

25 January 1971

Materiel Test Procedure 7-3-086
U. S. Army Aviation Test Board

U. S. ARMY TEST AND EVALUATION COMMAND
COMMODITY SERVICE TEST PROCEDURE

OXYGEN AND PROTECTIVE MASKS (AVIATION)

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1. OBJECTIVE

This document provides existing test methods and techniques necessary to determine the degree to which aviation oxygen and protective masks meet the requirements of the Qualitative Materiel Requirement (QMR), Small Development Requirement (SDR), or Technical Characteristics (TC's), and whether or not these items are suitable for Army use.

2. BACKGROUND

a. Requirements exist for Army aviation crewmember masks which dispense life supporting oxygen to the wearer and for masks which protect the crewmember's respiratory track, face, and eyes from contact with various chemical agents such as those used for riot control, for smoke, and for anti-plant missions.

b. The oxygen mask is the interface between the crewmember and the aircraft's personnel oxygen system. As such, the mask is usually constructed from elastomer materials moulded in various sizes to fit the individual's face and nose. A flexible hose connects the mask to an appropriate regulator which meters oxygen at low pressure to the user, usually on a demand basis. A built-in microphone allows the wearer to converse with other crewmembers on the interphone and to participate in air-to-ground communications while wearing the mask. Masks of the type described are used in Army aircraft required to operate at altitudes where the atmosphere's oxygen content is less than 16 percent.

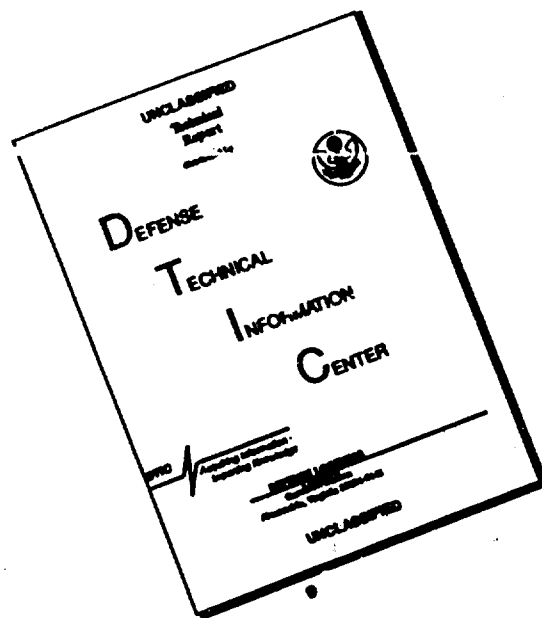
c. Protective masks, on the other hand, do not usually require a source of gaseous oxygen for their operation, but rely on filtration to remove various chemical agents from the air available for inhalation. The protective mask is designed to cover the entire face and eyes and is commonly worn with a headpiece or hood and permeable or impermeable types of protective clothing. Since the mask does not require a closed gaseous system for respiratory protection, an aircraft oxygen system is not required. However, certain protective masks can be adapted as an alternate dispenser of oxygen, the M-24 protective mask for example. Protective masks utilizing only air purifying filters are not effective in confined spaces where the oxygen content is not normally sufficient for sustaining life; the protective mask, the accessories, are intended for use by crewmembers involved in the dissemination and/or transport of chemical agents.

d. To illustrate the scope of the present day requirement and to indicate the trend which future requirements may take, three types of Army aviation masks are described below:

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- 1) Aviation Demand Oxygen Masks - This type of mask is used to dispense gaseous oxygen from diluter demand regulators to the crewmembers of Army aircraft such as the OV-1 and others containing appropriate oxygen systems. This type of mask does not require protective helmet removal when used, and the mask contains a built-in microphone for communications purposes.
- 2) Aviation Protective Masks - These masks are used to provide aircraft pilots and crewmembers with respiratory protection in flight and on the ground whenever aircraft are used to disseminate chemical agents and munitions. Major components usually include a facepiece, filter canister, carrier, antidim set, and antiglare eyelens outserts.
- 3) Combination Oxygen and Protective Mask - Masks of this type provide for the mission requirements described by 1) and 2) above. Essentially, these masks consist of the basic aviation protective mask and a kit which can be used to adapt the mask for direct connection to appropriate aircraft oxygen supply systems.

e. The aviation oxygen and protective mask service test must provide for assessing wearer physical and psychological reactions to the masks, the degree of protection afforded under applicable mission conditions, and the ease with which the masks are maintained under operational conditions.

3. REQUIRED SUPPORT

- a. Measuring tools to determine dimensions, weights, and time.
- b. Test subjects.
- c. Photographic equipment.
- d. Sizing and fitting facilities.
- e. Aircraft with appropriate chemical dispensing/transporting facilities.
- f. Aircraft with appropriate oxygen systems.

