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13. ABSTRACT

This procedure provides guidance for conducting engineering-type tests of helicopter mine and munition dispensing subsystems. The tests are designed to measure subsystem performance only up to the time that the mines come to rest on the emplacement surface or the time that the munitions function.

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Aberdeen Proving Ground

8 June 1971

U. S. ARMY TEST AND EVALUATION COMMAND
COMMON ENGINEERING TEST PROCEDURE

AIRCRAFT MINE AND MUNITION DISPENSING SUBSYSTEMS

1. OBJECTIVE

This MTP provides guidance for conducting engineering-type tests to evaluate the performance of helicopter mine and munition dispensing subsystems in accordance with the requirements of Materiel Need (MN).

2. BACKGROUND

Hardware for aerial dispensing of mines or munitions is of recent origin and therefore limited in number. In general, hardware has been developed to meet urgent requirements for the aerial dispensing of specific mines or munitions that were developed for other purposes. The only current mine dispensing subsystem is the XM47 type for dispensing mines of the Gravel family. The current munition dispensers generally are multitube devices with several munitions, such as bomblets or grenades, contained in each tube.

The present developmental effort includes additional single-purpose subsystems for dispensing specific mines or munitions as well as a multipurpose materiel dispensing subsystem. The multipurpose subsystem will be capable of dispensing a variety of mines and munitions, as well as general purpose stores ranging from antiradar chaff to food and water. Dispensable items are packaged either as single units, or in canisters containing several items that are compatible with the dispenser. Since standard mines (except for the Gravel mines), designed for manual emplacement, are not suitable for aerial emplacement, mines designed specifically for aircraft are also being developed. Similarly, the development of future multipurpose subsystems for munitions will require the concurrent development of new munitions when standard munitions are not compatible with the dispenser.

The major components of both the current single-purpose and multipurpose dispensing subsystems are the dispensers (or pods), hardware for attaching the dispensers to the aircraft, an intervalometer for controlling the dispensing rate, firing controls, and the mines or munitions. The mines or munitions are generally ejected by gas generating cartridges. The point of release is determined by pilot judgment rather than by a sight. Most subsystems are shipped with mines or munitions contained in the dispensers and with additional reload items in separate shipping containers.

For the purposes of this MTP, the following definitions are made:

Munition: Any explosive or pyrotechnic device designed to function in the air or on impact.

Mine: An explosive device which is dropped on land or water and detonates by subsequent action of the victim, by the passage of time (self-destruct), by a load or by other controlled means.
Canister: A subpack which occupies one bay or tube of a dispenser and contains two or more mines or munitions. The canister contents may be ejected directly from the canister in the dispenser or the canister may be ejected and subsequently opened to release the contents.
Dispenser: The device that launches the payload.
Dispensing hardware: The reusable portion of the subsystem which remains attached to the aircraft and consists of the dispenser and all ancillary equipment and components (including the controls, cables, mounts, racks, pylons, and any gas generating cartridges used to eject the dispenser payload).
Subsystem: The dispensing hardware plus its payload of mines, munitions, or canisters.

3. REQUIRED EQUIPMENT

Standard aircraft, impact ranges, and environmental facilities are required. Specialized equipment is indicated in the individual subtests of paragraph 6 and in the referenced MTP's.

4. REFERENCES

A. AR 70-38, Research, Development, Test, and Evaluation of Materiel for Extreme Climatic Conditions.
B. MIL-STD-810B, Environmental Test Methods.
C. USATECOM Regulation 385-6, Verification of Safety of Materiel During Testing.
D. USATECOM Regulation 750-15, Maintenance Evaluation During Testing.
E. MTP 3-1-002, Confidence Intervals and Sample Size.
F. MTP 3-2-608, Terminal Effectiveness, Antipersonnel Weapon Systems.
G. MTP 3-2-615, Radio-Frequency Radiation Hazards to Electroexplosive Devices.
H. MTP 3-2-825, Location of Impact or Airburst Positions.
I. MTP 4-2-130, Flares and Photoflash Items.
J. MTP 4-2-502, Safety Evaluation - Mines and Demolitions.
K. MTP 4-2-505, Mines and Demolitions.
L. MTP 4-2-804, Laboratory Vibration Tests.
M. MTP 4-2-813, Arena Test of HE Fragmentation Munitions.
N. MTP 4-2-815, Photographic Instrumentation for Trajectory Data.
O. MTP 4-2-819, Sand and Dust Testing of Ammunition.
P. MTP 4-2-820, Humidity Tests.
Q. MTP 4-2-826, Solar Radiation Tests.

