

Materiel Test Procedure 5-4-001
Yuma Proving Ground

22 October 1968 U. S. ARMY TEST AND EVALUATION COMMAND
ENVIRONMENTAL TEST PROCEDURE

DESERT ENVIRONMENTAL TESTING OF MISSILE AND ROCKET SYSTEMS

1. OBJECTIVE

The objective of this Materiel Test Procedure (MTP) is to provide a procedure for determining the capability of missile and rocket systems to withstand exposure to and function effectively within desert environments.

2. BACKGROUND

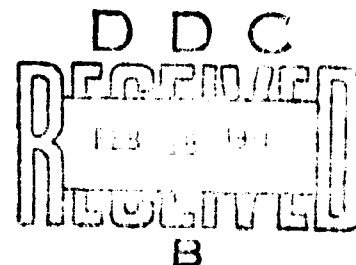
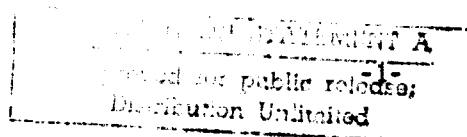
Materiel deployed or intended for combat use in desert areas may be uniquely stressed by the environment to the extent that dependability, serviceability, maintainability, safety, and ultimately, the success of military operations may be seriously jeopardized. Combat systems, therefore must be designed to withstand desert environmental stresses whenever they are designated for use on a worldwide basis. Although many of these stresses are known in advance and can be reproduced in the laboratory, testing in the natural desert environment is necessary to provide complete assurance that the system will function as intended during desert operations. Additionally, such testing serves to reveal design or production deficiencies and to identify targets for corrective action often missed during laboratory testing.

3. REQUIRED EQUIPMENT

- a. Equipment specified in applicable Volume 5 MTP's.
- b. Temperature measuring devices (thermometers, thermocouples, etc, in the 0° - 200° F range) with readout meters and recorders.
- c. Transducers (free or rate gyros, displacement gages, strain gages including triaxial accelerometers in the 0 - 20g range).
- d. Data recording equipment
- e. Data transmission equipment
- f. Vehicular velocity instrumentation (speedometers in the 0 - 70 mph range, odometers precise to 0.1 mile, and times accurate to 0.01 hour).
- g. Sensors and counters (used to measure vehicular traffic levels)
- h. Standard meteorological equipment (psychrometers, wind velocimeters, solar radiation measuring devices).
- i. Desert test facility (area which is representative of three main desert types; sandy, gravelly, and stony, and which possesses an instrumented ballistic range).

4. REFERENCES

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- B. Department of the Army, Army Regulation 705-15, Operation of Material Under Extreme Conditions of Environment, 4 October 1962, with Change 1, 14 October 1963.
- C. Department of Defense, Military Standard MIL-STD-210A, Climatic Extremes for Military Equipment, Office of the Assistant Secretary of Defense for Supply and Logistics, 2 August 1957, with Change 1, 30 November 1958.
- D. Van Lopik, J. R., and C. R. Kolb, Handbook, A Technique for Preparing Desert Terrain Analogs, Technical Report No. 3-506, U. S. Army Engineers Waterways Experiment Station, Vicksburg, Mississippi, May 1959.
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- H. Department of the Army, Field Manual, FM 31-25, Desert Operations, Headquarters, Department of the Army, January 1964.
- I. Department of the Army, Technical Manual, TM 5-545, Geology and its Military Applications, August 1952.
- J. MTP 5-2-500, Solid Propellant Systems
- K. MTP 5-2-501, Liquid Propellant Systems
- L. MTP 5-2-503, Restrained Firing Test Procedure
- M. MTP 5-2-506, Shock Test Procedure
- N. MTP 5-2-507, Vibration Test Procedure
- O. MTP 5-2-528, Ground Guidance Systems Test
- P. MTP 5-2-544, Missile System Transportability Test

5. SCOPE

5.1 SUMMARY

This MTP describes in general terms, the preparation, conduct, recording and reporting methods used for the desert environmental testing of various classes of missile, rockets and ancillary systems and equipment. Specific subtests include:

- a. Exposure - The objective of this subtest is to determine the effects of desert environmental exposure to missile, rockets, and ancillary equipment during storage, while being transported or handled.
- b. Performance - The objective of this subtest is to determine the capability of missiles, rockets and ancillary equipment to function effectively in a desert environment.
- c. Maintenance - The objective of this subtest is to determine the maintenance requirements for missiles, rockets and ancillary equipment engendered or aggravated by the use of such equipment in a desert environment.

