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Material Test Procedure 5-3-061
U. S. Army Field Artillery Board

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

MISSILE STATION, GUIDANCE AND LAUNCHING, VEHICULAR MOUNTED

1. OBJECTIVE

The objective of this test procedure is to describe the service test methodology, testing techniques, and minimum test requirements necessary for determining to what degree the test item performs the mission as prescribed in the Qualitative Materiel Requirements (QMR) and its suitability for field artillery use.

2. BACKGROUND

The field artillery has a continuous requirement for improved missile equipment that can achieve its mission with as much simplicity as possible. Great progress has been made toward this need but much is yet desired. The ultimate would be as small a group of missile support equipment as feasible, i.e., a missile station, vehicle mounted with all necessary guidance and launching equipment built in.

3. REQUIRED EQUIPMENT

- a. Maneuver and Operational Areas
- b. Vehicle Shop Facilities
- c. Firing Ranges
- d. Radio and Voice Communication as appropriate
- e. Maintenance Support Facilities
- f. Photographic Equipment
- g. Related Equipment as required
- h. Missiles and Inert Warheads, as required

4. REFERENCES

- A. AR 70-38, Research, Development, Test, and Evaluation of Materiel for Extreme Climatic Conditions.
- B. USATECOM Regulation 385-6, Verification of Safety of Materiel During Testing.
- C. Applicable Qualitative Materiel Requirements (QMR).
- D. Applicable Technical Characteristics (TC).
- E. USAMC Manual 385-224, AMC Safety Manual.
- F. MTP 2-3-500, Preoperational Inspection and Physical Characteristics.
- G. MTP 2-3-504, Cross-Country Mobility.
- H. MTP 2-3-505, Road Mobility.
- I. MTP 5-3-500, Preoperational Inspection and Physical Characteristics.
- J. MTP 5-3-501, Battlefield Mobility, Tactical Flexibility and Portability.
- K. MTP 5-3-506, Compatibility with Related Equipment.
- L. MTP 5-3-507, Human Factors Engineering (Compatibility of Man-Machine by Observation).

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- N. MTP 5-3-526, Emplacement, Action and March Order.
- O. MTP 5-3-528, Accuracy.
- P. MTP 5-3-530, Sectors of Fire and Changing Targets.
- Q. MTP 7-3-515, Air Transport, Internal (Suitability of Equipment for).
- R. MTP 10-3-501, Operator Training and Familiarization.
- S. MTP 10-3-504, Maintenance Evaluation.

5. SCOPE

5.1 SUMMARY

This materiel test procedure describes the following procedures:

- a. Preparation for Test - A determination of the operational condition of the test item and its physical characteristics prior to testing and an indication of personnel, facility and safety requirements.
- b. Operational Characteristics - A study to determine the capability of the test item to traverse paved roads, unpaved roads and cross-country terrain, evaluate its battlefield mobility and its emplacement, preparation for action and march order capability.
- c. Compatibility with Related Equipment - An evaluation of the compatibility of the test item with items of related equipment in the applicable missile system used in guidance and launching procedures.
- d. Accuracy - An evaluation of the accuracy and precision of the guidance and launching system.
- e. Sectors of Fire - A study to determine the amounts of range and deflection capabilities of the test item.
- f. Rate of Fire - A determination of the actual rate of fire of the test item.
- g. Changing Targets - A determination of the capability of the test item to change targets.
- h. Vulnerability to Countermeasures - A determination of the effects of countermeasures on the test item.
- i. Safety - A determination of the safety hazards encountered during the emplacement and operation of the test item.
- j. Maintainability and Reliability - An evaluation of the maintainability of the test item as regards the performance of scheduled and unscheduled maintenance and the adequacy of the maintenance package and a determination of the reliability of the test item and its major components.
- k. Air Transport - A determination of the suitability of the test item for air transport.
- l. Camouflage - A study to determine the effectiveness of camouflage on the test item.
- m. Training Literature Evaluation - A determination of the adequacy and accuracy of the supplied technical manuals, field manuals and charts.
- n. Human Factors Engineering - A study to determine the suitability of the test item by service personnel without causing undue fatigue, strain and mental errors.

