UNCLASSIFIED

AD NUMBER

ADA107579

NEW LIMITATION CHANGE

TO

Approved for public release, distribution unlimited

FROM

Distribution authorized to U.S. Gov't. agencies and their contractors; Administrative/Operational Use; 13 Nov 1981. Other requests shall be referred to HQ U.S. Army Developmental Test Command, Aberdeen Proving Ground, MD 21005-5055.

AUTHORITY

HQ DTC ltr, 4 Feb 2004

THIS PAGE IS UNCLASSIFIED

AD A107579

3782

22 May 1970

Materiel Test Procedure 6-3-026
U. S. Army Aviation Test Board

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

PROXIMITY WARNING DEVICES

1. OBJECTIVE

This document provides test methods and techniques necessary to determine the degree to which aircraft proximity warning devices and their associated tools and test equipment (Maintenance Package) meet the requirements stated in Qualitative Materiel Requirements (QMR's), Small Development Requirements (SDR's) or Technical Characteristics (TC's), or other governing documents and whether or not these items are suitable for Army use.

2. BACKGROUND

Proximity warning devices (PWD) are utilized on Army aircraft to warn operator personnel of the presence of other aircraft in their operating airspace. The airspace involved is a volumetric envelope composed of a given altitude above and below the aircraft and a given range from the aircraft. These systems can be either cooperative, i.e., each aircraft must be similarly equipped or non-cooperative. In principle, the cooperative system would function as an interrogator-transponder combination whereas the non-cooperative system would utilize the "echo" principle. These systems are used to provide protection from mid-air collisions during flight operations and, in the case of the cooperative system, can also be utilized to aid in the identification of friendly aircraft during field operations. Desirable characteristics of these systems are the provision of both visual and aural warning of the "intruder" and information pertaining to the range from and position with respect to the operating altitude of the inquiring aircraft.

Since these are safety devices, the system must be extremely reliable, must be fail-safe, and must provide for verification of integrity. As an installed system, it must also exhibit flexible installation and physical characteristics making it compatible for use on different aircraft. Of primary importance, however, is the ability of the system to operate reliably without false indications, in the various environments (mechanical, atmospheric, electromagnetic) to which it will be subjected with varying numbers of aircraft involved in training and mission procedures and profiles. The audio and visual signals must be distinctive from other warning systems which are common in Army aircraft. The visual display must rapidly identify the intruder's location in such a manner that the initial aviator reaction will produce a logical flight control input.

This testing program will examine these characteristics and, in addition, will provide additional evaluations to ensure complete testing and thus verify the suitability of the system for Army usage.

3. REQUIRED EQUIPMENT

a. Measuring tools for the determination of test item dimensions.

20030112211

DISCLAIMER NOTICE

THIS DOCUMENT IS BEST QUALITY PRACTICABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

b. Avionics maintenance facility.
c. Meteorological equipment.
d. Flight test range which includes various types of terrains.
e. Cameras, motion and still, and film.
f. Voice communications network.
g. Ground transponder equipment, as needed.
h. Appropriate number and types of test-bed aircraft.
i. Suitable operational airfield(s).
j. Personnel in appropriate numbers, of the proper MOS, grade, skill level, and with special training required.

4. REFERENCES

A. USAMC Regulation 385-12, Verification of Safety of Materiel from Development Through Testing, Production, and Supply to Disposition.
B. Army Regulation 385-16, Safety for Systems, Associated Subsystems, and Equipment.
C. MIL-STD-454B, Standard, General Requirements for Electronic Equipment.
D. MIL-STD-882, System Safety Program for Systems and Associated Subsystems, and Equipment, Requirements For.
E. USAAVNTBD Memorandum 108-1, Pictorial Services, Photographic Coverage.
F. USAAVNTBD Memorandum 385-10, Safety Confirmation of Avionics Equipment.
G. USAAVNTBD Memorandum 750-2, Maintenance of Supplies and Equipment, Maintenance Portion of the Service Test.
H. USATECOM 70-23, Equipment Performance Report.
I. USATECOM Regulation 70-24, Documenting Test Plans and Reports.
J. USATECOM Regulation 385-6, Verification of Safety of Materiel During Testing.
K. USATECOM Regulation 700-1, Value Engineering.
L. USATECOM Regulation 750-15, Maintenance Portion of the Service Test.
M. MTP 6-3-501, Pre-Test Inspection for Service Test.
N. MTP 6-3-502, Personnel Training Requirements.
O. MTP 6-3-513, Qualitative Electromagnetic Interference.
P. MTP 7-3-500, Physical Characteristics.
Q. MTP 7-3-502, Installation Characteristics.
R. MTP 7-3-506, Safety.
S. MTP 7-3-507, Maintenance.
T. MTP 7-3-508, Reliability.
U. MTP 7-3-509, Compatibility with Related Equipment.
V. MTP 7-3-510, Human Factors.

