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

CHRONOGRAPH, FIELD ARTILLERY

1. OBJECTIVE

The objectives of this MTP are to determine the suitability of the test item for calibration of artillery weapons by determination of muzzle velocity to an acceptable degree of accuracy and to determine compliance of the test item with the essential characteristics of the qualitative materiel requirements (QMR's) or small development requirements (SDR's) and the technical characteristics (TC's).

2. BACKGROUND

a. For years there has been a continuing requirement to develop a predicted fire capability through a projectile velocity measuring device for the delivery of accurate, grouped, and timely fire on known or suspected targets and targets of opportunity. True predicted fire can be visualized as firing on a target without prior registration and without adjustment. If the center of impact of a group of rounds can be accurately predicted to terminate near the center of an intended impact area then, in the sense of time on target (TOT) fire and target vulnerability, the results will be effective. There is no requirement for expensive electronic computers and associated equipment if the artillery is to continue the wasteful and time-consuming use of observed fire techniques of adjustment.

b. Numerous engineering developments and advancements have been made by industry and army developmental agencies in the attempt to develop a radar chronograph for accurate calibration of field artillery (FA) weapons, which in turn would facilitate predicted fire techniques. Such developments have been pursued since the closing days of World War II.

3. REQUIRED EQUIPMENT AND FACILITIES

a. Firing Ranges (capable of accepting impact from all firing charges)
b. Appropriate Weapons and Ammunition
c. Shop Facilities (for organizational, direct and general support maintenance)
d. Applicable Firing Tables, Tapes, etc.
e. Aiming Circle (2) and BC Scope
f. Standard Velocity Measuring Equipment
g. Radio and Wire Communications
h. Fire Direction Equipment
i. Flash Equipment (for four observation posts)
j. Meteorological Support
k. Stopwatch
l. Appropriate Radar Equipment
m. Still and Motion Picture Cameras with Film

4. REFERENCES

A. USAMC Regulation 250-15, Maintenance of Supplies and Equipment
B. USAMC Regulation 385-12, Safety
C. USATECOM Regulation 385-6, Safety Release
D. USATECOM Regulation 385-7, Safety Confirmation
E. USATECOM Regulation 750-15, Maintenance of Supplies and Equipment
F. MTP 3-3-506, Accuracy and Precision
G. MTP 6-3-500, Physical Characteristics
H. MTP 6-3-501, Technical Inspection
I. MTP 6-3-502, Personnel Training Requirements
J. MTP 6-3-504, Ease of Installation, Rigging, and Operation
K. MTP 6-3-505, Emplacement, Action, and March Order
L. MTP 6-3-506, Durability
M. MTP 6-3-509, Effects of Weather
N. MTP 6-3-510, Transportability of Communication, Surveillance, and Electronic Equipment
O. MTP 6-3-513, Qualitative Electromagnetic Interference
P. MTP 6-3-517, Electrical Power Requirements
Q. MTP 6-3-523, Safety
R. MTP 6-3-524, Maintenance
S. MTP 6-3-525, Human Factors
T. MTP 7-3-512, Air Drop Cabability
U. MTP 7-3-515, Air Transport, Internal
V. MTP 7-3-516, Air Transport, External

5. SCOPE

5.1 SUMMARY

This MTP describes the following procedures to be performed to determine whether a doppler intercept type radar chronograph is suitable for artillery use:

a. Receipt Inspection - A study to ensure that the test item is complete and in satisfactory condition prior to initiation of testing, and to determine its physical and electrical characteristics.

b. Operational Characteristics - A study to determine the test item's operational characteristics.

c. Operational Capability - A study to determine the capability of the test item to adequately determine the projectile velocity fired from all standard and developmental FA howitzers and guns and with all charges and projectiles of all available standard and developmental ammunition.

d. Effectiveness - A study to determine the effects of the application of muzzle velocity measurements obtained from the test item on the accuracy of unobserved fire.

e. Durability, Reliability, and Ruggedness - A study to determine if the test item and its ancillary equipment are sufficiently reliable, durable, and rugged to withstand the effects of continuous operation and transport over all types of roads and terrain with varying degrees of slope, and the extent

and effects of numerous emplacements, operation, and displacement.

f. Electrical Interference - A study to determine the effects of representative artillery radio, radar, and other electronic equipment normally operated in the vicinity of the test item.