4. REFERENCES

- A. USATECOM Regulation 70-23, Research and Development: Equipment Performance Reports (EPRs).
- B. USATECOM Regulation 70-24, Research and Development: Documenting Test Plans and Reports. (As implemented by USAAVNTBD Pamphlet 705-1).
- C. USATECOM Regulation 385-6, Safety: Verification of Safety of Materiel During Testing. (As implemented by USAAVNTBD Memo 385-10).
- D. USATECOM Regulation 700-1, Quality Assurance: Value Engineering.
- E. USATECOM Regulation 108-1, Photographic Coverage. (As implemented by USAAVNTBD Memo 108-1).

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- F. USATECOM Regulation 750-15, Maintenance of Supplies and Equipment: Maintenance Evaluation During Testing. (As implemented by USAAVNTBD Memo 750-2).
 - G. MTP 7-3-500, Physical Characteristics.
 - H. MTP 7-3-501, Personnel Training.
 - I. MTP 7-3-506, Safety.
 - J. MTP 7-3-507, Maintainability.
 - K. MTP 7-3-508, Reliability.
 - L. MTP 7-3-510, Human Factors.
 - M. MTP 7-3-514, Adequacy of Technical Manuals.
 - N. MTP 7-3-519, Photographic Coverage.
 - O. HEL Standard S-1-63B, Human Engineering Laboratories.
 - P. FM 3-8, Chemical Reference Handbook.

5. SCOPE

5.1 SUMMARY

a. The evaluation of aviation mask suitability for crewmember protection is only one element of the overall service test requirement. Additional elements of the service test must address overall operational suitability, comfort, masking and unmasking characteristics, compatibility with personal equipment, and suitability of the mask from the human factors and safety standpoints.

b. To quantitatively evaluate these elements, service tests are conducted under operational conditions by personnel representative of those who will wear the mask in actual operations in Army aircraft. The service test will record the observations of supervisory test personnel together with those of appropriate specialists called upon to comment on the mask. Test personnel will be interviewed, and their observations and recommendations will be recorded and correlated with other test data.

c. The data collected during the service test will be reviewed to obtain subjective and numerical indicators which characterize the mask's operational suitability. Tabulations, charts, and other graphic displays will be employed to present these indicators. Evaluation of test data will include comparisons of actual and desired performance criteria, and performance indicators obtained from the use of standard masks employed in similar or identical mission roles.

5.1.1 Preparation for Test

This section provides guidance for test project planning, facility and equipment requirements, and preparation for test personnel training and familiarization.

5.1.2 Test Conduct

The following tests are provided by this document:

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a. Arrival Inspection and Physical Characteristics - Procedures for an evaluation of the mask's arrival condition and for determining mask's dimensions and weight.

b. Functional Suitability - This section provides procedures for evaluation of the areas listed below:

- 1) Masking and unmasking.
- 2) Protection to the wearer.
- 3) Compatibility with the aviation environment.
- 4) Operational suitability.
- 5) Communications suitability.
- 6) Comfort.

c. Durability - An evaluation of the mask's characteristics to withstand wear under normal conditions of handling and usage.

d. Maintainability - To determine the suitability of the equipment for accomplishing scheduled and nonscheduled maintenance tasks over the entire period of service testing stated in terms of maintenance downtime and mean time to repair.

e. Reliability - To determine the mission reliability of the equipment in terms of failure-free operation time and mean time between failures.

f. Maintenance Evaluation - To determine the maintenance characteristics of oxygen and protective masks and the adequacy of the tools, test equipment and technical manuscripts and manuals.

- 1) Maintenance Characteristics - To determine the adequacy of modular construction and accessibility of components to provide ease of maintenance.
- 2) Tools and Test Equipment - To determine the adequacy of common and special tools and test equipment to perform the specified maintenance and repair functions.
- 3) Draft Technical Manuals - To determine whether the draft technical manuals are clear, accurate, and complete.

g. Human Factors - An evaluation of the man/item interface to determine the adequacy of mask design and performance characteristics related to the physical and psychological effect of the mask on the wearer.

h. Safety - An evaluation of mask design and performance characteristics to identify any hazard or hazardous conditions which could result in degradation of crewmember performance.

5.1.3 Test Data

This section details the data to be collected and recorded while completing the procedures of 6.2, TEST CONDUCT.

5.1.4 Data Reduction and Presentation

This section provides instructions for evaluating and displaying the data recorded and collected during testing.

5.2 LIMITATIONS

This MTP is intended to be used as a basic guide when preparing test plans for aviation oxygen and protective masks. Suitability for Army use criteria and attendant test procedures shall be determined in response to specific QMR, SDR, or TC requirements.

6. PROCEDURES

6.1 PREPARATION FOR TEST

The project officer should follow reference 4.3., with respect to plans and reports of tests. Certain planning information specifically applicable to aviation masks are provided by the following paragraphs:

6.1.1 Test Planning

6.1.1.1 Test Criteria

The project officer shall select test criteria which will adequately satisfy the officially stated objectives for service testing aviation oxygen and protective masks. Efforts should include, as a minimum, the following actions:

- a. Review the test directive.
- b. Study the QMR, SDR, or TC's.
- c. Review authorized sources of criteria such as--
 - 1) Designated test directive references.
 - 2) Mask specifications, or drafts thereof.
 - 3) Special instructions accompanying the test directive.
- d. Review authorized criteria inputs from cooperating agencies such as--
 - 1) United States Army Aeromedical Research Laboratory (USAARL).
 - 2) United States Army Aviation School (USAAVNS).
 - 3) United States Army Board for Aviation Accident Research (USABAAR).
- e. Study mask engineering test data, recommendations, and conclusions, as applicable.