5. SCOPE

5.1 SUMMARY

This document provides existing procedures for evaluating the characteristics of proximity warning systems installed on Army aircraft under

ILS611OE006

service use conditions. The total testing program will consist of the following subtests:

a. Preparation for Test - A series of preparatory procedures to determine that testing personnel are properly prepared and that the warning system is in satisfactory condition for initiation of the test program. These procedures will consist of the following:

1) General preparations.
2) Personnel training and familiarization.
3) PWD inspection.
4) Inventory check.
5) Physical characteristics.
6) Preoperational checks.

b. Operation and Performance - The operation and performance characteristics of the warning system will be determined under conditions that most nearly simulate those expected to be encountered in an actual field or training operation.

c. Maintenance - An evaluation of the equipment's maintenance characteristics and the maintenance package through examination of the following factors: maintainability, reliability, and availability. The purpose of this evaluation is to determine through examination of the design, maintenance procedures, tools, literature, etc., the ease with which the system can be maintained at or be returned to operative condition. Analysis of failures is also included.

d. Compatibility - An evaluation which examines the effects of the warning system upon and interactions with the established configuration of the aircraft and its mission profiles. This is a measure of the degree to which requirements of the test item differ from, require special considerations for, or interfere with tactical procedures, equipment, tools, and materials.

e. Draft Technical Manuals - Examination of the contents of draft technical literature to determine accuracy, completeness, and clarity.

f. Safety - An evaluation which examines the safety characteristics of the design and operating procedures of the test item and its maintenance provisions. The objective of this evaluation is a determination that the test item is safe for use by Army personnel in Army equipment.

g. Human Factors Evaluation - An evaluation to determine the adequacy of the design and performance characteristics of the subject equipment and associated equipment in terms of compatibility with the capabilities and limitations of specified user personnel with the test item in the operational environment for which it was designed. Characteristics as related to human factors and revealed during the conduct of each test shall be examined.

h. Personnel and Training Requirements - An evaluation which, through observation of personnel involved in operation and maintenance procedures, will be utilized to determine the adequateness and sufficiency of training and appropriateness of skill levels and experience specified for the selected test personnel.

i. Value Analysis - An evaluation directed at analyzing the test item primary functions and features for the purpose of reducing the cost of the item without compromising desired performance and safety characteristics.

5.2 LIMITATIONS

This MTP is intended to be used as a basic guide when preparing test plans for aircraft-installed proximity warning devices which are designed to warn of the presence of other aircraft within the system-equipped aircraft's operating airspace.

6. PROCEDURES

6.1 PREPARATION FOR TEST

6.1.1 General Preparations

a. Plan the utilization of photographic techniques where possible to record and document findings and results of testing. USAAVNTBD Memorandum 108-1 shall be consulted for procedures.

b. Prepare aircraft flight plans for each phase of the Test Conduct indicating ground landmarks and identifying each aircraft. These should serve as guidelines for all participating aircraft.

6.1.2 Personnel Training and Familiarization

Test personnel shall be qualified in accordance with provisions of MTP 6-3-502. The following shall be undertaken:

a. Instruct and train test personnel in the operation and maintenance of the equipment using the draft literature.

b. Determine that test personnel are aware of the test objectives and are knowledgeable in the procedures to be utilized.

6.1.3 Initial Inspection

Perform the pre-test inspection procedures required by MTP 6-3-501. In particular, perform a visual inspection to determine any physical damage. Photograph any evidences of damage.

6.1.4 Inventory Checks

a. Conduct an inventory against the Basic Issue Items List (BIIL). Record evidence of the following:

1) Missing maintenance literature or draft technical manuals.
2) Shortages in repair kits, accessories, or tools.
3) Missing kits.

b. Submit an Equipment Performance Report (EPR) for each noted shortage or discrepancy in accordance with applicable procedures in USATECOM Regulation 70-23.