5.2 LIMITATIONS

The scope of this MTP does not include the vehicle portion of the test item except those for vehicular tests directly related to the missile such as

maneuverability and mobility in the firing position area.

6. PROCEDURES

6.1 PREPARATION FOR TEST

6.1.1 Scheduling

6.1.1.1 Personnel

Prior to arrival of the test item ensure that operator and maintenance personnel are adequately trained as prescribed in MTP 10-3-501, and are familiar with test procedures to be used and all pertinent data, including the following for service personnel be recorded:

- a. Rank
- b. MOS
- c. Training time in MOS
- d. Experience in MOS

6.1.1.2 Facilities and Equipment

- a. Select and schedule the use of test courses and test sites.
- b. Prior to or immediately upon arrival of the test item arrange for or secure the following:

- 1) Maintenance support facilities
- 2) Safety Release in accordance with USATECOM Regulation 385-6

6.1.2 Safety

Safe test procedures shall be followed throughout all testing. Any unsafe or potentially unsafe condition will be cause for testing to cease until all questionable conditions are resolved.

6.1.3 Pre-Test Operations

NOTE: Missile warhead sections and missile propellant sections used in conjunction with the tests shall be inert and handled in accordance with reference 4E.

6.1.4 Preoperational Inspection and Physical Characteristics

- a. Determine that the test item and the vehicle in which it is mounted are operable by performing the applicable procedures of MTP 5-3-500 and MTP 2-3-500.
- b. Measure and weigh the test item and its major components and record the obtained dimensions and weights.
- c. Photograph the test item and its major components.

6.2 TEST CONDUCT

Tests shall be conducted concurrently with or in conjunction with other tests, whenever possible, so that the time taken to collect the required data can be minimized.

6.2.1 Operational Characteristics

The procedures of paragraphs 6.2.1.1 through 6.2.1.3 shall be performed under conditions of daylight, darkness and blackout.

6.2.1.1 Mobility and Maneuverability

a. Determine the ability of the test item to traverse approximately 200 miles over paved roads, unpaved roads and cross-country terrain as described by the applicable sections of MTP 2-3-505 and MTP 2-3-504.

b. At the completion of testing, subject the test item and test vehicle to the applicable procedures of MTP 2-3-500 and MTP 5-3-500.

6.2.1.2 Battlefield Mobility

a. Determine the battlefield mobility of the test item as described by the applicable sections of MTP 5-3-501.

b. At the completion of testing, subject the test item and test vehicle to the applicable procedures of MTP 2-3-500 and MTP 5-3-500.

6.2.1.3 Emplacement, Preparation for Action and March Order

Determine the emplacement, preparation for action and march order capability of the test item as described in the applicable sections of MTP 5-3-526, and the following:

a. Prior to emplacement, perform an operational check as described in the applicable technical manual to ensure the following:

- 1) Compatibility of the launcher and guidance system with their checkout equipment.
- 2) Operability of the launch and guidance equipment.
- 3) Operability of power sources, maintenance equipment and related support equipment.

NOTE: Instrumentation must be energized and in use, which means that the instrumentation be either shielded from or invulnerable to the test environment.

b. The test item shall be emplaced after approximately each 50 miles of its travel cycle and all functional requirements shall be accomplished to include:

- 1) Simulated firing
- 2) Actual firing
- 3) Operational check

NOTE: During this exercise all mission type functions listed in the QMR must be performed and analyzed as to the degree to which each function fulfills the QMR. Selected personnel of the test team will be placed so they may freely observe operator personnel as they operate the test item.

c. Each component or major part of the test item will be observed while being used to perform its intended function. Material characteristics which cause difficult time consuming operations will be recorded. The ease with which the test item can be operated will be noted.

6.2.2 Compatibility and Related Equipment

Determine the compatibility of the test item with all standard and development items used in preparing missiles for launch, and launching missiles as described in the applicable sections of MTP 5-3-506 and record the following:

NOTE: Compatibility determination will be based on the percentage of standard items suitable for use without requirements of modification.

