10 July 1970

U. S. ARMY TEST AND EVALUATION COMMAND
BACKGROUND DOCUMENT

TESTING WHEELED, TRACKED, AND SPECIAL PURPOSE VEHICLES

1. INTRODUCTION

Volume II of the Materiel Test Procedures (MTP) covers the testing of all tactical land vehicles and certain special vehicles in use by the Army. In particular, this volume includes all armored vehicles, all trucks that are used by the Army, trailers, administrative vehicles, amphibious vehicles, etc. MTP's of Volume II are also suitable for guidance in testing the automotive portion of special purpose vehicles, such as missile transporters, pipe layers, bridge builders, buses, and ambulances.

Vehicles falling within the realm of construction, support, and service equipment fall within Volume IX.

2. COGNIZANT AGENCIES AND OFFICES

The principal agencies and offices concerned with the testing of wheeled, tracked, and special purpose vehicles and their involvement are:

a. USACDC (Combat Developments Command) Headquarters, Fort Belvoir, Virginia: Responsible for QMR's and SDR's.

b. Project Manager, USAMC (Army Materiel Command): Specific project managers are assigned to direct and manage the funding of the development and procurement of specific vehicles or classes of vehicles.

c. USATACOM (Tank-Automotive Command), Detroit: Responsible to the project manager for the actual development and procurement of combat vehicles. Occasionally, also assigned project manager function.

d. USAMECOM (Mobility Equipment Command), St. Louis: Same as USATACOM except vehicles are for surface transportation, construction, bridging, and miscellaneous uses.

e. USATECOM - Armor Directorate: Responsible for accomplishing the testing and evaluation of combat vehicles.

f. USATECOM - Field Artillery Directorate: Responsible for accomplishing the testing and evaluation of self-propelled artillery.

g. USATECOM - General Equipment Directorate: Responsible for accomplishing the testing and evaluation of construction and service vehicles (mostly covered in Volume IX of the MTP's).

h. Aberdeen Proving Ground: Principal engineering test (ET) agency for testing vehicles.

i. Yuma Proving Ground: Secondary ET agency for vehicles; primary desert environmental test agency.

j. Arctic Test Center, Fort Greely, Alaska: Agency responsible for field arctic tests.

k. Tropic Test Center, Panama: Agency responsible for tropic testing of vehicles.

l. Armor and Engineer Board, Fort Knox: Responsible for service testing (ST) of most vehicles included in Volume II and IX.

m. General Equipment Test Activity: Responsible for the ST of many vehicles included in Volume II and the ET of vehicles included in Volume IX and the conduct of transportability tests.

n. Artillery Board, Fort Sill: Responsible for ST of field artillery, including self-propelled and towed.

o. Infantry Board, Fort Benning: Responsible for tests related to tactical application of certain vehicles.

p. Airborne, Electronics and Special Warfare Board, Fort Bragg: Responsible for airdrop and portability tests.

3. TESTING OF VEHICLES AS IT RELATES TO THEIR LIFE CYCLE

The life cycle of Army materiel begins with the determination of its need and ends with its ultimate phaseout and disposal. The four phases of life cycle (DA Pam 11-25) and the associated testing are as follows:

a. Concept Formulation Phase: USACDC initiates action by examining long-range intelligence forecasts, joint and Army plans and technological forecasts. These, together with additional studies, are used by USACDC to conduct its Land Combat System Study (LCSS). From the LCSS and other combat development studies USACDC produces, in chronological order, the Operational Capability Objectives (OCO), Qualitative Materiel Development Objective (QMDO), Advanced Development Objectives (ADO), and either a Qualitative Materiel Requirement (QMR) for significant items or a Small Development Requirement (SDR) for simple and inexpensive items. The OCO is concerned with the long-range, the QMR and SDR with the short-range, future.

b. Contract Definition Phase: During this phase the design and engineering are verified. A contractor(s) for the prototype is selected by USAMC.

c. Development and Production Phase: This covers the detailed design, building of prototype, testing, type classification, and production. Tests may include engineer design, component engineering, R&D acceptance, engineering, service, check, etc., all covered by RDT&E funding; and preparation, initial production, acceptance, and comparison tests covered by production (PEMA) funding.

d. Operations and Disposal Phase: This covers the storage of materiel produced, its use in the field, and its ultimate phaseout and disposal. During this period the tests may include confirmatory tests.