6.1.5 Physical Characteristics

NOTE: Do not test for data obtained and verified during the Engineering Test.

Physical characteristics shall be determined by performing the applicable sections of MTP 7-3-500, in particular the following:

a. Markings - Note the legibility and effectiveness of markings, legends, etc.

b. Dimension and weight data - Determine the dimensions, weight, and volume of all assembly components and the system total volume and weight.

6.1.6 Preoperational Checks

Perform the following procedures, noting that for systems already installed only procedures c. through i. are required. Note any difficulties experienced during any of the procedures.

a. Depreservation - remove all preservative.

b. Assembly - attach any items removed for transporting convenience. List each item involved.

c. Lubrication - verify completeness of the lubrication program.

d. Power Requirements - verify power input circuitry and note the electrical power requirements of the system. Ensure that all requirements are satisfied by the electrical systems available on the types of aircraft on which the test item will be utilized.

e. Installation - perform the procedures required by MTP 7-3-502 and the following:

1) Examine the instructions given for the mounting of all equipment for completeness.
2) Ensure the equipment is protected against shock and vibration, if required.
3) Check all cables, connectors, plugs for positive, secure locking and keying.
4) Examine the installation procedures for fast replacement of the system, e.g., quick disconnect fittings for cables, etc.

f. Controls, adjustments, and indicators (mechanical and electrical)- note the following:

1) For each control, adjustment, and indicator, determine the following as appropriate.

a) Operation is correct.
b) Effect on the system is as required.
c) Absence of binding and rubbing.
d) Calibration is proper.
e) Changes are monitored and displayed correctly.
f) Range is correct.

2) List any discrepancies.

3) Devices whose evaluation require flight conditions will be checked during the Operation and Performance Test.

g. Test item protective, and safety devices such as limit, overload, and interlock switches shall be checked for proper operation.

h. Systems equipped with confidence, self-check, or integrity circuits shall have these checked. Where a ground transponder test is provided and equipment is available, the check will be made.

6.2 TEST CONDUCT

6.2.1 Operation and Performance

6.2.1.1 Preparation and Conditions for Test

Perform the following:

a. Check the system for proper operation, without false indication, during all possible permissible training and mission procedures and conditions. Test shall be planned utilizing dual and multi-aircraft configurations with both rotary-and fixed-wing aircraft in various combinations. Conditions for the flight porcedures shall be modified in accordance with the type of system under test.

b. Obtain a minimum of four aircraft, preferably two fixed and two rotary-wing aircraft, the aircraft equipped as required.

c. Check each system for operational integrity using ground check equipment, or procedures and manual instructions.

d. Energize and check integrity or automatic checkout circuits.

e. Subject each system to a cold start and note warmup time.

f. To each system supply power repeatedly for three cycles, each time from a cold start, and determine any effects which the POWER-ON procedure has on the equipment.

g. Establish a voice communication network between all aircraft and a ground station.

6.2.1.2 Performance Tests

Perform the following:

a. Have one helicopter operate, at the test range center, as a hovering installation at various altitudes starting at ground level and proceeding to the maximum altitude for which the equipment is specified. During the procedures, this aircraft will also utilize various equipment range settings to determine their effects on acquisition.

b. Have a second helicopter (the intruder) make approaches to the hovering helicopter, at each altitude, from outside the maximum system range. The intruder will be informed of the hovering helicopter's altitude and will adjust the approaches to include combinations of the following:

1) Directional - a minimum of four, including the cardinal directions.