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d. Security From Detection - The objective of this subtest is to determine the capability of missiles, rockets and ancillary equipment to avoid detection in a desert environment.

e. Safety - The objective of this subtest is to determine the safety requirements of missiles, rockets and ancillary equipment operated in a desert environment.

5.2 LIMITATIONS

The procedures provided by this MTP do not constitute detailed test plans. A detailed test plan for desert environmental testing of missiles, rockets and ancillary equipment may be assembled from the guidance provided by this MTP and the applicable Volume 5 engineering test for components, but each environmental test planning activity must make its own judgement as to the applicability of each procedure and must determine how best to obtain the required data from each item under test. Specific limitations include:

a. Classes of missiles and rockets such as ICBM's and anti-ICBM's are not included in this MTP since they are not exposed in the desert except under controlled conditions.

b. Warheads for missiles and rockets and their associated special equipment.

c. Components and subsystems of missiles and rockets which serve non-weapon functions such as vehicle portions of self-propelled missile launchers, optical or electronic portions of fire control systems and explosive ordnance items.

d. Missile and rocket subsystems used in aircraft armament.

6. PROCEDURES

6.1 PREPARATION FOR TEST

6.1.1 General Preparations

Personnel responsible for conducting the tests shall ensure the following prior to testing:

a. That testing facilities, equipment and accessories are available properly calibrated and functional.

b. That all required test personnel will be available and briefed on the purpose of the test and results expected, prior to testing.

c. That power sources are checked to ensure correct outputs.

d. That final arrangements are made with supporting or participating agencies, activities or facilities.

e. That operating instructions for test instruments and equipment are obtained and made available to test personnel.

6.1.2 Test Item Preparations

Personnel responsible for conducting the tests shall ensure that the following preparations are made prior to testing:

a. A test item sample size plan shall be developed and prepared using the following criteria:

- 1) Each test lot shall consist of a statistically significant number of test items.

NOTES: 1. Although test samples may consist of a single test item, their size shall be greater than four (4), whenever possible, to increase the statistical accuracy of the test.

2. Sufficient control items shall be used to isolate and identify areas requiring corrective action. (Corrective action in this context includes redesign of the test item, redesign of packaging or storage configurations for the test item or reduction of the exposure limits).

b. An initial inspection of the test item shall be performed to determine the following:

- 1) That all test items, ancillary equipment and maintenance packages are present
- 2) That all test items and their components are correctly assembled, properly labeled and ready for test.
- 3) That all test items, ancillary equipment and maintenance packages arrived at the test installation in an acceptable condition.
- 4) That all test items and ancillary equipment are cleaned and lubricated according to appropriate maintenance instructions.
- 5) That packaging integrity is maintained for all test items and ancillary equipment requiring packaging for the various test modes.

c. Upon completion of the initial inspection, test items shall be repacked in accordance with the planned exposure mode. (Items which are required to be instrumented for exposure testing shall not be repacked at this point).

NOTE: All deficiencies discovered during the initial inspection shall be corrected whenever possible or recorded in the test log for consideration during the test data reduction phase.

d. A physical characteristics test shall be performed on the test item to determine the following:

- 1) That the test item's dimensions and characteristics conform to the applicable military characteristics as specified.

- 2) The actual exterior dimensions of the test item such as length, width, diameter etc., prior to environmental testing.
- 3) The actual interior dimensions of the test item such as cavity depths, thread diameters etc., prior to environmental testing.
- 4) The actual weights of the test item and major components, prior to environmental testing. (Guidance packages, power supplies, filters or other parts which may be vulnerable to dust may be weighed to ± 0.01 pound or greater preciseness if dust accumulations are to be determined by weight).
- 5) The color of the test item (Ref MIL-STD-595) including the presence of any reflecting or shiny surfaces. (May be recorded by color photography, but data shall include film type and response).
- 6) Other physical measurements which may assist in the evaluation of the test item or other associated equipment, such as center of gravity or moments of inertia.