4. TEST TYPES AND RESPONSIBILITIES

USATECOM has divided tests into two major categories: suitability tests and customer tests (USATECOM Regulation 704-11). Definitions of these categories and the types of tests falling within each, applicable to vehicles, are given below.

4.1 SUITABILITY TESTS

Those test programs for which USATECOM is responsible for the establishment of test objectives, preparation and approval of test plans, and processing and distribution of the report of test. The results of the suitabil-

ity test normally lead to type classification of materiel or recommendations as to suitability for release of end item for issue to the field. Test plans and reports are written by the USATECOM test agencies and approved by Headquarters, USATECOM. Most all subtests for vehicles are selected from the MTP's of Volume II. The various suitability tests are:

a. Engineering Test (ET) (AR 70-10). A comprehensive test conducted under the supervision of a Category II (T) agency (i.e., an independent test agency, such as USATECOM, not a part of the developing installation or laboratory) using an engineering approach, where the objective of the test is to determine to what degree the test item meets the requirements expressed in the QMR or SDR. In addition, maintenance and safe use by troops are evaluated. For vehicles falling within MTP Volume II, the engineering test plan is usually written by APG except for the field environmental test phase which is written by the appropriate climatic test agency; i.e., Yuma Proving Ground, Tropic Test Center, and Arctic Test Center. Each agency conducts its own tests and writes its own reports. Headquarters, USATECOM provides RDT&E funding.

b. Service Test (ST) (AR 70-10). A test conducted by a Category II (T) agency under simulated or actual field conditions to determine to what degree the item and its associated tools, equipment, and maintenance package satisfy the mission described in the QMR or SDR. This test is characterized by qualitative observations and judgments made by military personnel typical of those that would be expected to operate the materiel in the field. The ST provides the basis for type classification. The test plan for the ST of vehicles is written by the test agency assigned to conduct the test, usually the Armor and Engineer Board or U. S. Army General Equipment Test Activity. Field environmental tests are the responsibility of the agency assigned to conduct the environmental test. The field environmental tests are usually an integrated engineering-service test. Headquarters, USATECOM provides RDT&E funding.

c. Integrated Engineering-Service Test (ET/ST) (AR70-10). A test which combines the ET and the ST in a way that permits obtaining data to meet the needs of both tests. It optimizes testing time. The ST agency and the ET agency each write separate test plans which are later consolidated as one. The test is conducted at one location.

d. Check Test (CK) (AR 70-10). A retest performed on an ET/ST sample of selected items to determine whether deficiencies found in the ET/ST have been corrected, these deficiencies being of such nature that the item was found unsuitable for type classification.

e. Initial Production Test (IP) (AR 70-10). An engineering-type test normally conducted at an ET agency with initial production hardware to verify whether performance of the production hardware equals or exceeds the performance of the R&D prototype as documented by ET/ST results. Though funding for this test is derived from the developing agency, the test plan is written by the USATECOM ET agency.

f. Product Improvement (PI) (AMCR 70-7). This test is funded by the developing agency. This is sometimes a suitability test (test plan written by USATECOM) and sometimes a customer test (test plan written by customer, paragraph 4.2 below).