2) Altitude - at, above, and below the altitude of the hovering craft (where permissible).
3) Speed - from minimum to maximum airspeed.

c. Upon acquisition of the intruder, the hovering aircraft will report whether the intruder is at, below, or above its altitude and its range setting and the intruder will also report his range and altitude. These reports will be made to the ground station.

d. Repeat procedures a. and b. but utilize a fixed-wing aircraft as the "intruder". Report as in procedure c.

e. Allow one aircraft to perform procedures typical of training and mission operations. Have the second aircraft make various approaches as in procedure b. with reports given again as in procedure c. Have the two aircraft achieve as many configurations as possible to determine blind spots. Utilize both types of aircraft in various combinations for this procedure and in particular include the specific case of two aircraft on a course for head-on collision.

f. Repeat selected approach procedures, utilizing two aircraft but with a third aircraft placed in the airspace so that at various times it is next to each aircraft or between the two aircraft. Note any variations in the system performance. For systems provided with tracker circuits, the inquiring aircraft will report the nearest intruder.

g. Repeat selected approach procedures, first utilizing two aircraft and then with three, with patterns flown over different types of terrain to determine any effects on performance. Include the following types of terrain:

1) Flat and unwooded.
2) Heavily wooded.
3) Hilly or mountainous.
4) Over bodies of water.
5) Airfields with large buildings.

h. During all procedures, note evidence of the following:

1) Large voids in antenna patterns.
2) Intermittent or fading signals.
3) Loss of signal.
4) False indications.
5) Incorrect range or altitude indication.

6.2.1.3 Effects of Atmospheric Conditions

Perform selected procedures of section 6.2.1.2 during periods when changes in atmospheric conditions exist to determine the effects on transmission and other performance characteristics. These periods and/or conditions will include:

a. Night hours
b. Hours at sunrise and sunset.
c. Poor weather conditions (rain, fog).
d. High and low temperatures.

e. Operation to the maximum operative altitude of the equipment.

6.2.1.4 Durability

Perform the following:

a. A visual inspection with consideration given to the following:

1) Loose chassis components.
2) Loose or missing hardware.
3) Broken fasteners or seams.
4) Discoloration due to heat effects, rust, or corrosion.
5) Loose panel components.
6) Loose connectors or cables.

b. For each defect, note the nature and location.

6.2.2 Maintenance

NOTE: Include in the maintenance subtest the preparation of the following charts: (USAAVNTBD Memorandum 750-2 contains the charts and directions for their preparation).

a. Maintenance and reliability analysis chart.
b. Parts analysis chart.
c. Special tool analysis chart.
d. Maintenance package literature chart.

Perform the applicable procedures of MTP 7-3-507 and USAAVNTBD Memorandum 750-2 with the total evaluation emphasizing the following:

a. Maintainability.
b. Reliability.
c. Tools and test equipment.
d. Technical manuscripts and manuals.

6.2.2.1 Maintainability

a. List and provide complete details of occurrences for scheduled maintenance without downtime and unscheduled maintenance with minimum downtime (minor adjustments).

b. List and provide complete details of occurrences for unscheduled maintenance involving excessive downtime and/or replacement or repair of components.

6.2.2.2 Reliability

Perform the following:

a. Maintain an accurate log of accumulated operating time hours.
b. For each unscheduled maintenance involving any loss of operating

time record the following:

1) Conditions which indicated the malfunction.
2) Component or feature involved and method used to determine it.
3) Damage caused to associated parts of the test item by failure.
4) Repair procedures followed, personnel, material, and tools required.
5) Elapsed time since last malfunction, if any, accumulated operating time of failing component, and time to repair failure.

c. From the times recorded, calculate the MTBF and MTTR (see Appendix A).

d. Using the times recorded in 6.2.2.2, compute the availability figures (see Appendix A.).

6.2.2.3 Tools and Test Equipment

Determine, through utilization, whether common and special tools and test equipment are suitable for the intended purpose and maintenance level and also whether special tools provided or specified are unnecessary or excessive.

6.2.2.4 Technical Manuscripts and Manuals

Perform the following:

a. Review the maintenance instructions for preventive and major maintenance procedures for accuracy and completeness.

b. Note the presence of lists of recommended repair parts, tools, test equipment, and procedures for alignment, calibration, and troubleshooting.

6.2.3 Compatibility

During testing, maintenance, and other handling, note compatibility with operating and maintenance environments by performing the following:

a. Review during all procedures the factor of compatibility.

b. Note any instances of incompatibility using the following list as a guide:

1) Preparation for Usage: Note the need during installation of special tools, hardware, mounting brackets, etc. non-standard size or overweight items.
2) Operation and Performance: Note during the operational procedures whether the test item interferes with or is itself interfered with by other on-board or ground-based electronic systems. This can be accomplished by operating the system simultaneously with other on-board electrical systems and in the presence of radio frequency fields generated by ground installations.