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f. Prepare schedules and coordinate with appropriate levels of command as necessary to obtain appropriate test subjects. See 6.1.2 Mask Issue.

6.1.1.2 Required Equipment, Facilities and Personnel

Arrange for the items listed under Section 3, REQUIRED SUPPORT, and for special consultants, e.g., aeromedical specialists, etc., or other personnel required during the service test. Schedule photographic coverage required; see references 4.E. and 4.N.

6.1.2 Mask Issue

Select appropriate test subjects whose regular duties, TDY assignments and/or training commitments will afford an overall usage schedule of maximum mask exposure to the appropriate aviation operational environment within the time frame allocated for the service test. Consider, as a minimum, the following elements:

a. Select test subjects of the occupational specialty for which the mask is intended. Personnel whose head sizes are within the median, fifth, and ninety-fifth percentiles should be represented in the test subject group (provided appropriate mask sizes are available). This should include individuals wearing glasses, contact lenses, or dentures.

b. Obtain test subject head and facial measurements. Convert these measurements to the proper selection of face piece, e.g., short-narrow, regular-narrow, etc. Outfit each mask for final fitting by the individual crewmember. Consult reference 4.O.

c. Photograph representative test subjects wearing the mask prior to operational usage, as appropriate.

6.1.3 Familiarization

6.1.3.1 General Familiarization

a. Consult appropriate sections of reference 4.H., and familiarize test personnel and test subjects with the mask, accessories, and procedures of the service test. Accomplish, as a minimum, the following actions:

- 1) Familiarize personnel with specific evaluation objectives.
- 2) Acquaint flight personnel and/or other applicable test subjects with questionnaires, forms, etc., which are required during the operational evaluation of the mask.
- 3) Demonstrate the recommended technique for masking and unmasking, as applicable. Illustrate the use of head straps and harness, as applicable.

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b. Familiarize appropriate personnel with training and/or referee chemical agents planned for use during the service test. Consult reference 4.P.

c. Familiarize appropriate personnel with reference 4.N. and that portion of reference 4.E. applicable to the photographic coverage required.

6.1.3.2 Preflight Briefing Content

a. Ensure that flight personnel scheduled to take part in all types of mask evaluations receive the standard mission briefings including, as a minimum, the following:

- 1) Simulated tactical situation.
- 2) Weather conditions.
- 3) Air traffic control and communications procedures.

b. Ensure that all personnel involved in the execution of flight-ground protective mask evaluations involving referee agents have been--

- 1) Adequately trained in the characteristics of the agents and equipment to be used.
- 2) Briefed on the proper handling procedures.
- 3) Introduced thoroughly to safety precautions, first aid and decontamination procedures.
- 4) Adequately trained on provisions for crew protection, in-flight detection of malfunctions, and emergency procedures involving chemical agents.

6.2 TEST CONDUCT

6.2.1 Arrival Inspection and Physical Characteristics

6.2.1.1 Arrival Inspection

a. Inspect shipping containers for evidence of damage. Photograph any damage noted.

b. Examine container markings and record those which identify contents, indicate quantity, and mask size.

c. Unpack the mask container(s) and inventory the content against the Basic Issue Item List (BIIL) and external container markings which identify contents. Submit EPRs where differences in inventory lists and contents are found to exist.

d. Confirm suitability of the mask for test as demonstrated by freedom from variations in workmanship, damage or defect. Damage and/or material defect(s) shall be photographed and reported by EPR.

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6.2.1.2 Physical Characteristics

Consult reference 4.G. and perform the following:

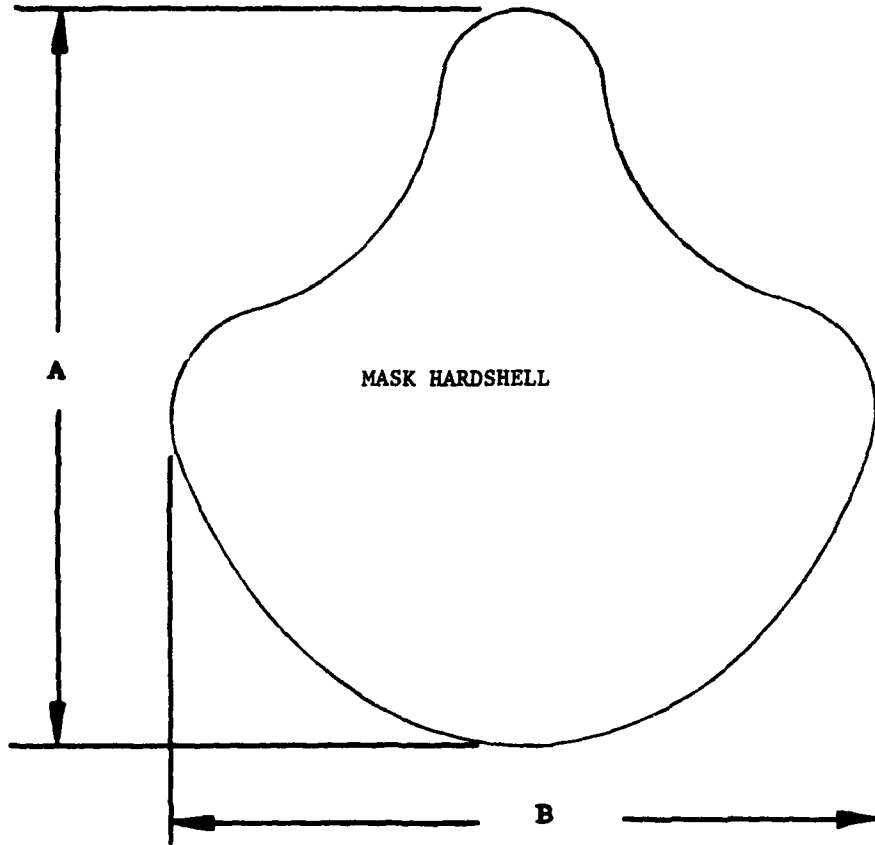
- a. Measure the significant dimensions of each mask size, e.g., large, medium small, etc., as illustrated by Figure 1, Typical Front View Dimensions, and Figure 2, Typical Side View Dimensions.
- b. Measure the lengths of the following components:
 - 1) Adjustment straps (minimum and maximum lengths).
 - 2) Delivery tube (nominal at rest length and maximum length).
 - 3) Microphone cord length (minimum and maximum lengths).
 - 4) Suspension harness straps, as appropriate.
- c. Measure the protective mask's filter canister dimensions (height and diameter).
- d. Weigh--
 - 1) The mask ready for service use with canister and accessories, as applicable.
 - 2) The mask readied for storage (include accessories, carrying case, etc.).
- e. Determine by trial fittings the range of head-face sizes and shapes (ideally from the 5th to the 95th percentile) that the mask will accommodate.
- f. Photograph the mask and accessories.

6.2.2 Functional Suitability

6.2.2.1 Masking and Unmasking

- a. Observe and photograph test subjects donning the mask. Evaluate, as a minimum, the following:
 - 1) Degree of interference caused by communications accessories, the delivery tube, canister and carrying case, suspension devices, etc.
 - 2) Ease of adjusting the mask and head harness to obtain a tight, comfortable facial and head fit.
- b. Observe and photograph test subjects doffing the mask. Evaluate, as a minimum, the following:
 - 1) Ease with which straps, harness, cordage, and fasteners were released for rapid and convenient doffing.

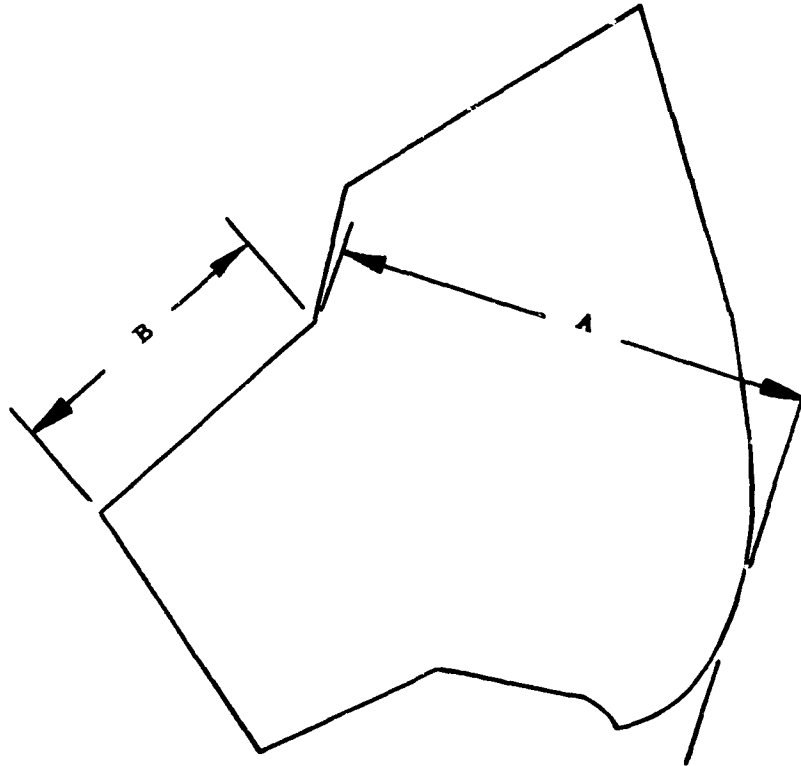
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DIMENSION	LARGE	MEDIUM	SMALL
A			
B			

Figure 1. Front View Dimensions, Typical

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DIMENSION	LARGE	MEDIUM	SMALL
A			
B			

Figure 2. Side View Dimensions, Typical

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- 2) Ease with which the mask was cleared of moisture and returned to the carrier.

