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Materiel Test Procedure 5-3-536
U. S. Army Artillery BoardU. S. ARMY TEST AND EVALUATION COMMAND
COMMON SERVICE TEST PROCEDURE

TRAINING DEVICES (MISSILE AND ROCKET SYSTEMS)

1. OBJECTIVE

The objective of this procedure is to provide a basis for evaluating guided missile and rocket system training devices for service personnel.

2. BACKGROUND

The inherent complexity and increasing cost of guided missile and rocket materiel necessitates development and production of adequate training devices. These devices are used for teaching and maintaining personnel proficiency in all handling, maintenance, test and checkout, prefiring and firing operations, and procedures for which the user is responsible. Requirements for these training devices exist because tactical equipment alone will not fulfill training needs due to the inability of such equipment to withstand continued handling and operation, its lack of fault insertion capabilities, and the high cost of many components which can be simulated relatively inexpensively.

Missile and rocket system training device evaluation is used to uncover unduly complex or time consuming operations, to present recommendations and solutions for deficiencies, shortcomings, excessive skill or manpower requirements, and to obtain a true picture of the cost versus the training value of the device.

The total inventory value of training devices, both in use and in storage, runs into millions of dollars. With mounting costs and the complexity of modern weapon systems to consider, it is necessary to obtain operationally acceptable equipment which will perform satisfactorily and can be produced at reasonable cost.

Effective evaluation begins with a thorough understanding of the military characteristics and requirements for the training device under evaluation and for the parent missile or rocket system which the trainer simulates.

3. REQUIRED EQUIPMENT

- a. Required test facility
- b. Qualitative Materiel Requirements (QMR's), Small Development Requirements (SDR's), Military Characteristics (MC's), and Technical Characteristics (TC's)
- c. Notes on Preliminary Operation and Maintenance Manuals (POMM) covering the training device under evaluation
- d. Army Materiel Command or manufacturer's drawings for details of manufacture, function, and testing of the training device.

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e. Department of Defense Index of specifications and standards for applicable specifications

4. REFERENCES

- A. Department of the Army Pamphlet 310-3, Index of Doctrinal, Training, and Organizational Publications
- B. Department of the Army Pamphlet 310-29, Index of Military Publications of Supply Manuals
- C. Army Regulation 611-201, Manual of Enlisted Military Occupational Specialties
- D. Training Devices Guide, NAVEXOS P-530-2
- E. TM's and FM's on tactical missile system
- F. AMCR 385-224, AMC Safety Manual
- G. MTP 5-3-503, Personnel Training
- H. MTP 5-3-505, Maintenance
- I. MTP 5-3-507, Human Factors Engineering
- J. MTP 5-3-510, Safety Hazards
- K. MTP 5-3-512, Transportability
- L. MTP 5-3-524, Personnel Training, Combat Vehicle Mounted Systems

5. SCOPE

5.1 SUMMARY

This materiel test procedure describes the following procedures used for the evaluation of training devices:

- a. Comparison with Normal Tactical Equipment - A study to determine the suitability of the test item as a device to train personnel in the use of the tactical item
- b. Operability Tests - A study to determine the ease of set-up, calibration, operation, disassembly, and operating characteristics of the training device, and the ability of the trainer to simulate technical equipment malfunctions
- c. Maintenance Evaluation - A study to determine the maintenance requirements of the training device
- d. Transportability - A study to determine the training devices transportability
- e. Safety - A study to determine the test item's compliance with safety specifications in the QMR, SDR, or other appropriate document
- f. Human Engineering - A study to determine the suitability of the training device as regards the man-machine relationship
- g. Evaluation Questionnaires - A study to determine if the training device is capable of performing its intended task

5.2 LIMITATIONS

The procedures in this document do not include the testing of training devices for explosive or nuclear components of missiles or rockets.

6. PROCEDURES

6.1 PREPARATION FOR TEST

6.1.1 Training Device Considerations

Prior to obtaining test personnel for operation, maintenance and evaluation, and test facilities, the test officer shall determine and record the following:

6.1.1.1 Training Objectives

- a. Information on specific skills, knowledge, coordinated actions or attitudes which the device will help to teach
- b. Essential objectives which must be fulfilled for the device to be valuable
- c. Secondary objectives

6.1.1.2 Learning Environment

- a. Phase of training during which the device will be used (basic training, advanced individual training, unit training, service school training, crew/team training, maintenance/operator training, etc.)
- b. How the device will be used in training
- c. The manner in which such training may be, or is accomplished without the training device

6.1.1.3 Personnel Considerations

- a. Required background of instructions
- b. Type of course (enlisted men training course, officers training course)
- c. Required background of trainees