NOTE: The requirements of MTP 6-3-513, Qualitative Electrical Interference, will also be satisfied.

3) Maintenance: Note any requirements for special tools, equipment, materials which can be substituted for or deleted.

6.2.4 Draft Technical Manuals

Perform the following:

a. For each procedure conducted, review the applicable section of the manual(s).

b. Record any instances of literature requiring correction using the following examples as a general guide.

1) Preparation for Use: Inadequate installation or checkout procedures.
2) Operation and Performance: Instructions not sufficient to achieve proper operation.
3) Transportability: Recommendations for the handling, packaging materials, precautions not given.
4) Safety: Any precautions required not specified in the text.

6.2.5 Safety

Perform the following:

a. The procedures required by MTP 7-3-506.

b. Observe the proper safety precautions and adhere closely to the draft manual's directives which deal with safety and/or protection.

c. Examine the procedures for all tests. Report any category II, III, or IV hazards, as defined by paragraph 3.14, Military Standard 882, to the project officer.

d. Examine the test item for system characteristics including the procedures for its operation and its design to ensure that potentially hazardous conditions are identified. Consider the following:

1) Examine operating procedures with a view that improperly executed or misinterpreted instructions could result in bodily harm or equipment damage.
2) Where hazardous conditions cannot be avoided, is the item properly and conspicuously marked for the condition and applicable manuals contain appropriate notes, cautions, and warnings?
3) Are all moving parts shielded and completely enclosed?
4) Are the electrical circuits guarded against accidental contact, or placarded?
5) Are any environmental limitations explicitly denoted?

e. Prepare a list of all protective and warning devices included on the test item. Consider the following:

1) Overheat devices.
2) Overload.
3) Locking mechanisms.
4) Limit switches.
5) Visual and audible warning devices.
6) Interlocks.

f. For each device listed, operation will be caused by simulating the type failure which the device is to detect, or otherwise utilizing the feature. Record the following:

1) The device/feature tested.
2) Failure which the device is to detect.
3) Proper operation of the device or failure detected.

g. Examine the test item for the possible additions and/or improvements to its design that will enhance safety. Record any recommendations.

h. Release of the Safety Confirmation shall comply with the requirements of USATECOM Regulation 385-6.

6.2.6 Human Factors Evaluation

NOTE: This evaluation will be conducted by preparing a human factors task and characteristics analysis checklist. The purpose of the checklist is to rate, from a human factors standpoint, the tasks associated with the test item characteristics revealed during the procedures for preparing, operating, transporting and maintaining the test item. The rating will be either satisfactory or unsatisfactory with explanatory information accompanying an unsatisfactory rating. For all tasks/characteristics, the following will be considered:

a. Ease of performance - mental and physical effort required.
b. Support - adequacy of instructions and tools for the task.
c. Time - time required to complete task with recommendations for modifying procedures to reduce time required.
d. Design characteristics - effects on performance of tasks.

Perform the following:

a. The procedures required by MTP 7-3-510.
b. A rating of the following tasks/characteristics for the evaluation listed.

1) Preparation for Usage.

a) Assemble components, move installation location, place in position, make external connections, lock into position with fasteners, connectors, etc.
b) Apply power, check controls and indicators, make required alignment, calibrate, and adjust.

c) Note operational status.

2) Operation and Performance.

a) Controls and indicators - operate controls, note changes in equipment status, monitor other displays.
b) Legends - effectiveness, readability, visibility.
c) Performance - note correct operation and system status feedback to operator (auditory, visual, etc.).
d) Fail-safe - when PWD is inoperative or incapable of performing mission, operating personnel are made aware of condition.

3) Preventive Maintenance

a) Clean and add lubricants.
b) Remove and replace minor items.
c) Tighten fasteners and connectors.
d) Adjust, calibrate, and align.

4) Nonscheduled Maintenance

a) Detection of malfunction by observing displays, noting visual or audible changes, or changes in operating effectiveness.
b) Isolate and identify causes by visual means or instrumentation.

5) Remove and Replace.

a) Open, gain access to and remove component.
b) Replace or repair and re-establish proper operation.