g. Effects of Weather - A study to determine if the test item is sufficiently weatherproof in the transport and operating positions and the effects of various weather conditions on the velocity measuring capability.

h. Power Source - A study to determine the suitability of the provided power source for operation whether it be from the electrical system of the transporting vehicle, a separate rectifier, or a separate power generator.

i. Human Factors Engineering - A study to determine if the test item has been designed to reduce strain and fatigue during employment, operation and march order.

j. Air Transportability - A study to determine the suitability of the test item for air transport, both internal and external, and airdrop, and its effect on the test item's operability.

k. Surface Transportability - A study to determine the suitability of the test item for surface transportation.

l. Safety Confirmation - A study to determine the adequacy of safety devices, existence of safety hazards, and possible safety hazards. Confirm the safety release.

m. Maintenance and Maintenance Evaluation - A study to determine the maintenance requirements of the test item and the ease of performing organizational, direct and general support maintenance.

5.2 LIMITATIONS

None

6. PROCEDURES

6.1 PREPARATION FOR TEST

6.1.1 Scheduling

6.1.1.1 Personnel

a. Ensure the presence of service personnel who have been or are being trained using the criteria of MTP 6-3-502 and are cognizant in the operation and maintenance of the test item.

NOTE: Personnel required for operating and maintaining the test item at organizational, direct support, and general support level will attend special instruction classes conducted by the manufacturer or equivalent engineering agency in military occupational specialties (MOS) 17B and 26B respectively.

b. Record the rank, MOS, time spent in training, and time spent in MOS for all personnel.

6.1.1.2 Equipment

Requisition required weapons, ammunition, supplies, and special equipment not readily available at the test site.

6.1.1.3 Facilities

a. Select and schedule use of appropriate firing ranges and facilities (firing points, observation posts, survey, communications, flash equipment, fire direction support, standard muzzle velocity instrument support and meteorological data).

b. Ensure that maintenance support facilities (organizational, direct and general support) are readily available.

c. Request assistance of the U. S. Army Airborne, Electronics and Special Warfare Board (USAAESWBD) to conduct the air transportability tests.

6.1.1.4 Safety Release

The project officer shall obtain, prior to performing the test, safety releases and statements for the test item.

6.1.2 Receipt Inspection

Upon receipt, the test item shall be subject to the following procedures:

6.1.2.1 Arrival Inspection

a. Visually inspect the test item packaging and record the following:

1) Indication of damaged or illegible markings
2) Missing components, instructions or manuals
3) Damages sustained

b. Measure and record the length, width, height, and weight of the packaged test item.

c. Unpack the test item, visually inspect it and its components and record the following:

1) All evidence of damage
2) Nomenclature
3) Model number
4) Serial number
5) Manufacturer

d. Photograph the test item "as received", with a still camera.

6.1.2.2 Inventory Check

Conduct an inventory against the basic issue list item (BILI) and

record any discrepancies as regards the maintenance package, spare parts, associated tools and test instruments, associated equipment and components. Record all shortages in the Daily Log and record an Equipment Performance Report (EPR), when applicable.

6.1.2.3 Physical Characteristics

Determine the physical characteristics of the test item as described in MTP 6-3-500 including the following:

a. Total weight of the test item
b. Height, width and weight
c. Cubage of the test item

6.1.2.4 Technical Inspection

Conduct a technical inspection of the test item as described in the applicable section of MTP 6-3-501.

6.1.2.5 Electrical Power Requirements

Determine the test item's power requirements as described by the applicable sections of MTP 6-3-517.

6.2 TEST CONDUCT

Note: Subtests shall be conducted concurrently with, or in conjunction with, other subtests, whenever possible, so as to minimize time and effort.

6.2.1 Operational Characteristics

a. Determine the operational characteristics of the test item under existing ambient temperatures and daylight.

NOTE: These tests shall be conducted under all conditions of temperature, wind, velocity, visibility and precipitation encountered during the period.

b. Record the following conditions during velocity determinations:

1) Temperature
2) Relative humidity
3) Precipitation, if any
4) Wind

a) Speed
b) Direction

6.2.1.1 Emplacement, Preparation for Action, Operation and March Order Suitability

Determine the ability of the average trained crew to emplace, prepare for action, operate and march order the chronograph, when vehicle mounted, as described by the applicable sections of MTP 6-3-505 and MTP 6-3-504 as follows:

a. Emplace the test item at various positions laterally and to the rear of a weapon being fired and perform the following at each emplacement.