NOTE: Characteristic photographs shall be taken as applicable.

6.1.3 Subtest Preparation

6.1.3.1 Exposure Subtest Preparation

6.1.3.1.1 Storage Exposure

a. Following the initial inspection and determination of physical characteristics, test items to be subjected to desert storage exposure shall be instrumented to provide the following temperature data.

- 1) Overpack and container skin temperatures
- 2) Storage container interior air temperatures
- 3) Average warhead and motor skin temperatures
- 4) Temperatures of critical components
- 5) Propellant and explosive component temperatures

b. Install instrumentation required to determine and record the ambient air temperatures for each storage site, to be used for conducting the tests, at distance 200cm above the ground surface and 5cm below the ground surface.

c. Install instrumentation required to determine and record the wind speed and direction and the solar radiation levels at the test site.

d. Install a counter to determine the vehicular traffic levels at the test site.

e. Instrumentation location shall be shown by photographs or line drawings as required.

6.1.3.1.2 Transportation Exposure

a. Items to be subjected to transportation exposure shall be instrumented to provide the following data(when applicable):

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- 1) Container skin temperatures
- 2) Container interior air temperature
- 3) Warhead and motor skin temperatures
- 4) Temperatures of critical components
- 5) Temperatures of explosive and propellants
- 6) Triaxial acceleration of the test item
- 7) Triaxial acceleration of critical components

b. The transporter of items to be subjected to transportation exposure shall be instrumented to provide the following data:

- 1) Vehicle mileage (± 0.1 mi)
- 2) Vehicle direction ($\pm 5^\circ$)
- 3) Vehicle compartment/enclosure temperatures ($\pm 2^\circ\text{F}$)
- 4) Vehicle triaxial accelerometer readings
- 5) Vehicle critical components strain gage readings

6.1.3.2 Performance Subtest Preparation

- a. Items which have been left in sealed containers will be removed and identified.
- b. Inspect test items for visual signs of deterioration.
- c. Remeasure physical characteristics of selected items to determine change wrought by exposure.
- d. Items which are components of major items (power supplies, fuzing systems, transmitters, etc) shall be assembled to standard components.

NOTE: Items requiring other operations for use will be prepared according to the operation manual.

- e. Accomplish any other preparatory steps as specified in the applicable MTP being utilized.

During the initial inspection, performed on the test item, (see paragraphs 6.1.2, b and c), test items shall be cleaned and, if required, lubricated. All maintenance performed at this time shall be recorded.

6.1.3.3 Security from Detection Subtest Preparation

- a. Select test sites typical of the world's deserts and providing suitable background conditions. (See Table I for landscape types to be included).

NOTE: Typical basic colors dominating in desert areas are shown in Table II (Dominant colors in desert terrain)

- b. Paint the test items in accordance with colors listed in Table II.

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- NOTES: 1. The dominant color should be tan, with earth brown used to breakup shapes or patterns
2. If netting is used for camouflage, garnish should be provided for desert terrain.

TABLE I. Landscape Types for Desert Testing

Landscape Types

Desert Flats
Hills/Badlands
Fan/Wash Complex
Mountains
Sand Field and Dunes

TABLE II. Dominant Colors in Desert Terrain
Color

<u>Terrain Type</u>	<u>U. S. Army Std</u>	<u>Munsell Symbol</u>
Barren areas, bare rock, shallow high mountain soils	Earth brown	10 YR, 3/2
Desert alluvial and sedimentary deposits, sand, and thin mountain soils	Tan	7-5 Yr, 6/6
Mountain soils of desert highlands	Earth Red	2-5 YR, 4/6

6.1.3.4 Safety Subtest Preparation

Prior to committing missile and rocket systems to exposure tests involving handling and to operational or functional tests, launching or otherwise, the applicable safety statement or safety release shall be reviewed.