6.2.7 Personnel and Training Requirements

Perform the following:

a. Observe the performance of personnel during operational and maintenance procedures.

b. Review the effects of personnel training or orientation programs as to their adequacy, etc., noting also any additional training required during the test and suggestions for changes to the training program.

c. Make a quantitative estimate as to the average number of training hours and type training required for both operational and maintenance personnel.

6.2.8 Value Analysis

During the conduct of all tests, service personnel shall rate the test item and associated equipment from a value standpoint and shall record comments concerning any features of the test item which can be eliminated and/or cost reduced without degrading the item's performance and safety. The applicable

portions of USATECOM Regulation 700-1 shall be used as a basis for this evaluation.

Record the following for each test item examined:

a. Description of feature.
b. Recommended change to be made.
c. Reasons for recommendations.

6.3 TEST DATA

NOTE: In compiling the Test Data section, test personnel should expound upon those data procedures which are other than quantitative in nature by recording narrative descriptions which will provide full details of conditions and/or events occurring during the conduct of the test.

6.3.1 Preparation of Test

6.3.1.1 General Preparation

a. Record the types of photographic equipment utilized during testing and a list of each photographic record and its purpose.
b. Present aircraft flight plans.

6.3.1.2 Personnel Training and Familiarization

Record the data required by MTP 6-3-502 and the following:

a. Methods used and completion of test personnel training and evaluation of the technical manuals.
b. Evidence that the test personnel are sufficiently knowledgeable in objectives and procedures.

6.3.1.3 Initial Inspection

Record the data required by MTP 6-3-501 and locations and types of physical defects found.

6.3.1.4 Inventory Check

List any materials missing from the Basic Issue Item List.

6.3.1.5 Physical Characteristics

Record the data required by MTP 7-3-500 and the following:

a. Code markings which are illegible or unclear.
b. Dimension, volume, and weight data for all components and total system weight and volume.

6.3.1.6 Preoperational Checks

For each check, record the personnel, materials, equipment, tools, etc., required for the check and the following:

a. Depreservation procedures utilized.
b. Any items which require assembly.
c. Lubrication procedures performed.
d. Any instances where the electrical requirements of the equipment cannot be satisfied by the aircraft's electrical system or indications that power input circuitry is incorrect.
e. The data required by MTP 7-3-502 and any indications of the following:

1) Mounting for shock and vibration not sufficient.
2) Insecure connectors.
3) Installation time excessive (where required).

f. For all controls and indicators, list beside each item any of the following conditions.

1) Improper operation.
2) Desired effect on test item not indicated.
3) Binding, rubbing, and jerking in motion.
4) Improper calibration.
5) Proper monitoring and display of system conditions not shown.
6) Range too small, too large, etc.

g. List any protective or safety device which does not operate properly.
h. Any problems encountered in the operation of self-checking circuits or ground tests of system.

6.3.2 Test Conduct

6.3.2.1 Operation and Performance

Record the data required by MTP 6-3-513.

6.3.2.1.1 Preparations and Conditions for Test -

Record the following:

a. The type of aircraft utilized in the test.
b. Excessively long warm-up time.
c. Any problems with the system after successive applications of primary power, e.g., blown fuses, noise in the audio system.
d. Details and layout of the test range utilized.

6.3.2.1.2 Performance Tests -

Record the following:

a. A list of the altitudes used by the hovering test item equipped aircraft.

b. For all approaches made at each altitude:

1) The direction of approach.
2) Approach above, below, or at altitude of hovering aircraft.
3) Airspeed utilized.

c. For the acquisition of each approach:

1) Report from the hovering test item equipped aircraft as to range setting and intruder's position relative to altitude and relative bearing.
2) Range report from intruder aircraft and his altitide.

d. For the training and mission procedures repeat the data required for procedures a., b., and c. and any apparent blind directions.

e. Any degradation in the system's performance due to the presence of the distracting aircraft.

f. Any lowering in system performance when conducting flights over different terrains listing the type of terrain, number of aircraft involved and the type fault.

6.3.2.1.3 Effects of Atmospheric Conditions -

Record the following:

a. The various atmospheric conditions under which tests were conducted.

b. Flight procedures used.

c. Indications of equipment malfunction or loss in performance.

6.3.2.1.4 Durability -

Record the following:

For the visual inspection, record the nature and location of the following:

a. Loose components, hardware, and connectors.

b. Discolorations.

c. Broken or frayed components.