NOTE: 1. The chronograph must be positioned so that when it is properly aimed, the predicted projectile trajectory will pass through the conical radar beam at the desired point.

2. The aiming system of the chronograph must also be correlated with that of the weapon to facilitate rapid aiming.

3. The location and orientation of the chronograph (either tripod or vehicle mounted) with respect to the weapon is normally accomplished in accordance with data given in the applicable extrapolation tables (i.e. TM 9-1290-325-12/2 for the M-36 chronograph). Location of the chronograph depends upon a number of factors such as weapon size, the severity of blast effects, and the amount of combustion products expected in addition to the factors which will effect projectile velocity, trajectory, and reflective qualities such as weapon elevation, type of propellant, projectile size, and the degree of flatness of the projectile rear surface.

b. Record the following for each emplacement:

1) Time required for emplacement
2) Difficulties encountered:

a) Leveling and aligning the test item
b) Boresighting the test item

3) Operator working space

c. Photograph the emplaced test item to show its position with respect to the weapon to be fired and the operator's working space.

d. Prepare the test item for operation and record the following:

1) Time required to:

a) Orient the test item
b) Warm-up the test item
c) Perform all required pre-operational checks and adjustments.

2) Ease of:

a) Orienting the test item
b) Performing pre-operational checks and adjustments

e. Fire the weapon being checked and record the following:

1) Propellant charge, if applicable
2) Time required for the test item to compute projectile muzzle velocity
3) Time required to obtain test item information for extrapolation to obtain projectile muzzle velocity, if required
4) Difficulties encountered, if any

f. March order the test item and record the following:

1) Time recorded to perform march order
2) Difficulties encountered, if any

g. Repeat steps a through d with all calibers of standard and, if applicable, development artillery (howitzers, guns, rockets and missiles).

6.2.1.2 Electrical Characteristics

During the conduct of paragraph 6.2.1.1, determine and record the following:

a. Equipment sensitivity tuning requirements
b. Suitability of the radar beam dimensions
c. Effects of minor variance and frequency on measurement accuracy.
d. Minimum warm-up time required for valid results

6.2.1.3 Optimum Location and Average Time Requirements

At the completion of the procedures of paragraph 6.2.1.1, determine and record the following:

a. Optimum location of the test item with respect to each weapon fired.
b. Effect of misorientation on velocity determinations
c. Average time required to:

1) Emplace the test item
2) Warm-up the test item for valid results
3) Prepare for action
4) Determine projectile muzzle velocity
5) March order the test item

6.2.1.4 Ground Emplaced Operation

Repeat the procedures of paragraphs 6.2.1.1 through 6.2.1.3 with the test item emplaced on the ground.

6.2.1.5 Darkness and Blackout Conditions

Repeat the procedures of paragraph 6.2.1.1 under darkness and blackout conditions with the test item vehicle mounted and then ground emplaced.

6.2.2 Operational Capability

a. Emplace a vehicle mounted test item, in the optimum location for one of the guns/howitzers fired in paragraph 6.2.1 as determined in paragraph 6.2.1.3

b. Emplace a standard velocity measuring device in its optimum position for the weapon of step a.

c. Survey a minimum of four flash observation posts to an accuracy of 1/3000.

NOTE: Caution shall be exercised in the selection of these positions to ensure that the observers are able to see the burst of each round, not just rising and blowing smoke.

d. Fire a minimum of 300 rounds, in groups of ten, using the highest propellant charge for the weapon.

e. Record the following for each group fired:

1) Charge
2) Elevation
3) Azimuth of fire
4) Ambient temperature
5) Relative humidity
6) Wind speed and direction
7) Number and coordinates of firing position

f. Determine and record the following, for each round.

1) Flashed location of each round
2) Muzzle velocity reading for each round:

a) Test item
b) Standard velocity measuring device

g. Repeat steps d through f using all available charges for the test weapon.

h. Repeat steps a through g using all calibers of standard and developmental ammunition for the gun/howitzer of step a.

i. Compute the fall of shot data of the fired rounds.

1) As described in MTP 3-3-506 for observed data
2) Using muzzle velocity data obtained by:

a) Test item
b) Standard velocity measuring device

j. Determine and record the effects of muzzle blast on:

1) Test item accuracy
2) Test item continuous functioning

k. Repeat steps e through j for all gun/howitzers used in paragraph 6.2.1.

l. Repeat steps e through j for test items emplaced in the ground mode.

m. At the direction of the test director, or when applicable, repeat steps a through l for short and medium range rockets/missiles for a minimum of two ten-round groups.