6.1.1.4 General Environment

- a. Location of training (school, shop, trailer, indoors, outdoors, in-the-field)
- b. Expected total number of hours to be devoted to the training course
- c. Expected total number of hours the training device is expected to be operated
- d. Expected maximum continuous use without shutdown

6.1.1.5 Comparison Data

- a. Operational equipment to be simulated
- b. Cost of training device
- c. Cost of operational equipment

6.1.2 Personnel Training and Familiarization

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a. Service personnel responsible for evaluating, operating, and maintaining the test item shall have been trained using the criteria of MTP 5-3-503 and/or MTP 5-3-524 and should be familiar with the test item's manuals and the manuals of similar training devices, if applicable, and the operational equipment.

b. Record the following for all service personnel involved in the conduct of this procedure:

- 1) Rank
- 2) MOS
- 3) Experience in MOS
- 4) Training time in MOS

6.1.3 Test Facilities

Ensure the availability of test facilities capable of accommodating the requirements and physical configuration of the test item.

6.1.4 Safety

Personnel shall adhere to the applicable provisions of The Army Materiel Command Safety Manual, AMCR 385-224.

6.2 TEST CONDUCT

6.2.1 Comparison with Normal Tactical Equipment

6.2.1.1 Packaging

Unpack the test training device and determine and record if the following are the same as that used for the tactical equipment:

- a. Material used in packaging
- b. Tools required for uncrating
- c. Method of uncrating and unpackaging

6.2.1.2 Physical Characteristics

Inspect the training device and determine and record if the test item conforms to the specifications in the QMR or other appropriate document:

- a. Physical appearance:
 - 1) Weight
 - 2) Cubage
 - 3) Overall length, width, and height
 - 4) Shape
 - 5) Color
- b. Power requirements

- c. Mobility requirements
- d. Portability requirements
- e. Number, type and location of connectors and connections
- f. Number, and location of access doors and plates
- g. Number, types and locations of meters, knobs, indicators, switches, scales, indexes, lamps, lenses, and fuses
- h. Number, type and location of warning and safety devices
- i. Number and location of hooks, rings, and eyes for handling or moving the test item

6.2.1.3 Assembly/Disassembly

Assemble and install the test item and determine and record the following:

- a. If the same tools can be used by both tactical equipment and the training device for assembly/disassembly
- b. If the POMM's procedures provide suitable and adequate guidance for assembly/disassembly of the test item
- c. If the training device connections are interchangeable with the tactical equipment, and if not, note if the required adapters are included as standard equipment
- d. If interior components have the same location and method of installation
- e. If both interior and exterior components in the trainer are marked in a conspicuous place as "Trainer Equipment" to preclude their inadvertent use on tactical equipment

6.2.1.4 Set-Up and Operation

During the conduct of paragraph 6.2.2, determine and record:

- a. If before, during and post operation checks and adjustments are similar to the tactical equipment procedures
- b. If the sequence of events, when power is applied, is the same as on the tactical equipment; for example:
 - 1) Does sequence timer begin running?
 - 2) Do indicator light illuminate or extinguish?
 - 3) Do indicators, switches, and relays operate in the same manner?

6.2.1.5 Maintenance and Repair

During the conduct of paragraph 6.2.3, determine and record the following:

- a. If the same tools can be used for maintenance and repair of the training device as are used on the tactical equipment
- b. If the test equipment authorized for the tactical equipment will also check out the training device
- c. If the replaceable components for the trainer are so keyed to

prevent their use in tactical equipment

d. If the training device components are replaced, repaired, and adjusted in the same manner as the tactical equipment

e. If the training device is readily adaptable for modification work orders (MWO's) that would apply to the tactical equipment

f. If maintenance, repair, and troubleshooting procedures stated in the POMM's are adequate

g. If the schematics/wiring diagrams are in sufficient detail for operator and maintenance personnel guidance (e.g. pin numbers and terminal board locations)

6.2.2 Operability Tests

6.2.2.1 Simulation of Normal Operation

NOTE: This procedure shall be performed by both experienced personnel responsible for evaluation, and inexperienced personnel who are to be trained using the training device.

a. Set-up and operate the test item, in its normal configuration, and determine and record the following:

- 1) Ease of set-up of trainer
- 2) Ease of calibration of trainer
- 3) Ease of operation of trainer
- 4) Maximum allowable sustained operation
- 5) Relief (cooling) period required between operations
- 6) Compatibility with existing government furnished equipment (GFE) required to operate the test item

b. Prepare the training device for transportation and record the following:

- 1) Ease of disassembly
- 2) Ease of packaging for shipment

c. Repeat steps a and b with the test item exposed to, and record the effects of, various weather conditions, as applicable, on trainer set-up, operation, and disassembly.