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R. MTP 7-1-004, Army Aircraft Armament.
S. MTP 7-2-501, Safety Evaluation of Aircraft Armament.
T. MTP 7-2-504, Maintenance Evaluation of Aircraft Weapons.
U. MTP 7-2-505, Human Factors in Aircraft Weaponry.
V. MTP 8-2-130, Terminal Effectiveness of Chemical Projectiles.

5. SCOPE

5.1 SUMMARY

This MTP covers the following phases of testing helicopter mine and munition dispensing subsystems:

Pretest Inspection, paragraph 6.2.1.
Safety Evaluation Phase, paragraph 6.2.2.
Supplementary Shock, Vibration, and Environmental Tests, paragraph 6.2.3.
Performance Tests, paragraph 6.2 4.
Bullet Impact and Vulnerability Tests, paragraph 6.2.5.
Reliability, paragraph 6.2.6.
Human Factors Evaluation, paragraph 6.2.7.
Maintenance Evaluation, paragraph 6.2.8.

5.2 LIMITATIONS

This MTP is general in nature because of limited experience in mine and munition dispensing subsystem testing and the lack of information about the design details and performance requirements of future dispensing subsystems.

This document considers subsystem performance only up to the time that the mines come to rest on the emplacement surface or the time that the munitions function. Mine performance after emplacement is determined in accordance with MTPs 3-2-608, 4-2-502, 4-2-505, and 4-2-813. Applicable portions of the above, and MTPs 4-2-130 and 8-2-130, are used to evaluate munition performance.

6. PROCEDURES

6.1 PREPARATION FOR TEST

6.1.1 Literature Review

All literature pertinent to the test item is reviewed. The purpose is familiarization with performance requirements, the overall operational characteristics, the function of various components, and the results of previous tests. The literature includes MN, the test directive, drawings, operating manuals, the safety statement, safety-of-flight release, and previous test reports.

R. MTP 7-1-004, Army Aircraft Armament.
S. MTP 7-2-501, Safety Evaluation of Aircraft Armament.
T. MTP 7-2-504, Maintenance Evaluation of Aircraft Weapons.
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Before testing, all components are examined for damage. The damage is described and its relationship to various performance parameters carefully observed. In addition, the nomenclature and serial numbers of the subsystem and its major components are recorded.

The maintenance test package is examined for completeness in accordance with the listing provided.

6.2.2 Safety Evaluation Phase

The safety evaluation phase is a portion of the engineering test and the initial production test designed to obtain reasonable assurance that service testing can be conducted with minimum hazard to personnel. The test results are forwarded to Headquarters, USATECOM by letter. At least a preliminary evaluation is required within 30 days of test initiation. Additional instructions are contained in USATECOM Regulation 385-6.

The tests required for the safety evaluation phase are specified in the engineering test plan for the particular subsystem. For mine and munition dispensing subsystems the tests must include, but are not limited to, those described below. The payload (mines, munitions, or canisters) is evaluated separately from the dispensing hardware. Some tests, however, are conducted with the mines or munitions loaded in the dispensers.

6.2.2.1 Dispensing Hardware

The safety evaluation test must demonstrate that:

a. The presence of the dispenser subsystem does not adversely affect the aircraft flight characteristics.

b. The forces generated by ejection of the dispenser contents do not adversely affect the aircraft flight characteristics or cause mines or munitions to function prematurely.

c. All ejected components clear the aircraft.

The test phases are shown in Tables I and II.

NOTE: Aircraft and ammunition should be grounded to assure premature initiation will not result from static electricity.

6.2.2.2 Mines and Munitions

The safety evaluation test of mines and munitions is concerned with the potential hazard associated with the explosive or pyrotechnic content. This test phase must demonstrate that the items are safe to store, transport, handle, and dispense from the aircraft. The subtests are outlined in Table III.

Table I - Safety Evaluation Phase: Ground Tests for Dispensing Hardware

NOTE: These tests are conducted in the sequence shown.

Test	Procedure
Test Stand Phase	
Ambient Temperature	Mount each dispenser to a test stand and dispense contents of inert mines or munitions. Observe and record pattern of ejected components to determine whether they would be hazardous to the aircraft or its occupants. Inspect dispenser for damage.
Extreme Temperatures	Condition dispensers, loaded with inert mines or munitions, at extreme operating temperatures specified in guidance documents. If not specified, use extremes of -50° and +145°F. Repeat dispensing test.
Aircraft Phase	Install the subsystem, with empty dispensers, on the aircraft. Inspect for following and record results: a. Evidence of damage to subsystem or aircraft. b. Presence of firing signals at dispenser electrical terminals when firing controls are operated in proper sequence. Repeat b, above, with controls operated in sequence other than that specified for firing. Load inert mines or munitions into dispensers and dispense. Observe and record: a. Paths of ejected components. b. Damage to subsystem and aircraft.
Firing Circuit Check	Test firing circuitry in accordance with MTP 3-2-615 to determine whether it is subject to initiation from r-f sources. Record results and any improper functioning.