- c. Record the time required to don and doff the mask under routine and simulated emergency conditions, as applicable.

6.2.2.2 Protection of the Wearer

6.2.2.2.1 Oxygen Masks

- a. Issue the mask to flight personnel (see 6.1.2, Mask Issue) who are assigned as crewmembers of aircraft equipped with appropriate oxygen dispensing systems.

- b. Issue the standard mask to half the crew of each evaluation aircraft in order that comparative data be collected under similar operational conditions.

- c. Evaluate the mask under simulated operational conditions.

- d. Evaluate, as a minimum, the following:

- 1) Mask leakage characteristics (with mask worn by both clean shaven personnel and personnel with a day's growth of beard).
 - 2) Face adherence characteristics in the presence of a high velocity air stream.
 - 3) Adequacy of delivery hose length.

- e. Describe any occasion where the mask failed to provide oxygen to the wearer in the proper quantity due to leakage, rupture or failure of internal valves, collapse of delivery tube, or restriction of internal passages.

6.2.2.2.2 Protective Masks

- a. Issue the protective mask and standard protective clothing and accessories as required to flight personnel who are assigned as crewmembers of aircraft equipped to dispense or transport chemical agents.

- b. Issue the standard protective mask to half the crew of each evaluation aircraft in order that comparative data be collected under similar operational conditions.

- c. Evaluate the protective mask using training smoke and/or referee agents (see reference 4.P.). Consider the following elements as a minimum:

- 1) Agent dispensing at low altitude, at various airspeeds, and in the presence of varying wind conditions (speed and direction).

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- 2) Mission conduct under directed environmental conditions.
- d. Evaluate, as a minimum, the following mask characteristics:
- 1) Leakage when mask is worn by both clean shaven personnel and crewmembers with a day's growth of beard).
 - 2) Protection afforded to the face and eyes.
 - 3) Face adherence suitability in the presence of high velocity air stream.

6.2.2.3 Compatibility with Aviation Environment

a. Evaluate the mask's compatibility with standard items of flight clothing and the following items of personal equipment:

- 1) Personnel armor.
- 2) Protective helmet.
- 3) Protective (CBR) clothing.
- 4) Parachute.
- 5) Ejection seat.
- 6) Eyeglasses.
- 7) Sun glasses.
- 8) Contact lenses.
- 9) Helmet sunshade.
- 10) Dentures.

b. Evaluate the mask's compatibility with all inventory aircraft in which use is anticipated. Record any evidence that the mask or attached components, e.g., harness, straps, cords, etc., had a tendency to catch or snag on objects in the aircraft. In particular, evaluate the mask for any characteristics which could interfere with crew member entrance to, or exit from, the aircraft under routine and emergency conditions.

c. Evaluate any possibility of the mask preventing or interfering with a crewmember's ability to turn his head when assigned to both primary and alternate crew stations.

d. Photograph, where possible, findings of the evaluations of a. through c. above.

6.2.2.4 Operational Suitability

Evaluate the following features of the mask, as a minimum, under conditions identical to those described in paragraphs 6.2.2.2.1 and 6.2.2.2.2, as applicable.

a. Effect of the protective mask's eyelens and supporting structure on the crewmember's peripheral vision.

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- b. Effectiveness of antifogging kit or provisions to reduce eyelens fogging (reduction of condensed water droplets to an even film on the eyelens).
- c. Effectiveness of antiglare eyelens outserts to reduce glare without impairing the crewmember's vision.
- d. Length of time required to don the CBR mask.
- e. Length of time required to put on the oxygen mask when required due to mission/flight requirements.
- f. Ease of adjusting either the oxygen or protective masks to prevent leakage and obtain wearer comfort (with and without gloves).
- g. Suitability of mask for being adjusted with one hand.
- h. Removal and ease of stowage following use of mask. Common suspension device suitability and ease of returning the mask to the carrier, as appropriate.
- i. Communication cordage and delivery tube lengths to allow adequate freedom of crewmember movement within the cockpit.
- j. Effect on masks of various G-forces as experienced in abrupt aircraft maneuvers.
- k. Operational characteristics of masks in varying climatic conditions such as precipitation and non-precipitation, high and low temperature, and high and low humidity environments.
- l. Operation of masks at high and low altitudes.