6.2.3 Effectiveness

a. Emplace one of the guns/howitzers fired in paragraph 6.2.1 in a firing position.

b. Select an impact area at the weapons mid range (80 percent of maximum range) that meets the survey requirements of paragraph 6.2.2.6 and compute the firing data for this point for all known non-standard conditions.

c. Boresight the gun

d. Emplace the test item as determined in paragraph 6.2.1.2

e. Fire a minimum of 10 rounds, mean point of impact group (MPI group), using the test item's maximum charge.

f. Record the following for the group:

1) Charge
2) Elevation
3) Azimuth of fire
4) Ambient temperature
5) Relative humidity
6) Wind speed and direction
7) Number and coordinates of firing position

g. Determine and record the following for each round fired:

1) Flashed location of each round
2) Muzzle velocity reading for each round

h. Check the boresight at the completion of each MPI group, correct if necessary and record corrections.

i. Adjust fire and repeat steps c through h if necessary.

j. Compute firing data for the target of step b using all known non-standard corrections and the projectile muzzle velocity as determined during step g.

k. Repeat step e through g.

l. Repeat steps a through k using all of the guns/howitzers of paragraph 6.2.1

6.2.4 Durability, Reliability and Ruggedness

Determine the durability, reliability and ruggedness of the test item

using the criteria of MTP 6-3-506 and the following:

a. The test item shall be transported in various types of tactical vehicles for a minimum of 2000 miles over the following types of roads, for the mileage specified:

NOTE: 1. Operational personnel shall accompany the test item.

2. Mileage accumulated during the conduct of the other sections of this MTP may be included in the total mileage.

1) 25% of the mileage over improved (secondary) roads
2) 50% of the mileage over unimproved roads
3) 25% of the mileage cross-country

b. At the completion of each 50 miles of travel, the test item shall be subject to a velocity measuring mission (emplacement, set-up, operation and march order) for a number of projectiles prescribed in the test plan.

c. After each 50 miles of tactical transporting, field operation and continuous operation with only scheduled maintenance, note and record the following, as applicable:

1) Effects of prolonged field operation on test item.
2) Type of tactical vehicle(s) transporting the test item, if various vehicles are used for transporting.
3) Stowed configuration of test item
4) Effects of stowing
5) Damage sustained due to transporting
6) Effects on accuracy determinations immediately after travel cycles.

6.2.5 Electronic Interference

Determine the effects of electronic signals on the operability of the test item, and the test item's effect on local electronic equipment by performing the tests described in the applicable sections of MTP 6-3-513 and the following:

a. Representative radio, radar, and other electronic equipment normally operated in the vicinity of the test item will be emplaced and operated in conjunction with the test item to reflect any degradation of effects on the emplaced equipment, the test item, or both.

b. Two sets of test item equipment will be emplaced at various distances apart for determination of any mutual interference or effects on the accuracy of readings.

c. Record the following:

1) Effects of the test item's operation on radios, radars, and other electrical equipment within the immediate area.

2) Effects of operating an emplaced radio, radar, and other electrical equipment on the test item's operation.
3) Any mutual interference between two test items operating simultaneously in the same immediate vicinity.

6.2.6 Effects of Weather

a. Throughout testing and during periods of inclement weather including rain, snow, sleet and wind, blowing sand, extreme heat and cold, the test item will be emplaced to measure velocity on all available caliber of weapons, howitzers and guns.

b. Determine the effects of weather on the test item as described in the applicable sections of MTP 6-3-509.

c. Record all malfunctions, failures, or difficulties attributable to the inclement weather.

d. Record the prevailing weather conditions which contributed to each malfunction, failure, etc.

6.2.7 Power Source

The provided power source and/or alternate power sources shall be used to furnish power to the test item during all phases of testing.

a. Determine the suitability and reliability of the test item's power source using the criteria in the applicable sections of MTP 6-3-517.

b. Determine and record the adequacy of the power source in respect to providing sufficient and proper electrical output.

c. Record the number and types of power failure experienced during testing.

d. Determine whether actual performance meets the expected performance requirements as depicted in appropriate technical manuals and publications for specific power supplies.

e. Record all requirements for replacement of parts, electrical or mechanical.