Table II - Safety Evaluation Phase: Aerial Tests for Dispensing Hardware

NOTES: 1. Flight tests are not conducted until a safety-of-flight release has been received and the ground tests (Table I) satisfactorily completed.

2. The safety of the subsystem for operation during flight is determined by applicable procedures in MTPs 7-1-004 and 7-2-501 as well as the tests below.

Test	Procedure
Cruising Speed	Dispense a full complement of mines or munitions with the aircraft flying at prescribed altitude and at cruising speed. The mines or muritions are either inert or contain minimal live content that will not endanger the aircraft if premature functioning occurs. Observe and record: a. Path of ejected components. b. Effect of dispensing on control of aircraft. c. Any evidence of damage to dispensing hardware or aircraft as determined by post-flight inspection. Also record aircraft altitude and airspeed and dispensing rate used.
Maximum Speed	Repeat above test with aircraft flying at maximum airspeed.
Minimum Speed	Repeat above test with aircraft flying at minimum airspeed.

Table III - Safety Evaluation Phase: Tests for Mines and Munitions

Test	Procedure
Safety Inspection	Inspect and manipulate in accordance with MTP 4-2-502.
Environmental and Shock Tests	Expose live ammunition to transportation-vibration, rough handling, 40-foot drop, and other tests of MTP 4-2-502 as appropriate. If mines and munitions are shipped loaded in the dispenser, test in this configuration also. During this phase performance tests are conducted after exposure at -50° and +145°F.
Aircraft Vibration	Vibrate loaded dispenser, secured to suitable test fixture, in accordance with MIL-STD-810B, method 514. Record any damage to mines or munitions and dispenser.
Arming and Functioning Delay	Measure and record arming and functioning delay times, using most appropriate of following methods: a. Statically initiate delay element of individual items. b. Dispense item from a dispenser mounted on a test stand. c. Dispense items with minimum live content from aircraft during flight. Determine danger radius in accordance with MTP 4-2-813 and record. Correlate delay time and danger radius to determine whether arming or functioning occurs at safe distance from aircraft.
Dispensing Tests	Dispense mines or munitions, including samples exposed to environmental, shock, and aircraft vibration tests above, as follows and observe and record evidence of hazardous conditions: a. Items with live main charge from dispenser mounted on test stand. b. Items with inert main charge and other components live from aircraft.
R-F Hazard	Test in accordance with MTP 3-2-615.

6.2.3 Supplementary Shock, Vibration, and Environmental Tests

The test items are subjected to the tests outlined in Table IV. Upon completion of each exposure, the items are inspected for evidence of damage or deterioration then submitted for the performance tests described in 6.2.4 below. Shock, vibration, and environmental tests that have been performed during the safety evaluation phase (6.2.2 above) need not be repeated. A description of each test procedure and the results of the post-test inspections and performance tests are recorded.

Table IV - Exposures for Entire Subsystem (Loaded Dispenser)

Test	Procedure
Transportation Vibration	Expose packaged hardware to vibration treatment described in MTP 4-2-804. Use test temperatures of -50° and +145°F unless otherwise specified. Expose with mines or munitions in the dispensers if the subsystem is shipped in this manner.
Salt Spray	Expose unpackaged, with mines or munitions in the dispensers, in accordance with MIL-STD-810B, method 109.
High Humidity	Expose unpackaged, with mines or munitions in the dispensers, in accordance with MTP 4-2-820.
Sand and Dust	Expose the dispensers, containing mines or munitions, in accordance with MTP 4-2-819.
Solar Radiation	Expose the dispensers, containing mines or munitions, in accordance with MTP 4-2-826.
Extreme Temperature Storage	Expose packaged to temperatures of magnitude and duration specified in guidance documents. If guidance not provided, use temperatures of -50° and +145°F for 7-day period.

6.2.4 Performance Tests

6.2.4.1 Dispensing Hardware

Performance test procedures for dispensing hardware are outlined in Tables V and VI.