6.2.2.5 Communications Suitability

- a. Evaluate the transmission qualities of the mask mounted microphone and the degree with which external aircraft noise was reduced by the type of microphone mounting and supporting structure acoustic characteristics. Interview crewmembers immediately following flights in which the test mask was utilized. As a minimum, determine the following:
 - 1) Degree of background noise noted when receiving voice transmission made by the test mask microphone on the interphone.
 - 2) Received voice clearness and general understandability of received voice messages as compared with transmissions of other crewmembers not wearing a mask.
- b. Evaluate the voice transmission qualities of the mask mounted

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microphone as influenced by the available range of adjustment, if any. Interview ground-to-air radio circuit operators to assess whether or not any speech articulation differences and/or speech interference levels could be discerned between the test mask microphone and the microphones used as part of the standard mask(s). See Appendix A for representative questions to be used during interviews.

6.2.2.6 Comfort

a. Evaluate the wearer's comfort while performing primary duties and his ability to perform required tasks with minimal discomfort. This evaluation should be carried out under as many varied climatic and operational conditions as possible.

b. Interview mask users and obtain, as a minimum, the following information:

- 1) Odor characteristics when new and after prolonged use.
- 2) Harness, adjustment straps, strings, etc., effect on the wearer's comfort.
- 3) Degree of perspiration build-up under the mask and wearer's ability to clear moisture without exposure to chemical agents or loss of life supporting oxygen.
- 4) Effect on the wearer's face, e.g., results in skin rash(es), or other form of skin irritation. Also, users should be questioned on the degree of facial smoothness required to avoid leakage or beard-face discomfort.
- 5) Interference with eyeglasses, sunglasses, contact lenses, helmet sunshade, or dentures.

c. Obtain user's opinion regarding the long term comfort of the mask as compared with the standard issue mask (oxygen or protective). See Appendix A for sample questions to be used during interviews.

6.2.3 Durability

a. At the completion of the service test, inspect each mask that was exposed to normal handling and usage during training and operational flights. In particular, observe for, as a minimum, the following:

- 1) Faceblank permanent set which may affect the fit of the mask.
- 2) Excessive stiffness of the facepiece.
- 3) Any tackiness, brittleness, or indication of tears, splits, etc.
- 4) Offensive odor(s).
- 5) Adjustment strap(s) loss of elasticity, as applicable.
- 6) Carrier wear.
- 7) Eyelens condition, as applicable.
- 8) Condition of the delivery tube.

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- 9) Any evidence of communication cordage fraying at microphone mask interface and/or at plug connections.
- b. Photograph masks representative of worst case and minimum wear.

6.2.4 Maintainability

- a. Throughout the testing, record the performance of scheduled and unscheduled maintenance as prescribed in the appropriate maintenance instructions. Assess all maintenance factors in accordance with reference 4.J. including maintenance downtime and mean time to repair.
- b. Compare all replacement parts and components provided with oxygen and protective masks with anticipated and actual requirements and evaluate repair parts requirements under actual operating conditions.
- c. Record the requirements for additional tools and instruments, shortcomings in authorized tools and instruments, and needs for specialized tools and instruments to accomplish assigned levels of maintenance.
- d. Record all repair parts used, man-hours and elapsed time, and level of skill required.

6.2.5 Reliability

Starting with the initial checkout of oxygen and protective masks, maintain a complete log of all assembly, installation, operation, disassembly, and maintenance activities for the purpose of reliability analysis in accordance with reference 4.K. The log shall include the following information:

- a. Hours of operation, daily and cumulative.
- b. Equipment failures and malfunctions, including chronological data required to determine failure-free operating time and mean time between failures.
- c. Effect of failures on the operational test conduct.

6.2.6 Maintenance Evaluation

Evaluate oxygen and protective masks' maintenance characteristic as required by the QMR or SDR. In particular, throughout the conduct of service tests, personnel of appropriate MOS levels and varying proficiencies shall perform all maintenance functions listed in the draft technical manual and the following:

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6.2.6.1 Maintenance Characteristics

a. Evaluate the adequacy of modular construction and accessibility of components to provide ease of maintenance of oxygen and protective masks.

b. Report any maintenance difficulties experienced resulting from inadequacy of construction or inaccessibility of components and provide suggested improvements when applicable.

6.2.6.2 Tools and Test Equipment

a. Indicate the adequacy of the common and special tools for the performance of the specified maintenance and repair functions.

b. Indicate the suitability of the test equipment for the performance of established testing functions, necessary support equipment maintenance and calibration, if required.

6.2.6.3 Draft Technical Manuals

a. Evaluate the adequacy and simplicity of the draft technical manuals for the intended maintenance level as specified in reference 4.M.

b. Verify the technical documentation against the equipment for completeness, accuracy, clarity, and ease of use.

c. Report any difficulties experienced, errors, and/or omissions and provide suggested changes or improvements to the maintenance test package when applicable.

6.2.7 Human Factors

Human factors evaluations shall be conducted simultaneously with all service test evaluations. Consult reference 4.L. The mask service test plan shall be evaluated to ensure that ample opportunities are provided to demonstrate the suitability of the man-item interface. Evaluate the following:

a. Degree of user comfort or discomfort:

- 1) While masking or unmasking.
- 2) In normal flight operations.

b. User reaction to mask facial fit and long term comfort under varied climatic and tactical conditions.

c. Ease of adjustment with one hand (with and without gloves).