6.2.8 Human Factors Engineering

During the conduct of the test determine the skill level required for operation and maintenance, the suitability of the test item design with respect to location of indicating devices, adjustment devices, carrying, handling and fastening and connecting devices, those operations which are unduly time consuming, fatiguing, or inconvenient, and existing safety hazards as described in MTP 6-3-525.

6.2.9 Air Transportability

6.2.9.1 Internal Air Transportability

a. Determine the suitability of the test item to be air transported tied down in an aircraft, as described in the applicable sections of MTP 7-3-515 and record the following:

1) Difficulties encountered while loading, unloading, and tying-down
2) Air craft used
3) Damage sustained by the test item
4) Air conditions

b. At the completion of the air transportability test, unload the test item, position and operate it with only operator type maintenance. Record any difficulties.

c. Repeat steps a and b for each suitable aircraft, as applicable.

d. Repeat steps a through c with the test item secured in a vehicular transporter.

e. The test item as secured on the aircraft shall be photographed with a still camera.

6.2.9.2 External Air Transportability

a. Determine the suitability of the test item to be air transported, while being carried externally by a rotary wing aircraft, as described in the applicable sections of MTP 7-3-516 and record the following:

1) Difficulties encountered while attaching, detaching, and carrying the test item
2) Aircraft used
3) Damage sustained by the test item
4) Air conditions

b. At the completion of the air transportability test, detach the test item, position and operate it with only operator type maintenance. Record any difficulties.

c. Repeat steps a and b for each suitable aircraft, as applicable.

d. Repeat steps a through c with the test item secured in a vehicular transporter.

e. The test item as secured on the aircraft shall be photographed with a still camera.

6.2.9.3 Air Drop Capability

a. Determine the suitability of the test item for a parachute drop, as described in the applicable sections of MTP 7-3-512 and record the following:

1) Difficulties encountered preparing and loading the test item for air drop
2) Difficulties encountered releasing the test item from the transporting aircraft
3) Aircraft used
4) Damage sustained by the test item
5) Air conditions

b. At the completion of the air drop, the test item shall be

positioned and operated with only operator type maintenance. Record any difficulties.

c. Repeat steps a and b for each suitable aircraft, as applicable.

d. Repeat steps a through c with the test item secured in a vehicular transporter.

e. Air drop test procedures shall be photographed with a motion picture camera.

6.2.10 Surface Transportability

Determine the surface transportability of the test item as described in the applicable sections of MTP 6-3-510.

6.2.11 Safety Confirmation

Determine the safety of the test item by performing the applicable sections of MTP 6-3-523 and the following:

a. Examine the test item to confirm the safety release under the specified conditions of the release, and determine that no foreseeable hazards exist in the testing or use of the test item and record the existence of any deficiencies.

b. Conduct a thorough inspection of the electrical system to insure that provisions have been made to eliminate or minimize electrical hazards and record all deficiencies.

c. Record any safety hazards resulting from storage, transport, operation, and maintenance of the test item to include any specific peculiarities of the transport vehicle.

6.2.12 Maintenance Evaluation

Perform maintenance evaluation of the test item as described in applicable sections of MTP 6-3-524 as follows:

a. Perform authorized maintenance in accordance with the maintenance allocation chart and record the following:

1) Skill level required to perform operation
2) Number of man-hours expended
3) Difficulties encountered

b. Record all requirements for additional tools, shortcomings in authorized tools, and special tools needed to accomplish the assigned level of maintenance.

c. Inspect, check, and evaluate the maintenance package and record deficiencies.

6.3 TEST DATA

6.3.1 Preparation For Test

6.3.1.1 Personnel

Record the following information for all personnel:

a. Rank
b. MOS
c. Time spent in training, in weeks
d. Time spent in MOS, in weeks

6.3.1.2 Receipt Inspection

6.3.1.2.1 Arrival Inspection -

a. Record the following:

1) For the test item's packaging:

a) Damaged or illegible markings
b) Missing components, instructions or manuals
c) Length, width, height, in feet and inches

2) For the test item

a) All evidence of damage
b) Nomenclature
c) Model No.
d) Serial No.
e) Manufacturer

b. Retain all photographs

6.3.1.2.2 Inventory Check -

Record all shortages

6.3.1.2.3 Physical Characteristics -

Record the following:

a. Data collected as described in MTP 6-3-500.
b. Total weight of the test item, in pounds
c. Height, width and length, in feet and inches
d. Cubage, in ft^3.