6.2.2.2 Simulation of Malfunctions

NOTE: Troubleshooting shall be performed by both experienced personnel responsible for evaluation, and inexperienced personnel undergoing training.

a. Experienced personnel, who are cognizant of the tactical equipment shall insert malfunction(s) into the training device using the following criteria:

NOTE: Malfunctions may be simulated as follows:

1. Electrical: Programmed IBM cards and punched tape
 2. Mechanical: Opening terminals, shorting relays, unsoldering components, grounding signals, and inserting faulty components
- 1) Malfunctions must be easily inserted with a minimum of time involved.
 - 2) Malfunctions must simulate a type that occurs frequently in the tactical equipment under actual operation.
 - 3) Malfunctions must give an indication similar to that of the tactical equipment that is readily noticeable by operating or maintenance personnel.
 - 4) Malfunctions must not damage associated equipment.
 - 5) Malfunctions, while giving a true indication of a problem, shall not indicate whether they are real or simulated malfunctions.

NOTE: A method of monitoring the inserted fault shall be provided to ensure that no malfunction is inadvertently left in the equipment.

b. Conduct a malfunction evaluating session and record the following for each malfunction inserted:

- 1) Malfunction
- 2) For personnel:
 - a) MOS
 - b) Experience in MOS
 - c) Training time in MOS
- 3) Time required to determine fault

6.2.3 Maintenance Evaluation

The trainer shall be subject to the maintenance evaluation of MTP 5-3-505 and the following:

- a. Perform all scheduled maintenance as directed in the test item's technical manual.
- b. Perform all unscheduled maintenance as required during the operation of the test item.
- c. Prepare an Equipment Performance Report for all malfunctions discovered during maintenance operations.

NOTE: Tools and equipment required for maintenance shall be part of the trainer's maintenance package or indigenous to the level of maintenance.

d. Record the following for steps a and b:

- 1) Total operating time for malfunctioning items
- 2) Total operating time of test item
- 3) Ease of maintenance operation
- 4) Total down time (see Glossary)
- 5) Time required to perform maintenance
- 6) Category of maintenance
- 7) Special tools or equipment required
- 8) Nomenclature and FSN of parts required or replaced
- 9) Adequacy of maintenance instructions

6.2.4 Transportability

Determine the transportability of the test item using the criteria of MTP 5-3-512.

6.2.5 Safety

During the set-up, operation, and disassembly of the test item, determine any hazard to crew operation using the criteria of MTP 5-3-510.

6.2.6 Human Engineering

During the operation of the training device, determine the suitability of the trainer design with respect to location of knobs, dials, indicators, etc., and associated equipment and their effect on operations using the criteria of MTP 5-3-507.

6.2.7 Evaluation Questionnaires

At the completion of the conduct of paragraph 6.2.1 through 6.2.6, the following shall be performed:

NOTE: Careful development of questionnaires is required to elicit meaningful comments.

a. All test personnel, evaluators and trainees shall fill out questionnaires pertaining to the following:

- 1) Training device's ability to develop trainee's ability and confidence to perform on tactical equipment
- 2) Training device's ability to integrate related information and skills acquired earlier

b. Evaluation personnel shall fill out questionnaires pertaining to the following:

- 1) Ability of the training device to provide knowledge of the trainee's proficiency

- 2) Compatibility of the training device's responses, characteristics, and malfunction indications with the tactical equipment
- 3) Estimated endurance and breakout ability (see Glossary) of the training device
- 4) Up-to-dateness of the training device

6.3 TEST DATA

6.3.1 Preparation for Test

6.3.1.1 Training Device Considerations

6.3.1.1.1 Training Objectives -

Record the following:

- a. Skills, knowledge, coordinated actions or attitudes the device will help teach
- b. Essential objective of the device
- c. Secondary objective of the device

6.3.1.1.2 Learning Environment -

Record the following:

- a. Phase of training during which the device will be used
- b. How the device will be used
- c. Method of training without the training device

6.3.1.1.3 Personnel Considerations -

Record the following:

- a. Required background of instructors
- b. Type of course
- c. Required background of trainees

6.3.1.1.4 General Environment -

Record the following:

- a. Location of training
- b. Expected number of hours for the course
- c. Expected number of hours the device shall be operated
- d. Expected maximum continuous use, without shutdown, in hours

6.3.1.1.5 Comparison Data -

Record the following:

- a. Operational equipment to be simulated
- b. Cost of training device
- c. Cost of operational equipment