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d. Psychological reaction of the user to the mask based on facial fit, smell or other physical characteristics.

6.2.8 Safety

a. Throughout the service test, observe the mask being worn and identify those characteristics which presented a potential hazard or were directly or indirectly the cause of any hazard. Consult references 4.C. and 4.I. Evaluate, as a minimum, the following:

- 1) Adequacy of antiglare provisions of the eyelens to prevent eye strain, as appropriate.
- 2) Suitability of emergency procedures.
- 3) Effects of prolonged use and/or exposure to oxygen causing a change in facial fit characteristics which could result in leakage.
- 4) Ease of release or disconnection of mask attachments from fixed components under emergency conditions.

b. Provide recommendations for additions to safety aspects of the mask and accessories.

c. Photograph, where possible, any hazard involving the mask.

6.3 TEST DATA

6.3.1 Preparation for Test

Data to be recorded prior to testing shall include, as a minimum, the following:

a. Nomenclature, serial number(s), manufacturer's name, and function of the item(s) under test.

b. Nomenclature, serial number, accuracy tolerances, calibration requirements, and last date calibrated of the test equipment selected for the tests.

c. Damages incurred during transit and/or manufacturing.

6.3.2 Test Conduct

a. Data originating in all tests and phases shall be recorded in the following forms, as appropriate:

- 1) Operators', observers', and controllers' logs.
- 2) Narrative comment and observations.
- 3) Maintenance records.

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- 4) Photographs; still and movie.
- 5) Diagrams.
- 6) Tapes and graphic recordings.

b. All data items shall be properly identified and annotated with respect to:

- 1) Test, subtest, test phase.
- 2) Source.
- 3) Time.
- 4) Pertinent correlative information.

c. Data to be recorded in addition to specific instructions given in succeeding paragraphs for each subtest shall include:

- 1) Sample size (number of measurement repetitions).
- 2) Instrument or measurement system mean error stated accuracy.

6.3.2.1 Arrival Inspection and Physical Characteristics

6.3.2.1.1 Arrival Inspection

Record the following:

- a. Markings which appear on the shipping container.
- b. Results of inventories conducted against the BILL, container markings, and/or packing lists.
- c. Status of the received mask with respect to suitability for service test, e.g., freedom from serious defects, variations in workmanship, etc.

6.3.2.1.2 Physical Characteristics

Record:

- a. Mask dimensions for each size of mask (see Figures 1 and 2).
- b. Consider dimensions (inches).
- c. Weight--
 - 1) Prepared for use (including accessories) (pounds).
 - 2) Prepared for storage (including accessories) (pounds).
- d. Results of trial fittings to determine actual range of facial and head sizes that each mask size will accommodate.

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6.3.2.2 Functional Suitability

6.3.2.2.1 Masking and Unmasking

Record:

a. Number of test subjects participating.

b. Masking

- 1) Simulated operational conditions.
- 2) Identification of clothing worn at time donning of test mask was initiated.
- 3) Average length of time required.
- 4) Ease of adjustment for tight, comfortable fit.
- 5) Any problems encountered.

c. Unmasking

- 1) Emergency conditions simulated.
- 2) Average length of time required.
- 3) Ease of clearing moisture.
- 4) Any problems encountered.

6.3.2.2.2 Protection of the Wearer

a. Oxygen Masks

Record:

- 1) Personnel to whom each type of mask (test and control) were issued.
- 2) Identification of aircraft used during the evaluation. Describe and identify the oxygen system employed.
- 3) Evaluation under simulated operational conditions.
 - a) Mask leakage characteristics.
 1. Clean shaven.
 2. One day's growth of beard.
 - b) Face adherence in presence of high velocity air stream.
 - c) Adequacy of delivery hose length.
- 4) Description of any event in which mask failed to provide proper quantity of oxygen due to--
 - a) Leakage.
 - b) Rupture.

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- c) Failure of internal valves.
- d) Collapse of delivery tube.
- e) Restriction of internal passages.

b. Protective Masks

Record:

- 1) Personnel to whom each type of protective mask (test and control) were issued.
- 2) Identification of aircraft used during the evaluation.
- 3) Chemical agents and dispensing system used, as appropriate.
- 4) Climatic conditions at time of evaluation.
- 5) Description of simulated mission(s).
- 6) Protection characteristics, including--
 - a) Leakage.
 - b) Face adherence.

6.3.2.2.3 Compatibility

Record:

- a. Degree of compatibility with personal equipment (identify each interface evaluated).
- b. Aircraft compatibility
 - 1) Type of aircraft evaluated with the mask.
 - 2) Degree of unencumbered manipulation of aircraft controls, fire control equipment, and all other related items available in the same time frame. Identify in detail.

6.3.2.2.4 Operational Suitability

Record:

- a. Simulated or actual conditions under which evaluation was conducted.
- b. Effect of the protective mask's eyelens and supporting structure on the crewmember's peripheral vision.
- c. Effectiveness of antifogging kit or provisions.
- d. Effectiveness of antiglare provisions.
- e. Length of time required to don each type of mask when appropriate alert has been given.