6.2 TEST CONDUCT

6.2.1 Exposure Tests

6.2.1.1 Storage Exposure

- NOTES: 1. Hot-dry climates are intrinsically favorable for the preservation of mechanical equipment. However, certain chemical compounds, particularly those used in explosives and propellants, are susceptible to accelerated deterioration under extremes of heat and solar radiation. Other components, including seals and electronic parts are sensitive to the extremes of heat, solar radiation, ozone concentrations and rapid temperature changes which are associated with desert environments.

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2. Blowing sand results in rapid abrasion of exposed surfaces. Sand may penetrate small crevices and clog moving parts. Dust is a major source of trouble in this latter respect. Not only will dust act as an abrasive when trapped between moving parts, it will also clog delicate mechanisms (such as guidance and control linkages).
3. Criteria for each of the storage modes are prescribed below. After each of the storage periods, inspect the test items in accordance with paragraph 6.1.2.b, and if possible, repair or replace any defective parts noted in the course of the inspection, failed and badly deteriorated parts should be preserved for examination to determine extent, type, and cause of deterioration.

CAUTION: Use extreme care if explosives or propellants appear deteriorated or discolored. Allow only qualified personnel to handle such items.

6.2.1.1.1 Depot Storage

- a. Leave the test item in the sealed shipment container and place on open desert terrain for a period of three months. (Items shall be furnished with normal modes of dunnage and covering during storage period).
- b. Visually examine the test item, while being stored in the above indicated manner, on a regular once-a-month basis and note and record all evidences of deterioration noted. (During this examination, protective provisions shall be restored as required).

NOTE: Depot storage under protected and supervised circumstances in hot-dry climates does not significantly stress Army Materiel, except for those items having a possibility of depot storage while still sealed within shipment containers and possessing many non-metallic components susceptible to high temperature deterioration. Depot storage subtests shall be conducted on those items only, which fall within the parameters established herein.

6.2.1.1.2 Forward Area Storage

NOTE: The forward area storage subtest shall be conducted upon conclusion of the road transportation subtests. Items shall be parked or off-loaded on open terrain with natural cover features. Protection from sunlight will be afforded the test item, in order to simulate light camouflage measures.

- a. Emplace the test item in the area chosen for forward storage for a minimum period of 60 days, with a minimum of 48 days having air temperatures in excess of 100° for 6 hour periods. (For desirable severity levels, see TABLE III).

TABLE III. Exposure Criteria for Forward Area Storage
(based on a design goal at 3,780°F-hr above 90°F)

<u>Air Temperature (°F)</u>			<u>Ground Temperature (°F)</u>		
<u>No. of</u> <u>Days</u>	<u>No. of</u> <u>Hr/Day</u>	<u>Min</u> <u>Temp</u>	<u>No. of</u> <u>Days</u>	<u>No. of</u> <u>Hr/Day</u>	<u>Min</u> <u>Temp</u>
5	2	110	5	3	140
+10	4	105	+10	4	135
+19	3	100			
3	2	110	5	1	140
+15	4	105	+20	4	135
+13	3	100			
10	4	105	10	1	135
+30	3	100	+30	4	130

b. Test personnel shall visually inspect the test item at the conclusion of the forward area storage period, and note in the test log, all apparent effects of storage of the test item. Correctable deficiencies shall be corrected when possible or a note shall be made in the test log as to the reason for non-correction.

c. At the conclusion of the forward area storage, the test item shall be performance tested in accordance with paragraph 6.2.2, to determine the effects of forward area storage on test items which have not been discovered during the inspection phase.

d. Record data discovered during the performance test according to paragraph 6.2.2.

- NOTES:
1. If climatic conditions are such that the more severe conditions will be reached with a short extension of the scheduled exposure time, the project engineer shall endeavor to modify his overall schedule to allow such extension.
 2. During the forward area storage subtests, vehicular traffic shall be routed upwind of the storage area with a minimum of 120 vehicles passing during the storage period. Thick dust deposits (6-12 inches in depth) shall be maintained on adjoining roads.