6.3.1.2.4 Technical Inspection -

Data shall be collected and recorded as described in the applicable sections of MTP 6-3-501.

6.3.1.2.5 Electrical Power Requirements -

Record data as collected under the applicable sections of MTP 6-3-517.

6.3.2 Test Conduct

6.3.2.1 Operational Characteristics

6.3.2.1.1 Emplacement, Preparation for Action, Operation, and March Order Suitability -

a. Record the following for each weapon and test item position:

1) Light condition (daylight, darkness, blackout)
2) Mode of operation (vehicle mounted, ground emplaced)
3) Ambient temperature in °F
4) Relative humidity in percent
5) Precipitation, if any
6) Wind speed in mph
7) Wind direction
8) Test weapon (175 mm gun, 105 howitzer)
9) Emplacement position with respect to test weapon
10) Data collected as described in the applicable section of MTP 6-3-504 and MTP 6-3-505 including the following:

a) For emplacement:

(1) Time required to emplace, in minutes
(2) Difficulties encountered:

(a) Leveling and aligning test item
(b) Boresighting the test item

(3) Operator working space

b) For preparation for action:

(1) Time required in minutes, to:

(a) Orient the test item
(b) Warm-up the test item
(c) Perform all required pre-operational checks and adjustments

(2) Ease of:

(a) Orienting the test item
(b) Performing all required pre-operational checks and adjustments.

c) For operation:

(1) Propellant charge, if applicable
(2) Time required to obtain muzzle velocity in seconds
(3) Time required for extrapolation, if required, in seconds
(4) Difficulties encountered, if any

d) For March Order:

(1) Time required to march order in minutes
(2) Difficulties encountered, if any

b. Retain all photographs taken.

6.3.2.1.2 Electrical Characteristics -

Record the following for each weapon fired:

a. Equipment sensitivity tuning requirements
b. Suitability of the radar beam dimensions
c. Effects of minor variance and frequency on measurement
d. Minimum allowable warm-up time in minutes

6.3.2.1.3 Optimum Location and Average Time Requirements -

Record the following for each weapon fired

a. Optimum test item location
b. Effect of misorientation on velocity determinations
c. Average time required to:

1) Emplace the test item
2) Warm-up the test item
3) Prepare for action
4) Determine projectile muzzle velocity
5) March order the test item

6.3.2.2 Operational Capability

a. Record the following for each 10 round group fired:

1) Weapon fired (105 mm howitzer, 125 mm gun)
2) Group number (1, 3, 5, etc.)
3) Charge
4) Projectile (Smoke, H. E., etc.)
5) Gun elevation in mils
6) Azimuth of fire in mils
7) Ambient temperature in °F
8) Relative humidity in %

9) Wind speed in mph
10) Wind direction
11) Number and coordinates of firing position

b. Record the following for each round in the group:

1) Round number
2) Flashed location of each round
3) Muzzle velocity, in feet per second, for:

a) Test item
b) Standard velocity measuring device

c. Record the following fall of shot data for each group fired:

1) As determined in MTP 3-3-506
2) As determined using the test item velocity data
3) As determined using the standard velocity measuring device velocity data

d. Record the effects of muzzle blast on:

1) Test item accuracy
2) Test item continuous functioning

6.3.2.3 Effectiveness

a. Record the following for each MPI group fired:

1) Type of firing (observed, velocity determination)
2) Weapon fired
3) Group number (1, 2, etc.)
4) Charge
5) Gun elevation in mils
6) Azimuth of fire in mils
7) Ambient temperature in °F
8) Relative humidity in %
9) Wind speed in mph
10) Wind direction
11) Number and coordinates of firing position

b. Record the following for each round fired:

1) Flashed location of each round
2) Projectile muzzle velocity in fps.

6.3.2.4 Durability, Reliability and Ruggedness

Record the following:

a. Data collected using the criteria of MTP 6-3-506

b. Mileage travelled, in miles, over:

1) Improved roads
2) Unimproved roads
3) Cross-country

c. At the completion of each 50 miles of tactical transporting, field operation and continuous operation with only scheduled maintenance, record the following, as applicable:

1) Effects of prolonged field operation
2) Type(s) of tactical transporting vehicle(s)
3) Stowed configuration of test item
4) Effects of stowing
5) Damage sustained due to transporting
6) Effects on accuracy determination immediately after travel cycles

6.3.2.5 Electronic Interference

Record the following:

a. Data collected and recorded as described in the applicable sections of MTP 6-3-513
b. Effects of the test item's operation on radios, radars, and other electrical equipment within the immediate area.
c. Effects of operating an emplaced radio, radar, and other electrical equipment on the test item's operation.
d. Any mutual interference between two test items operating simultaneously in the same immediate vicinity.