Table V - Performance Phase: Ground Tests for Dispensing Hardware

Test	Procedure
Preparation	Install dispensing hardware on an aircraft which (alone) has been evaluated for performance, stability, and control. Photograph the hardware as mounted on the aircraft. Record aircraft and subsystem nomenclature or other identification.
Inspection	Inspect hardware as installed and record: a. That the subsystem is properly installed. b. Accessibility of subsystem components and ease of making adjustments. c. Suitability of location of subsystem instruments and controls with respect to flight control instruments.
Electrical Tests	With the subsystem, with empty dispensers, installed on the aircraft: a. Install ejection cartridges if used to eject the dispenser contents. b. Prepare instrumentation to measure dispensing rate and electrical power required to operate subsystem. c. Actuate firing mechanism with controls set at maximum dispensing rate. Record dispensing rate, operating voltages, and maximum power requirements. d. Repeat c, above, with controls set at minimum dispensing rate.

Table VI - Performance Phase: Aerial Tests for Dispensing Hardware

Test	Procedure
Dispensing	Dispense inert or minimum content mines or munitions under the following conditions as a minimum: a. With aircraft operated at minimum and maximum airspeeds and altitudes required by guidance documents. b. With subsystem intervalometer set at minimum and maximum dispensing rates. c. With aircraft operating over a high dust level area. During flight determine and record: a. Aircraft altitude, airspeed, and heading. b. Effect of dispensing on control of aircraft. c. Dispensing rate.
Inspection	After each flight inspect dispensing hardware and aircraft for evidence of damage and record results.

6.2.4.2 Mines and Munitions

Performance tests of the mines and munitions are generally accomplished concurrently with the aerial tests of the dispensing hardware (Table VI above). The following performance characteristics, as appropriate, are determined and recorded by the applicable procedures described in MTPs 3-2-825 and 4-2-816.

a. Ejection altitude and aircraft speed.

b. Time after ejection, and altitude, at which the following events occur prior to impact:

1) Opening of canisters, clusters, and velocity-retarding devices.
2) Functioning and subsequent associated events such as burning or smoke emission.

c. Rate of descent for items equipped with velocity-retarding devices.

d. Number of test items that function on impact.

e. Number of items that malfunction and description of the malfunctions.

f. Dispersion and range, with a plot of the dispersion pattern, of all mines and those munitions designed to function on impact. The plot is to include the aircraft flight path and the points of ejection initiation and cessation.

In addition, the type of previous exposure (salt spray, transportation vibration, none, etc.) of the test item is recorded.

6.2.5 Bullet Impact and Vulnerability Tests

The bullet impact test (a standard test of mines) determines the sensitivity of the mines and munitions to impacts from small arms projectiles. The test is conducted using 7.62-mm and cal .50 projectiles in accordance with MTP 4-2-505. Test items may be both packaged and unpackaged on the ground.

The vulnerability test of the subsystem, with payload, is conducted to determine whether small arms fire that strikes a loaded dispenser will cause a detonation in the dispenser that is hazardous to the aircraft. In some cases the bullet impact test may be adequate to appraise the vulnerability of the subsystem. In other cases, especially where the payload is contained within the dispenser, firing is conducted against a live-loaded dispenser from directions and with projectiles that simulate enemy ground fire. The dispenser is detached from the aircraft for this test.

6.2.6 Reliability

The various requirements documents (MN) may specify certain reliability criteria. These may involve such requirements as mission reliability (e.g., all tubes will successfully dispense their contents during a single flight) or overall reliability (a certain number of launchings will be performed without a malfunction). Functioning reliability of the mines and munitions may also be specified. Data obtained throughout the test are used in this analysis, or additional firings may be required for adequate data for expressing reliability with a certain degree of confidence.

Samples may not always be available in the quantities needed to satisfy the desired confidence criteria. The test director should consult statisticians regarding the analysis of the data which is available (MTP 3-1-002 may be used as a guide).

6.2.7 Human Factors Evaluation

Throughout the conduct of the test the man-item relationship is evaluated in accordance with MTP 7-2-505.

6.2.8 Maintenance Evaluation

The maintenance characteristics of all subsystem components are evaluated using the applicable procedures of MTP 7-2-504, which implements USATECOM Regulation 750-15.

6.3 TEST DATA

Data to be recorded are indicated in 6.1 and 6.2 above.

6.4 DATA REDUCTION AND PRESENTATION

The reduced data will be presented by a direct comparison of item performance with the stated levels of performance in the TCs and applicable parts of the MN. Additionally, the data will be used:

a. To determine the degree of improvement of degradation compared with similar or standardized armament subsystems.

b. As input data to that gathered for safety release recommendations to higher headquarters (USATECOM Reg. 385-6).