6.2.1.2 Transportation Exposure

NOTE: For many missile and rocket systems, the transportation environment is much more severe than the storage environment. Since missiles and rockets are frequently carried on open racks or launchers, all the factors of the desert are brought to bear on the test item. Criteria for each of the transportation tests are prescribed below. After each of the transportation cycles, inspect the test items in accordance with Paragraph 6.1.2. Individual items should also be checked during the transport phases for failures.

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6.2.1.2.1 Road Transportation - Depot to Forward Area

NOTE: This subtest is intended to be conducted when test items are to be transported from the depot storage area to the forward area storage site and should not be initiated until completion of the depot storage subtests.

a. Place test items on wheeled cargo carriers, transporters, or self propelled vehicles and transport them, in their usual configurations and modes of transportation, from the depot storage area to the forward area storage site.

NOTE: Test items shall be transported during the daylight hours of the hot summer months and movement shall consist of a minimum of 150 miles along paved roads, 450 miles of secondary roads and maximum exposure to dust. (A course similar to the YPG Truck Gravel Course shall be used to conduct testing).

b. Upon conclusion of the transportation phase of testing, inspect the test items in accordance with 6.2.1.b and record the inspection results in the test log. Deficiencies discovered during the inspection shall be corrected whenever possible or an appropriate note shall be entered into the test log describing the deficiency, for consideration during the data reduction phase of the test.

6.2.1.2.2 Road Transportation - Tactical Deployment

NOTE: This subtest is intended to be conducted when test items are to be tactically deployed from the forward area storage site and should not be conducted until completion of the forward area storage subtest.

a. The following procedures shall be complied with when road testing portable missile and rocket systems in a desert environment:

- 1) Load the test items on light tactical wheeled or tracked vehicles consistent with the usual mode of field transport for the test item, and move the item over the terrain combinations and interconnecting secondary roads in accordance with the schedule given in Table IV.

NOTE: Total transportation mileage for the first cycle will be 150 miles minimum, including 60 miles over secondary roads in convoy and 90 miles over any combination of terrain given in Table IV.

- 2) Following the first cycle above, off-load test items onto loose surface terrain containing zerophyte (non-succulent) vegetation and dig in or conceal in the ready-for-use condition for a minimum of 12 hours.

- 3) Re-situate the test items from the original position, to another site for a second 12-hour minimum period in the ready-for-use condition
- 4) Repeat the re-situation procedure described in 3, above for a third 12 hour period.

NOTE: The test items will be re-situated in 2, 3, and 4 above in rocky, sandy, and gravelly terrain, respectively.

- 5) Re-load the test items onto light tactical wheeled or tracked vehicles in the manner prescribed in 1, above, and repeat procedure 1, for the second cycle.
- 6) Inspect the test items and make appropriate notations in the test log, in accordance with paragraph 6.1.2.b.

b. The following procedures shall be complied with when road testing vehicle mounted missile and rocket systems in a desert environment:

- 1) Mount test item on tactical vehicles in a manner consistent with normal modes for transport and secure for traveling.
- 2) Move the test item over the terrain combinations and inter-connecting secondary roads, in any convenient order, in accordance with Table IV.

NOTE: Total transportation mileage for the first cycle shall be 250 miles minimum, including convoy travel over secondary roads.

- 3) Off load test items and emplace them in the ready-for-launching configuration and provide with light cover simulating camouflage for a period of 12 hours. (Test item shall be emplaced in gravelly soil).
- 4) Re-situate the test items from the original emplacement position to a second position and leave emplaced for an additional period of 12 hours. (Test item shall be emplaced in rocky soil).
- 5) Repeat steps 1 and 2 above for a second complete cycle.
- 6) Repeat steps 3 and 4 above for a second emplacement.
- 7) Repeat steps 1 and 2 above for a third complete cycle.
- 8) Park vehicles, with test items loaded aboard, on sandy terrain with no protection for period of 24 hours.
- 9) Repeat steps 1 and 2 above for a fourth complete cycle.
- 10) Inspect the test items and make appropriate entries into the test log, in accordance with paragraph 6.1.2.b.

c. The following procedures shall be complied with when road testing Field Artillery missiles and support equipment:

- 1) Mount test items on tactical vehicles in a manner consistent with normal modes for transport and secure for traveling.
- 2) Move the test items over the terrain combinations and interconnecting secondary roads, in any convenient order in accordance with Table IV.