- a. Nomenclature and identity of all standard components or devices used with the test item not requiring modification.
- b. Nomenclature, identity and comments pertaining to this compatibility of all developmental type items used.

6.2.3 Accuracy

Determine the accuracy of the test item as described in the applicable sections of MTP 5-3-528, recording all pertinent data including the following:

- a. Trajectory information including range, direction and height of burst for all firing tests.
- b. Miss data for firing tests.
- c. Precision of test item indicating components.

6.2.4 Sectors of Fire

- a. Determine the sectors of fire capability of the test item, while emplaced on a flat surface as described in the applicable sections of MTP 5-3-530.
- b. Repeat the procedures of step a with the test item emplaced on various slopes and prepared to fire at various ranges and directions, and record the ability of the test item to cover the sector of fire from minimum to maximum range.

NOTE: The degree of slope, range and direction shall be as specified in the test directive or by the test director.

6.2.5 Rate of Fire

Determine the rate of fire of the test item during specific firing and non-firing tests by measuring and recording the following:

- a. Time required to assemble missile onto the test item and fire.
- b. Time interval between firing one missile and being ready to fire another missile.

6.2.6 Changing Targets

Determine the target changing characteristics of the test item as described in the applicable section of MTP 5-3-530.

6.2.7 Vulnerability to Countermeasures

On specified firing and non-firing tests subject the missile system, including the test item, to countermeasure action and record the following:

- a. Countermeasure equipment used
- b. Effects of countermeasures

6.2.8 Safety

Determine the safety characteristics of the test item as described in the applicable section of MTP 5-3-510, and the following:

- a. On all tests, operations will be observed to detect unsafe conditions.
- b. Record observations concerning:
 - 1) Material characteristics which cause unsafe conditions.
 - 2) Operating procedures which are hazardous for crewmen or which may cause damage to material.
 - 3) Conditions which may endanger friendly troops.

6.2.9 Maintenance Evaluation

Determine the maintainability and reliability characteristics of the test item as described in the applicable sections of MTP 10-3-504, with emphasis on the following:

6.2.9.1 Maintainability

a. All material shall be inspected before, during and after tests. All authorized maintenance operations will be performed. The organizational and field maintenance portions of the maintenance allocation chart will be proofed to determine whether maintenance operations can be performed within the limitations of the echelon to which they are allocated. Appropriate repair parts will be checked to ensure that maximum interchangeability has been effected. Adequacy of repair parts, tools and personnel for organizational and field maintenance will be checked.

- b. Record the following maintainability data:

- 1) Man-hours required to perform maintenance on each major component of the test item.
- 2) Difficult or time consuming operations.
- 3) Maintenance operations which should be reassigned.
- 4) Parts or components which should be replaced by standard items.
- 5) Frequency of replacement.
- 6) Human engineering aspects of cleaning, lubrication, repair or replacement of parts.

6.2.9.2 Reliability

During all firing and non-firing tests the test item and its major components shall be examined for failures and malfunctions and the following recorded for each failure/malfunction:

- a. Detail of each failure/malfunction
- b. Time required for repairs
- c. Total downtime
- d. Total operating time of malfunctioning/failed component

6.2.10 Air Transport

Determine the suitability of the test item for air transport as described in the applicable sections of MTP 7-3-515, including the following:

- a. The test item will be studied with reference to weight, overall and reducible dimensions and obstructions to loading in appropriate aircraft. The test item with separate components (if any) will be loaded, restrained, flown and offloaded from appropriate aircraft.
- b. Motion pictures shall be taken of loading and offloading operations.
- c. Details of all difficulties encountered shall be recorded.

6.2.11 Camouflage

Perform the following under both daylight and night conditions:

a. Determine and record the maximum distances at which the test item is discernible without camouflage and with camouflage (using natural materials, artificial materials, or a combination of both) from ground positions, using:

- 1) Unaided eye
- 2) Optical instruments
- 3) Photography

b. Determine and record the maximum altitudes at which the test item is discernible without camouflage and with camouflage (using natural materials, artificial materials, or a combination of both) from aerial observations, using:

- 1) Unaided eye
- 2) Optical instruments

3) Aerial photograph

c. Make observations and obtain photographs, both ground and aerial, of the test item and test vehicle in march columns and emplaced in the vicinity of other vehicles and determine if the test item/test vehicle combination has a discernible signature.