6.3.2.2 Maintenance Evaluation

Record the data required by MTP 7-3-507 and complete the maintenance charts.

6.3.2.2.1 Maintainability -

Record the following:

a. For each scheduled or unscheduled maintenance involving minor adjustment.

1) Operation performed.
2) Personnel, time, tools etc., required.
3) Elapsed time since last performance of the same procedure.
4) Difficulty in using instructions provided.

b. For each unscheduled maintenance involving excessive downtime and/or replacement or repair of component, record the data as called for in paragraph 6.3.2.2.2.b.

6.3.2.2.2 Reliability -

Record the following:

a. Total operating time of the system.
b. For unscheduled maintenance procedure involving downtime:

1) Failure condition indication - loss of power, etc.
2) Failing component and procedures used to determine same.
3) Signs of damage to other components - burns, etc.
4) Repair procedures, personnel, material, tools, and equipment utilized.
5) Operating time of failing component, and time to repair.

c. The reliability figure in MTBF and also MTTR.
d. Record the inherent, and achieved, availability figures in percent.

6.3.2.2.3 Tools and Test Equipment -

Record the following:

a. All tools and test equipment not specified but required.
b. Special tools provided but replaceable by those found in the maintenance facility complement.
c. Recommendations for changes to tools or test equipment.

6.3.2.2.4 Technical Manuscripts and Manuals -

Record the following:

a. Procedures which are inaccurate, incomplete or not understandable.
b. Missing lists or procedures for specific maintenance, e.g., calibration, missing.

6.3.2.3 Compatibility

Record the data required by MTP 7-3-509 and instances of the

the following:

a. Special tools, equipment and materials specified but not required.
b. Physical or electrical characteristics not compatible with aircraft capabilities.
c. Test item interferes or is interfered with by other equipment generating, utilizing, or radiating electrical energy.

6.3.2.4 Draft Technical Manuals

Record any instances, for all tests, of information which is missing, incorrect, unclear, or not according to format.

6.3.2.5 Safety

Record the data required by MTP 7-3-506 and the following:

a. Comments regarding hazardous conditions found in the procedures of any test.
b. For general safety characteristics:

1) Poorly worded or unclear operating instructions.
2) Warning labels - lacking, not conspicuous.
3) Unprotected electrical circuits.
4) Markings for environmental limitation missing.

c. Prepare a table to include the following:

1) A list of all safety devices utilized.
2) The type of failure each device is to detect.
3) Indication that the device has successfully operated.

d. List any missing devices or unsafe conditions.
e. List any suggested additions to the safety features.

6.3.2.6 Human Factors Evaluation

Record the data required by MTP 7-3-510 and in addition complete the checklists prepared for the tasks of the procedures for preparing, operating, maintaining and transporting the system. Rate each task as satisfactory or unsatisfactory from a human factors standpoint. In rating each task, consider and record instances of the following:

a. Instructions.

1) Lacking clarity.
2) Insufficient or excessive detail.

b. Tools.

1) Proper tools not supplied.
2) Excess of special tools specified.

3) Additional tools recommended.

c. Mental and Physical Effort.

1) Above average skill or strength required of test personnel.
2) Task is excessively tiring.

d. Design.

1) Poor location of component.
2) Component not accessible.
3) Visibility hindered.
4) Insufficient variables (control, adjustments).

e. Time required for task is excessive and reasons why.
f. Personnel requirements.

1) Insufficient number specified.
2) Qualifications for personnel in error.

6.3.2.7 Personnel and Training Requirements

Record the following:

a. The most appropriate skill levels and experience (background) suggested for operator and maintenance personnel.
b. Any suggested changes to training techniques, literature, etc., to eliminate operator errors or reduce maintenance time.
c. Each additional training technique utilized after the start of testing and suggestions for additions, or deletions to the training program.
d. The training time, in hours, for maintenance and operating personnel.

6.3.2.8 Value Analysis

Record the following:

a. Description of feature examined.
b. Recommendation of change(s) to be made.
c. Reason(s) for recommendation.

6.4 DATA REDUCTION AND PRESENTATION

Operation and Performance.

a. Review the results of the test, in particular, look for indications of the following:

1) Particular approach patterns which indicate poor antenna patterns.
2) Loss, fading, or intermittent signals for approaching intruder.