NOTE: Total transportation mileage for each cycle shall be 150 miles minimum including convoy travel over secondary roads.

- 3) Following the first cycle, arrange items to correspond with a missile system tactical emplacement in ready-to-launch, configuration, and maintain this installation for 2 days. (Terrain shall be gravelly).
- 4) Prepare the test items and transportation equipment for a short cross-country move at maximum speed. (Test items will be configured for traveling no more than essential).
- 5) Move the test item cross-country to a site on rocky terrain and emplace as in 3, above. Maintain this installation for two days.
- 6) Place the test item in full traveling configuration and repeat 2, above, for a second cycle.
- 7) Same as 6.2.1.2.2., b, 10.

d. The following procedures shall be complied with when exposure testing defensive missile systems (Anti-aircraft):

- 1) Place the test items in traveling configuration and drive or tow over secondary roads, in convoy, for a minimum distance of 300 miles.
- 2) Emplace test items in the ready-to-launch condition on prepared terrain and maintain emplaced for a minimum period of 60 days.
- 3) Place test items, following emplacement, in traveling configuration and move over secondary roads in convoy, for a minimum distance of 100 miles.
- 4) Repeat step 2, above after the move in step 3.
- 5) Same as 6.2.1.2.2, b, 10.

NOTE: If cross-country capability is required, the following additional transportation test shall be conducted on terrain combinations and for distances as noted below:

a) Mountainous terrain	-	15 miles
b) Badlands and hills	-	15 miles
c) Fan and wash complex	-	15 miles
d) Desert plains and flats	-	45 miles
e) Dust course	-	<u>10 miles</u>
		100 miles

TABLE IV. Mileage Requirements for Tactical Deployment Cycles

Type Desert Component	Type Missile and Rocket System		
	LAW (6.2.3.2.2.a)	MAW-HAW (6.2.3.2.2.b)	Fld Arty (6.2.3.2.2.c)
Mountains	5	15	10
Badlands/Hills	15	30	20
Fan/Wash	15	30	20
Plains/Flats	30	75	40
Dunes/Fields	5	20	20
Dust course	5	10	10
Total	75	180	120

6.2.2 Performance Tests

Performance tests shall be conducted according to the applicable Volume 5 commodity MTP contained in Volume I, Index of Commodity Test Procedures.

- NOTES: 1. Control items shall be tested intermittently or concurrently with the test items. Test items shall be kept in isothermic storage between exposure tests and performance tests.
2. Performance tests shall be conducted after completion of exposure tests.

6.2.3 Maintenance Tests

During the cycles of organizational maintenance required in connection with exposure and functioning tests, effects of the desert environment on maintenance conditions and procedures will be investigated. (Refer to MTP 5-3-505). Maintenance instructions shall be consulted and their adequacy evaluated. Special notice shall be taken of measures required to ensure serviceability of equipment, cleaning, removal of dust accumulations, tightening connections and fastenings, replacement of fragile components which have failed, necessity for extra lubrication, integrity of seals, covers, etc. Investigate requirements for non-standard tools, equipment and supplies needed to accomplish necessary maintenance, which were not furnished. AR 705-26, Maintainability, shall be used for guidance.

6.2.4 Security From Detection Tests

NOTE: The security from detection subtest may be conducted during the test item's emplacement while undergoing transportation exposure testing contained in section 6.2.1.2.

a. With the test item sited or emplaced, replace or remove all displaced natural material and observe and record the camouflage and concealment of qualities of the test item as situated in the following terrain types:

- 1) Open desert pavement, no cover.
- 2) Rocky or boulder strewn desert, no vegetation.
- 3) Terrain having xerophyte vegetation (non-succulent).
- 4) Sandy soil.

b. Observe and record the extent to which blowing sand and surface finish changes associated with abrasion or solar radiation degrade or improve concealment in the above locations.

c. Observe and record signature effects such as tracks, operational noise, dust clouds, flash smoke, acoustic radiation shadows, etc., during transport, emplacement and actual use of the items under test.