6.2.12 Training Literature Evaluation

Evaluate the training literature (technical manuals, field manuals and charts) provided with the test item throughout the test for operating and maintaining the test item and record the following:

- a. Modifications required to emplacing, preparation for action, operating and maintenance instructions.
- b. Errors.
- c. Omissions.
- d. Unsafe procedures.
- e. Other inadequacies.

6.2.13 Human Factors Engineering

Determine the suitability of the test item design with respect to the man-machine relationship throughout the period of testing as described by the applicable sections of MTP 5-3-507.

Determine and record the suitability and compatibility of the test item with the service personnel who will operate and service it, with regard to their skills, aptitudes and physical limitations.

NOTE: Each test item detail requiring human attention and/or manipulation shall be observed and evaluated as well as those for the complete missile system.

6.3 TEST DATA

6.3.1 Preparation for Test

6.3.1.1 Scheduling

6.3.1.1.1 Personnel -

- a. Record data collected as described in the applicable sections of MTP 10-3-501.
- b. Record the following for all service personnel:
 - 1) Rank
 - 2) MOS
 - 3) Training time in MOS, in months
 - 4) Experience in MOS, in months

6.3.1.2 Preoperational Inspection and Physical Characteristics

a. Record the following:

- 1) Preoperational inspection data collected as described in the applicable sections of MTP 2-3-500 and MTP 5-3-500.
- 2) Weight of test item, in pounds.
- 3) For assembled test item, in feet:
 - a) Length
 - b) Width
 - c) Height
- 4) For each major component, in inches:
 - a) Length
 - b) Width
 - c) Height

b. Retain all photographs.

6.3.2 Test Conduct

6.3.2.1 Operational Characteristics

Record the following for each test conducted:

- a. Time of day
- b. Lighting condition (daylight, darkness)
- c. Weather condition (clear, rainy, snow, sleet, etc.)
- d. Ambient temperature, in degrees Fahrenheit

6.3.2.1.1 Mobility and Maneuverability -

- a. Record data, collected as described in the applicable sections of MTP 2-3-505 and MTP 2-3-504.
- b. Record inspection data, collected as described in the applicable sections of MTP 2-3-500 and MTP 5-3-500.

6.3.2.1.2 Battlefield Mobility -

- a. Record data, collected as described in the applicable sections of MTP 5-3-501.
- b. Record inspection data, collected as described in the applicable sections of MTP 2-3-500 and MTP 5-3-500.

6.3.2.1.3 Emplacement, Preparation for Action and March Order Capability -

- a. Record data as required by the applicable sections of MTP 5-3-526.
- b. Record the number of simulated and actual firings during each emplacement.

- c. For missile system equipment, record:
 - 1) Time of checkout (prior to emplacement, after emplacement)
 - 2) Operability of:
 - a) Checkout equipment
 - b) Launch equipment
 - c) Guidance equipment
 - d) Power sources
 - e) Maintenance equipment
 - f) Other support equipment

6.3.2.2 Compatibility and Related Equipment

Record the following:

- 5-3-506.
 - a. Data, collected and described in the applicable sections of MTP
 - b. For standard items:
 - 1) Total number checked
 - 2) Nomenclature and identity of items not requiring modification
 - c. For each developmental item:
 - 1) Nomenclature and identity
 - 2) Comments concerning compatibility

6.3.2.3 Accuracy

Record the following:

- 5-3-528.
 - a. Data collected as described in the applicable sections of MTP
 - b. For trajectory data:
 - 1) Range in meters
 - 2) Direction in degrees
 - 3) Burst height in meters
 - c. Miss data in meters:
 - 1) Horizontal
 - 2) Vertical
 - d. Precision of all indicating components

6.3.2.4 Sectors of Fire

Record the following for each test:

- a. Slope of emplaced test item in degrees.
- b. Minimum and maximum range, in meters, and direction, in degrees, for aiming point.
- c. Data collected as described in the applicable sections of MTP 5-3-530.