3) Errors in range at acquisition.
4) Errors in indication of position relative to the plane of altitude.

b. The remainder of the data will be summarized using tabulations and/or charts as appropriate. Where photographs are used, they will be positively identified. The data will be analyzed to determine to what degree the test item and its maintenance package meet the requirements of QMR's, SDR's, TC's, and detail military specifications. Record all shortcomings or deficiencies. Provide a recommendation as to the suitability of the proximity warning device and its maintenance package for use by the Army.

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX A

1. MEAN TIME BETWEEN FAILURES (MTBF)

Mean Time Between Failures is the total operating time divided by the total number of chargeable system failures occurring during the total test period.

2. INHERENT AVAILABILITY (A_i).

The probability that a system or equipment when used under stated conditions, without consideration for any scheduled or preventive maintenance, in an ideal support environment (i.e., available tools, parts, manpower, manuals, etc.), shall operate satisfactorily at any given time. A_i excludes ready time, preventive maintenance downtime, supply downtime, and waiting or administrative downtime. It may be expressed as:

$$A_i = \frac{MTBF}{MTBF + MTTR}$$

where

MTBF = Mean-time-between-failure; and

MTTR = Mean-time-to-repair.

3. MEAN TIME TO REPAIR (MTTR)

That portion of the total unscheduled maintenance time which is expended to correct chargeable system failures divided by the total number of chargeable system failures occurring during the total test period.

4. ACHIEVED AVAILABILITY (A_a).

The probability that a system or equipment when used under stated conditions in an ideal support environment (i.e., available tools, parts, manpower, manuals, etc.) shall operate satisfactorily at any given time. A_a excludes supply downtime and waiting or administrative downtime. It may be expressed as:

$$A_a = \frac{MTBM}{MTBM + \overline{M}}$$

where MTBM = Mean-time-between-maintenance, in the total operating time, divided by the total preventive (scheduled) and corrective (unscheduled) maintenance actions occurring during the total test period and

$\overline{M}$ = Mean active maintenance downtime resulting from both preventive and corrective maintenance actions.

THIS PAGE INTENTIONALLY LEFT BLANK

UNCLASSIFIED
Security Classification

DOCUMENT CONTROL DATA - R & D

Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) US Army Test and Evaluation Command (USATECOM) Aberdeen Proving Ground, Maryland 21005	2a. REPORT SECURITY CLASSIFICATION Unclassified 2b. GROUP ----------

3. REPORT TITLE
U. S. Army Test and Evaluation Command Materiel Test Procedure 6-3-026, Commodity Service Test Procedure, "Proximity Warning Devices".

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)
Final

5. AUTHOR(S) (First name, middle initial, last name)
----

6. REPORT DATE 22 May 1970	7a. TOTAL NO. OF PAGES 24	7b. NO. OF REFS 22
8a. CONTRACT OR GRANT NO. DA-18-001-AMC-1045(R) b. PROJECT NO. AMCR 310-6 c. d.	9a. ORIGINATOR'S REPORT NUMBER(S) MTP 6-3-026 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report) ----------	

10. DISTRIBUTION STATEMENT
This document is subject to special export controls and each transmittal to foreign governments or foreign nationals,-WITH THE EXCEPTION OF AUSTRALIA, CANADA, AND UNITED KINGDOM,-may be made only with prior approval of HQ,USATECOM.

11. SUPPLEMENTARY NOTES ----------	12. SPONSORING MILITARY ACTIVITY Headquarters US Army Test and Evaluation Command Aberdeen Proving Ground, Maryland 21005

13. ABSTRACT
This Army Service Test Procedure describes test methods and techniques for evaluating the performance and characteristics of Proximity Warning Devices for Army Aircraft, and for determining their suitability for service use by the U. S. Army. The evaluation is related to criteria expressed in applicable Qualitative Materiel Requirements (QMR), Small Development Requirements (SDR), Technical Characteristics (TC), or other appropriate design requirements and specifications.

DD FORM 1 NOV 65 1473 (PAGE 1)
S/N 0101-807-6811

UNCLASSIFIED
Security Classification

A-31408

UNCLASSIFIED
Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Army Service Test						
Proximity Warning Devices (for Army aircraft)						
Mid-air Collision Protection						
Test Procedures						
Test Methods and Techniques						