NOTE: Observations concerning camouflage and concealment shall be made with observers positioned at ranges of 500, 1000, and 3000 meters, within line of sight. In cases of test item emplacements greater than 4 sq. yards, observations shall be made from the air.

d. Monitor and record visibility conditions such as the following:

- 1) Atmospheric clarity (freedom from dust and haze).
- 2) Sky conditions (cloud cover).
- 3) Elevation of the sun (time of day and date).

NOTE: Recordings taken during this subtest, shall be made utilizing cover film and high speed motion cameras, if possible.

6.2.5 Safety Tests

a. Identify data relating to test item safety and record in the test log.

b. Safety test conduct shall be performed according to MTP 5-2-502 and in addition, the following observations shall be noted during each of the other subtests given in this MTP:

- 1) Interior and exterior temperatures of test item relative to ambient conditions.
- 2) Clarity of the test item's identification.
- 3) Presence of safety warnings.
- 4) Safety of handling instruction procedures.
- 5) Presence and adequacy of safety devices.
- 6) Sharp or projecting edges, controls, etc.
- 7) Accessibility to emergency cut-off controls.
- 8) Replaceable safety devices.
- 9) Adequacy of instructions for dealing with emergencies.
- 10) Adequacy of personnel operating instructions, (from point of view of safety with respect to heating conditions present during desert testing).

NOTE: Observations regarding safety shall be observed and recorded continually during the entire environmental test cycle. Photographs shall be made of deficiencies whenever possible.

c. Safety deficiencies noted during conduct of safety tests and other tests shall be recorded and steps taken whenever possible to eliminate all unsafe conditions.

6.3 TEST DATA

6.3.1 Exposure Tests

6.3.1.1 Storage Exposure

a. The following data will be recorded at hourly intervals throughout the storage test periods:

- 1) Ambient air temperature (20 cm above the surface, $\pm 2^{\circ}\text{F}$).
- 2) Ground temperature (5 cm below surface, $\pm 2^{\circ}\text{F}$).
- 3) Air temperature under covers ($\pm 2^{\circ}\text{F}$).
- 4) Various thermocouple readings (Paragraph 6.1.2, $\pm 2^{\circ}\text{F}$).
- 5) Relative humidity ($\pm 5\%$).

b. The following data will be recorded continuously during the same periods of storage and emplacement:

- 1) Precipitation (± 0.01 in.).
- 2) Wind speed (20 cm above surface, ± 5 mph).
- 3) Wind direction (20 cm above surface, $\pm 5^{\circ}$).
- 4) Solar radiation (± 10 Btu/ft²/hr).

c. The following data will be recorded when the storage installation or emplacement is first made and each time it is subsequently changed or re-located:

- 1) Site conditions (type or surface, masking features, vegetation, etc., including photographs).
- 2) Test item orientation (upright, side, facing or pointing direction $\pm 10^{\circ}$ or sufficiently detailed to enable retrieval of incidence angle of solar radiation if desired).

d. The following data shall be recorded at the conclusion of each storage period:

- 1) All evidences of deterioration including location on test item, probable effect of deterioration on test item performance, and action taken to alleviate the condition.
- 2) All deficiencies attributable to storage exposure.
- 3) Results of performance tests.

6.3.1.2 Transportation Exposure

a. During the movement phases of exposure testing specified in paragraph 6.2.1.2, the following data shall be recorded continuously.

- 1) Vehicle mileage (± 0.1 mi).
- 2) Vehicle compartment/enclosure temperatures ($\pm 2^{\circ}\text{F}$).
- 3) Various accelerometer readings (± 0.5 g).
- 4) Various strain gage readings (± 5 percent total allowable).
- 5) Nature of terrain crossed (nomenclature plus topographic and micro-relief details from maps or survey, sufficient to construct course profiles).
- 6) Time (± 1 min).
- 7) Vehicle speed (± 5 mph).

b. Same as 6.3.1.a, 1, 2, 3, 4, 5 and 6.3.1.b, 1, 2, and 4.

c. Record the results of the inspection upon completion of transportation cycles. Results of visual inspections conducted between each cycle should be recorded as applicable.