6.3.2.6 Effects of Weather

Record the following:

a. Data collected and recorded as described in the applicable sections of MTP 6-3-509.
b. All malfunctions, failures, or difficulties attributable to the inclement weather.
c. Prevailing weather conditions which contributed to each malfunction, failure, etc.

6.3.2.7 Power Source

Record the following:

a. Data collected and recorded as described in the applicable sections of MTP 6-3-517.
b. The adequacy of the power source in respect to providing sufficient and proper electrical output.

c. Number of power failures during testing
d. Types of power failures
e. Whether actual performance meets the expected performance requirements.
f. All requirements for replacements of parts, electrical or mechanical.

6.3.2.8 Human Factors Engineering

Data shall be recorded as collected, as described in the applicable sections of MTP 6-3-525 including the following:

a. Suitability of the location and shape of:

1) Dials, meters, indices, and other instruments or indicators
2) Knobs, handles, straps, fasteners, cables, connectors and other items requiring manual operations

b. Suitability of the display of data
c. Presence of existing safety hazards
d. Operations that are unduly time-consuming, fatiguing or inconvenient.
e. Adequacy of space for efficient operation and easy access for maintenance, including when personnel are wearing environmental and/or protective clothing.
f. Skill levels required for:

1) Operation
2) Maintenance

6.3.2.9 Air Transportability

6.3.2.9.1 Internal Air Transportability -

a. Record data collected as described in the applicable sections of MTP 7-3-515.
b. Record the following for each aircraft used:

1) Difficulties encountered while loading, unloading, and tying-down
2) Aircraft used
3) Damage sustained by the test item
4) Air conditions
5) Type of vehicular transporter, when applicable

c. Record any operational difficulties due from air transportability.
d. Retain all photographs.

6.3.2.9.2 External Air Transportability -

a. Record data collected as described in the applicable sections of MTP 7-3-516.
b. Record the following for each aircraft used:

1) Difficulties encountered while attaching, detaching and carrying the test item
2) Aircraft used
3) Damage sustained by the test item
4) Air conditions
5) Type of vehicular transporter, when applicable

c. Record any operational difficulties due from air transportability
d. Retain all photographs

6.3.2.9.3 Air Drop Capability

a. Record data collected as described in the applicable sections of MTP 7-3-512.
b. Record the following for each aircraft used:

1) Difficulties encountered preparing and loading the test item for air drop.
2) Difficulties encountered releasing the test item from the aircraft.
3) Aircraft used
4) Damage sustained by the test item
5) Air conditions
6) Type of vehicular transporter, when applicable

c. Record any operational difficulties due from air dropping
d. Retain all photographs

6.3.2.10 Surface Transportability

Data shall be collected and recorded as described in applicable sections of MTP 6-3-510.

6.3.2.11 Safety Confirmation

Record the following:

a. Data collected and recorded as described in the applicable sections of MTP 6-3-523.
b. Discrepancies of safety conditions of test item from safety release.
c. Corrections required to minimize electrical hazards.
d. Safety hazards resulting from:

1) Storage
2) Transportation
3) Operation

4) Maintenance
5) Peculiarities of the transport vehicle

6.3.2.12 Maintenance Evaluation

Record the following:

a. Data collected and recorded as described in the applicable sections of MTP 6-3-524
b. Authorized maintenance:

1) Skill level required to perform operation
2) Number of man-hours expended
3) Difficulties encountered

c. Tools:

1) Additional tools required
2) Deficiencies in authorized tools
3) Special tools required

d. Deficiencies in maintenance package

6.4 DATA REDUCTION AND PRESENTATION

Upon completion of each day's test activity and, when possible, upon completion of each phase of testing, film and field data should be processed and analyzed to determine the results obtained. The tabulated data together with an explanation of the method used to procure the data should be maintained in the form of a log. It is extremely important that the test log be kept for future tests and/or comparison data. The obtained test data when analyzed and reduced to recurrent failures or shortcomings will determine the degree that the test item meets the requirements of the QMR/SDR and TC.