6.3.2.5 Rate of Fire

Record the following:

- a. Time required to assemble missile onto test item and fire, in seconds.
- b. Time between firing one missile and being ready to fire another missile, in seconds.

6.3.2.6 Changing Targets

Record data collected as described in the applicable section of MTP 5-3-530.

6.3.2.7 Vulnerability to Countermeasures

Record the following for each countermeasure test:

- a. Countermeasure equipment used
- b. Effectiveness of countermeasures

6.3.2.8 Safety

Record the following:

- a. Data collected as described in the applicable sections of MTP 5-3-510.
- b. Material characteristics which cause unsafe conditions.
- c. Operating procedures hazardous to crewmen or may cause material damage.
- d. Conditions which may endanger friendly troops.

6.3.2.9 Maintenance Evaluation

6.3.2.9.1 Maintainability -

Record data collected as described in the applicable sections of MTP 10-3-504, and the following:

- a. Man-hours required to perform maintenance on each major component of the test item.
- b. Difficult or time consuming operations.
- c. Maintenance operations which should be reassigned.
- d. Parts or components which should be replaced by standard items.
- e. Frequency of parts replacement.

f. Human engineering aspects of:

- 1) Cleaning
- 2) Lubrication
- 3) Repair of parts
- 4) Replacement of parts

6.3.2.9.2 Reliability -

Record data collected as described in the applicable sections of MTP 10-3-504, and the following:

- a. Detail of each failure/malfunction
- b. Time required for repairs, in minutes
- c. Total downtime, in minutes
- d. Total operating time of malfunctioning/failed component in hours

6.3.2.10 Air Transport

a. Record the following:

- 1) Data collected as described in the applicable sections of MTP 7-3-515.
- 2) Details of difficulties encountered.

b. Retain all photographs.

6.3.2.11 Camouflage

a. Record the following for each visual observation from ground positions:

- 1) Visibility condition (daylight, darkness)
- 2) Test item emplacement condition (camouflaged, uncamouflaged)
- 3) Maximum distances in meters at which the test item is discernible by:

- a) Unaided eye
- b) Optical instruments
- c) Photography

b. Record the following for each visual observation from aircraft:

- 1) Visibility condition (daylight, darkness)
- 2) Test item emplacement condition (camouflaged, uncamouflaged)
- 3) Maximum altitudes in feet at which the test item can be detected by:

- a) Unaided eye
- b) Optical instruments
- c) Aerial photography

- c. Record any undue signature identifiable with the test item.
- d. Retain all photographs.

6.3.2.12 Training Literature Evaluation

Record the following:

- a. Modifications required to:
 - 1) Emplacement instructions
 - 2) Preparation for action instructions
 - 3) Operating instructions
 - 4) Maintenance instructions
- b. Errors
- c. Omissions
- d. Unsafe conditions
- e. Other inadequacies

6.3.2.13 Human Factors Engineering

Record the following:

- a. Data collected as described in the applicable sections of MTP 5-3-507.
- b. Service personnel comments on the suitability and compatibility of the test item with respect to their skill levels, aptitudes and physical limitations in:
 - 1) Operation
 - 2) Maintenance

6.4 DATA REDUCTION AND PRESENTATION

Data obtained from each performance subtest shall be summarized, compared and evaluated.

Appropriate charts, graphs, tables, and photographs shall be used to summarize where appropriate.

Safety Confirmation shall be presented in accordance with USATECOM Regulation 385-6.

Specific qualitative data shall be evaluated against the specific requirements of the QMR.

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13. ABSTRACT This Army Service Test Procedure describes test methods and techniques for evaluating the performance and characteristics of Missile Station, Guidance and Launching, Vehicular Mounted, and for determining their suitability for service use by the US Army. The evaluation is related to criteria expressed in applicable Qualitative Materiel Requirements (QMR), Technical Characteristics (TC), or other appropriate design requirements and specifications.			

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