6.3.2 Performance Tests

a. Data shall be recorded during performance tests as indicated in the applicable MTP, selected for the test item.

b. Record the following environmental data:

- 1) Meteorological data for the days during which performance tests are conducted.
- 2) Terrain conditions at the test site.

6.3.3 Maintenance Tests

a. Record actions taken to ensure serviceability of the test item.

b. Record the use of, or need for tools or equipment or other supplies to accomplish maintenance actions.

6.4.3 Security from Detection Tests

a. Record the characteristics of the terrain in which observations are to be made.

b. Record the observed camouflage and concealment qualities possessed by the test item for each terrain type on which testing is accomplished such as:

- 1) Extent to which blowing sand and surface finish changes associated with abrasion or solar radiation degrade or improve concealment.
- 2) Signature effects.

c. Record the time of day and sky conditions present when observations are made.

6.3.5 Safety Tests

- a. Record data as indicated in applicable portions of MTP 5-2-602.
- b. Record safety observations indicated in 6.2.5,b.
- c. Record all safety discrepancies and deficiencies noted during the conduct of all subtests. (Conditions discovered unsafe and corrected shall be indicated and described in the test log. The method of correction shall be listed.

6.4 DATA REDUCTION

6.4.1 Exposure Tests

6.4.1.1 Storage Exposure

- a. Graphically summarize data from thermocouples and meteorological instrumentation, recorded in 6.3.1.1, for the total test period as follows:

- 1) Plot monthly summaries of ambient air temperature and ground temperature, wind velocity, relative humidity and solar radiation, at 6-hour intervals and mark at daily intervals.
- 2) Plot data in (1) above at hourly intervals for a 24-hour period showing most extreme and mildest days and a representative day during the exposure period.
- 3) Key test item thermocouple readings to ambient air temperatures and ground temperature and plot in the manner of the monthly and daily presentations in (1) and (2) above.

- b. Prepare presentations as required to illustrate circumstances relating to malfunctions and failures attributed to desert environmental stresses.

- c. Compare values from presentations, with prescribed or desired values, tolerances etc., and determine the acceptability of the test item in this regard.

6.4.1.2 Transportation Exposure

- a. Present meteorological data and thermocouple readings as indicated in 6.4.1.1,a.

- b. Summarize graphically, acceleration and route data recorded in 6.3.1.2,a, to show the following:

- 1) Accelerometer readings, vehicle bed temperatures, test item temperature and air temperature as a function of mileage.

NOTE: Traces shall be annotated to show time of day and start and finish of various terrain courses.

- c. Present profiles of routes followed (horizontal scale 1:15, 625 if map plotted, or 1:10 000 if surveyed; vertical scale 1:120) including annotations per surface conditions (type and microgeometry), slopes and other significant data.

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- d. Same as 6.4.1.1,b.
- e. Same as 6.4.1.1,c.

6.4.2 Performance Tests

- a. Present data as indicated in the applicable MTP selected for the particular test item.
- b. Same as 6.4.1.1,a.
- c. Same as 6.4.1.1,b.
- d. Same as 6.4.1.1,c.

6.4.3 Maintenance Tests

Present a narrative statement of results of the observations relating to maintenance. The narrative shall be fully supplemented by tabular data, drawings and photographs, as required.

6.4.4 Security from Detection Tests

Present a narrative statement of results of the observations relating to security from detection. Photographic illustrations shall be used as required to substantiate the narrative. (Photographic illustrations should include film type, filters, and exposure data.)

6.4.5 Safety Tests

Safety observations should be summarized in a narrative statement, supplemented by photographs and drawings, as required. The narrative should be concluded with a safety statement as prescribed in MTP 5-2-602.

SECTION 50	
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