6.3.2 Test Conduct

6.3.2.1 Comparison with Normal Tactical Equipment

6.3.2.1.1 Packaging -

Record variations between the tactical equipment and the training device for the following:

- a. Materials used in packaging
- b. Tools required for uncrating
- c. Method used for uncrating

6.3.2.1.2 Physical Characteristics -

Record the following:

- a. Weight
- b. Cubage
- c. Length, width, and height
- d. Shape
- e. Color
- f. Power requirements
- g. Mobility requirements
- h. Transportability requirements
- i. Number, type and location of:
 - 1) Connectors and connections
 - 2) Access doors and plates
 - 3) Meters, knobs, indicators, switches, scales, indexes, lamps, lenses, and fuses
 - 4) Warning and safety devices

6.3.2.1.3 Assembly/Disassembly -

Record the following:

- a. If the same tools can be used to assemble/disassemble the trainer and the tactical equipment
- b. If the POMM's procedures provide suitable and adequate guidance for assembly/disassembly of the test item
- c. If the training device connectors are interchangeable with the tactical equipment, or if required adapters are included
- d. If the trainer interior components have the same location and are installed in the same manner as the tactical equipment
- e. If both interior and exterior trainer components are marked "Trainer Equipment"

6.3.2.1.4 Set-up and Operation -

Record the following:

- a. If pre, post and operating checks and adjustments are similar to the tactical equipment
- b. If the sequence of events, with power applied, is similar to the tactical equipment

6.3.2.1.5 Maintenance and Repair -

Record the following:

- a. If the same tools can be used for the training device and the tactical equipment
- b. If the same test equipment can be used for the training device and the tactical equipment
- c. If the training device spare parts are so keyed as to prevent their use in the tactical equipment
- d. If the training device components are replaced, repaired, and adjusted in the same manner as the tactical equipment
- e. If the training device is adaptable for tactical equipment modification work orders
- f. If maintenance, repair, and troubleshooting procedures stated in the POMM's are adequate
- g. If the schematics/wiring diagrams are in sufficient detail for operator and maintenance personnel

6.3.2.2 Operability Tests

6.3.2.2.1 Simulation of Normal Operation -

Record the following for each operation:

- a. Type of personnel performing the test (experienced, trainees)
- b. Ease of set-up
- c. Ease of calibration
- d. Ease of operation
- e. Maximum allowable sustained operation, in hours
- f. Relief period required, in minutes
- g. Ease of disassembly
- h. Ease of packaging for shipment
- i. Compatibility with existing GFE required to operate the test item

6.3.2.2.2 Simulation of Malfunction -

Record the following for each malfunction:

- a. Malfunction inserted (shorted relay, error in tape, etc.)
- b. For personnel performing troubleshooting:

- 1) MOS
- 2) Experience in MOS, in months
- 3) Training time in MOS, in months

c. Time required to determine malfunction

6.3.2.3 Maintenance Evaluation

Record the following:

- a. Data collected as described in MTP 5-3-505
- b. Type of maintenance (scheduled, unscheduled)
- c. Operating time of malfunctioning component, if applicable, in hours
- d. Test item's total operating time, in hours
- e. Ease of maintenance operation
- f. Total down time, in hours
- g. Time required to perform maintenance, in hours
- h. Maintenance category (organizational, direct, general support)
- i. Special tools or equipment required
- j. Nomenclature and FSN of parts required or replaced
- k. Adequacy of maintenance instruction

6.3.2.4 Transportability

Record the data collected as described in MTP 5-3-512.

6.3.2.5 Safety

Record the data collected as described in MTP 5-3-510.

6.3.2.6 Human Engineering

Record the data collected as described in MTP 5-3-507.

6.3.2.7 Evaluation Questionnaires

Retain all questionnaires.

6.4 DATA REDUCTION AND PRESENTATION

Test results shall be presented in both narrative and chart form to indicate the following:

- a. Similarity between the training device and tactical equipment
- b. Differences between the training device and tactical equipment
- c. Effectiveness of the training device
- d. Comparison between the training device and the present method of training as regards:

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- 1) Effectiveness in training operators, maintenance men
- 2) Time required to train the personnel
- 3) Cost per individual for the training program

GLOSSARY

1. Breakout: Frequent major item unpackaging and repackaging, major component mating and unmating, and removal and replacement of individual assemblies.
2. Downtime: That portion of calendar time during when an item is not in a condition to perform its intended function.
3. Endurance: Ability to withstand repeated handling and rough usage.
4. Trainer: Training device.
5. Training device: A 3-dimensional aid such as a model, miniature, or cutaway, including such complex mechanical or electronic 3-dimensional aids as synthetic trainers, mechanized evaluators, and simulated operational systems.