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f. Ease of adjusting either type of mask with one hand, with and without gloves.

g. Removal and stowage characteristics in aircraft.

h. Communication cordage and delivery tube length suitability.

6.3.2.2.5 Communications Suitability

Record:

a. Comparison of crewmember's ability to articulate adequately as compared to the control mask and when wearing no mask.

b. Subjective crewmember opinions regarding speech interference levels of the test and control mask.

c. Suitability of microphone adjustment(s), as applicable.

6.3.2.2.6 Comfort

Record:

a. Odor characteristics.

b. Perspiration and moisture control suitability.

c. Effect(s) on wearer's face (including over tightness).

d. Comparative opinions regarding comfort of the test mask and control mask(s).

e. Any interference with eyeglasses, sun glasses, contact lenses, helmet sunshade, or dentures.

6.3.2.3 Durability

Record:

a. Evidence of:

- 1) Faceblank (permanent set).
- 2) Facepiece (excessive stiffness).
- 3) Tears, splits, tackiness, brittleness.
- 4) Offensive odors.
- 5) Adjustment straps, loss of elasticity.
- 6) Carrier wear.
- 7) Eyelens scratches.
- 8) Delivery tube wear.

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9) Communication cordage fraying at microphone-mask interface and/or plug connections.

b. Number of hours each type of mask was worn.

c. Conditions under which masks were used.

6.3.2.4 Maintainability

Record:

a. Data as specified in reference 4.J. including maintenance downtime and mean time to repair.

b. Performance of scheduled and unscheduled maintenance.

c. Requirements for additional tools, the shortcomings of furnished tools, and needs for specialized tools and instruments not furnished.

d. All repair parts used, man-hours to install and level of skill required.

6.3.2.5 Reliability

Record:

a. Data as specified in reference 4.K.

b. Hours of operation, daily, and cumulative.

c. Equipment failures and malfunctions, including chronological data required to determine failure-free operating time and mean time between failures.

d. Effects of failures on the operational test conduct.

6.3.2.6 Maintenance Evaluation

Record data required by the applicable QMR, SDR and the following:

6.3.2.6.1 Maintenance Characteristics

a. Comments on the adequacy of modular construction and accessibility of components for ease of maintenance.

b. Any maintenance difficulties experienced and suggested improvements, if applicable.

6.3.2.6.2 Tools and Test Equipment

- a. Adequacy of tools and test equipment in performance of assigned tasks.
- b. Adequacy of test equipment without unscheduled maintenance or calibration.

6.3.2.6.3 Draft Technical Manuals

- a. Adequacy and simplicity of draft technical manuals as specified in reference 4.M.
- b. Accuracy, completeness, and clarity of the technical documentation.
- c. Suggested changes to the maintenance test package as a result of the service tests.

6.3.2.7 Human Factors

Record:

- a. Degree of user comfort or discomfort.
- b. User reaction to prolonged use of the mask.
- c. Ease of adjustments with one hand (with and without gloves).
- d. Psychological reaction(s) of the user to the mask's facial fit, smell, or other physical characteristics.

6.3.2.8 Safety

Record:

- a. Adequacy of antiglare provisions of the eyelens for day and night operations.
- b. Suitability of material characteristics in preventing health hazard(s).
- c. Adequacy of the protection provided in the prevention of crewmember injury during normal and emergency situations.
- d. Identification of real or potential hazards discovered during all phases of testing.

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6.4 DATA REDUCTION AND PRESENTATION

- a. All data taken during the service test will be summarized, using tabulations and/or charts, as appropriate.
- b. Where photographs are used, positive identification will be insured.
- c. The data will be analyzed to determine to what degree the oxygen and protective masks meet the QMR, SDR, or TC requirements.
- d. The presentation will conclude with a summarization of the suitability of oxygen and protective masks for use by the Army.

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APPENDIX A

Communications Suitability and Comfort Questionnaire

A. Communications Suitability

1. Does the background noise interfere with message transmission?
2. Were voice messages clear and understandable?
3. Were voice messages transmitted by the test mask microphone better or worse compared to the transmissions of crewmembers not wearing a mask?
4. Does the mask effect speech articulation or cause any speech interference?
5. Could brevity codes be understood when transmitted by the test mask microphone?
6. Could procedure words be understood when transmitted by the test mask microphone?
7. Did the receiving operators misunderstand any messages transmitted by the test mask microphone?
8. Did the test mask wearer experience any difficulty in transmitting messages?

B. Comfort

1. Was wearer able to perform his primary duties with minimal discomfort, considering operational and climatic conditions?
2. Was the mask difficult to adjust, and was it uncomfortable when properly adjusted?
3. Does the mask interfere with eyeglasses, sun glasses, contact lenses, helmet sunshade, dentures, or items of clothing?
4. Does the mask cause skin irritation?
5. Does moisture build up on the lenses?
6. Does the mask material contain offensive odors?
7. Does the mask interfere with normal breathing?

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