Army Test and Evaluation Command, 14 November 1963.
5. Message 11-65, STEBG-ACFT, US Army Aviation Test Board, 21 November 1963, "Interim Report for Service Test of Helmet, Flying, Fragmentation, Protective, USATECOM Project Number 4-4-6010-01."
6. Letter, AMSTE-BG, Headquarters, US Army Test and Evaluation Command, 17 January 1964, subject: "Service Test of Helmet, Flying, Fragmentation Protective, USATECOM Project No. 4-4-6010-01."

USATECOM PROJECT NO. 4-4-6010-01

SERVICE TEST OF HELMET, FLYING,

FRAGMENTATION PROTECTIVE

PHOTOGRAPHS

INCLOSURE 4

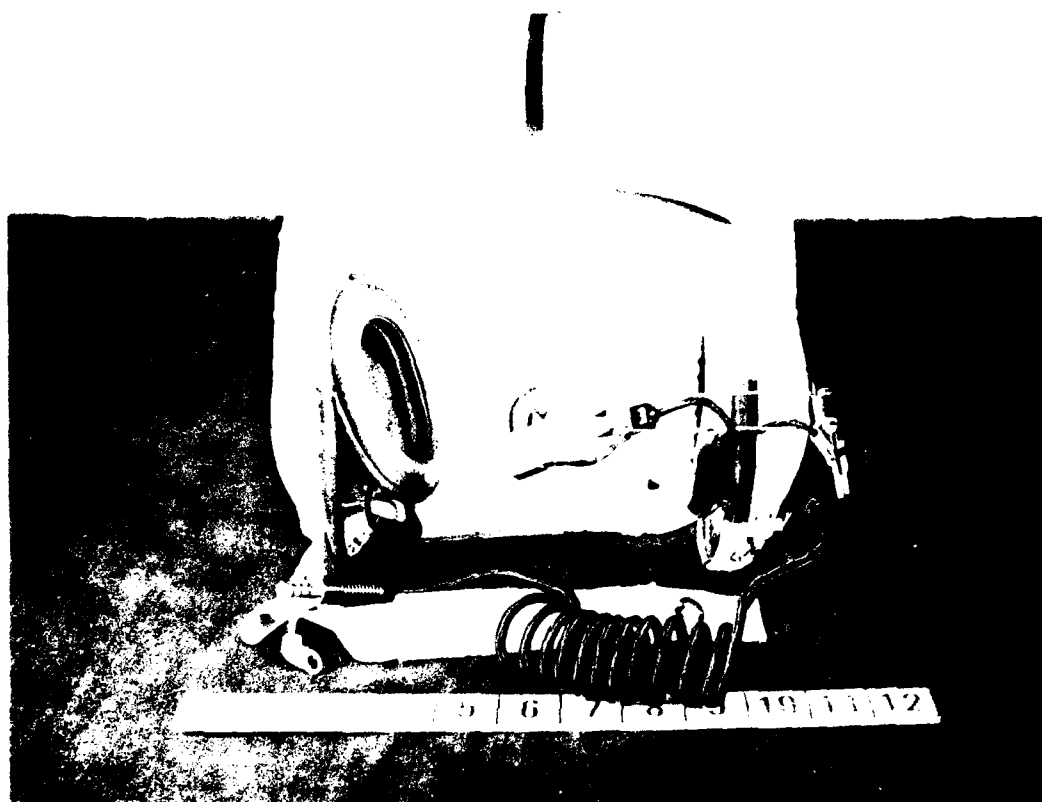


Figure 1. Front view of helmet, sizing pads not installed.

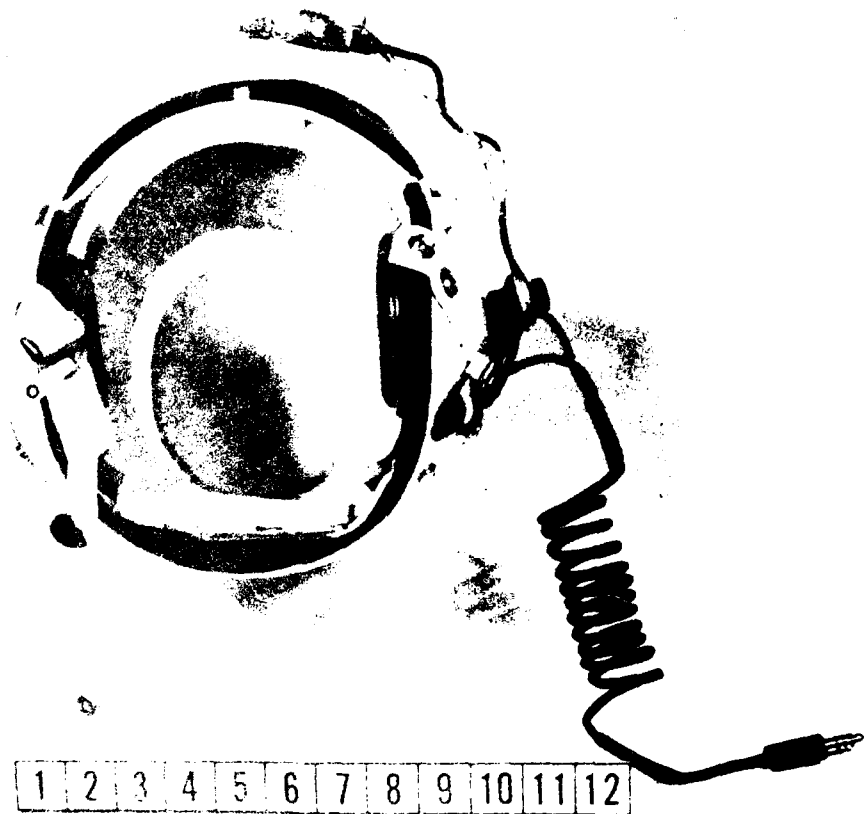


Figure 2. Bottom view of helmet. sizing pads installed.

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 Service Test of Helmet, Flying, Fragmentation, Protective

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Aberdeen Proving Ground, Maryland 21005

AMSTE-BG

2 April 1964

SUBJECT: Report of Test, USATECOM Project No. 4-4-6010-01,  
Service Test of Helmet, Flying, Fragmentation  
Protective

TO: Commanding General  
U. S. Army Materiel Command  
ATTN: AMCRD-DE  
Washington, D. C. 20315

1. Inclosed is the U. S. Army Aviation Test Board's letter report covering recent Service Test of the Helmet, Flying, Fragmentation Protective (Incl 1).
2. Analysis of the report indicates that the subject Helmet, in its present configuration, would not be a suitable replacement for the standard APH-5 Helmet now in use.
3. This headquarters concurs with U. S. Army Aviation Test Board's recommendations that the deficiencies be corrected and the helmet retested.

FOR THE COMMANDER:

2 Incl  
1. Distribution Test (5 cys)  
2. as (5 cys)

/s/ Robert A. Bailey  
/t/ ROBERT A. BAILEY  
1st Lt AGC  
Asst Admin Officer

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