4.2 CUSTOMER TESTS

Those test programs in which USATECOM is performing a service for the requesting agency and in which the test objectives, plan of test, and processing and distribution of the report of test are the responsibility of the requestor. In general, customer tests are concerned with early research and development and, once production has started, with quality control. MTP's in Volume II will usually be applicable; the customer may, however, request more severe conditions or conditions not covered by the MTP's. Customer tests may also be conducted by the customer himself at his own installation or that of a contractor The types of customer tests are as follows, generally in chronological order:

a. Research Test (RE). A test conducted during the research phase to confirm concepts and to further research projects and tasks.

b. Feasibility Test (FE) (AR 320-5). The determination of a process of technical examination and study of the possibility of attainment of end-item materiel development. Technical feasibility consists of two parts: long-range or state-of-the-art study wherein the probability of attaining general technological goals is determined; and feasibility study of a desired end item after the military characteristics are known.

c. Component Engineering Test (CE) (AMCR 70-7). An engineering-type test conducted by or under the direction of the developing agency to develop component design concepts or evaluate components embodying new and advanced state-of-the-art principles. The test item is not specifically related to any existing end-item development.

d. Engineer Design Tests (EDT) (AR 70-10). A series of tests conducted by or under the control of the Category II agency where the objective of the tests is to determine inherent structural, electrical, or other physical and chemical properties of construction materials, a component, subassembly, or prototype assembly, item, or system, including the effect of environmental stresses on these properties. They are characterized by controlled conditions and elimination of errors in human judgment, insofar as possible, through the utilization of laboratory.equipment, modern statistical methodology, and the use of personnel trained in engineering or scientific fields. The purpose of such tests is to collect design data, confirm preliminary concepts and calculations, and to determine the compatibility of components.

e. Military Potential Test (MPT) (AMCR 70-7). A test of a system, item, or component for which no definitive characteristics have been established or a test conducted to determine whether the materiel or equipment has military potential. The vehicle tested is usually one developed by private industry or a foreign country. The test usually is a limited test conducted under field conditions. It does not negate the requirement for ET and ST prior to type classification. When the item may provide a new capability not covered by an active RDT&E program, the test may be a suitability test with test plan written by the USATECOM test agency.

f. Research and Development Acceptance Test (RDAT) (AR 70-10). A test conducted on an item or system designed and developed by a contractor to insure that the specifications of the development contract have been fulfilled. Acceptance of the item or system for ET is dependent on the results of the R&D acceptance test. The effectiveness, or readiness, of a given development project, however, is measured at the time of type classification, not at the time it begins [illegible]. Early initiation of ET, irrespective of minor deficiencies anticipated

in these tests, as a means of expediting an overall development process, should be the goal of both developing and testing agencies.

g. Preparation Test (PPT) (AR 70-10). An engineering-type test conducted or supervised by the Category II agency on a preproduction model produced during advanced production engineering or early production in accordance with the production specifications and drawings using methods, materials, and equipment that will be used during regular production, in order to verify production drawings, processes, and materials.

h. Comparison Test (IC) (AMCR 715-509). A test of random samples of production line items conducted as a quality assurance measure to detect any design, manufacturing, or inspection deficiencies that may reduce the effective operation of the items by the using agency.

i. Product Improvement Test (PI) (AMCR 70-7). A test conducted on modified standard items of Army materiel to verify that essential military characteristics have not been adversely affected by the modification and to establish the durability, operational capability, and maintainability of the modified item.

j. Confirmatory Test (CF) (AR 71-3). A test or investigation of an item or system after type classification as standard or limited production, conducted by USACDC by expedited test in the field using TOE-type units for the conduct of the test.

k. Reconditioning Test (RT) (AMCR 70-7). A test conducted on standard items, which have been modified to correct dificiencies discovered during use, to verify that essential military characteristics have not been adversely affected and to establish the durability, operational capability, and maintainability of the modified item.

5. ENVIRONMENTAL TESTING OF VEHICLES

Environmental tests are conducted to determine whether an item will perform effectively in the environments of its intended use. The most important policies regarding environmental testing of vehicles, including those in AR 70-38, are:

a. All equipment is required to perform effectively in the wet-warm, wet-hot, intermediate hot-dry, and intermediate cold climatic categories of AR 70-38. Other required climatic categories are delineated in QMR's and SDR's which may permit the use of kits to adapt the equipment to the severest environments.

b. Because testing of materiel in special adverse environments, such as arctic, desert, jungle, seashore, and mountains, is costly in terms of manpower, money, materiel, and time, the maximum amount of testing will be performed in climatic chambers which simulate the adverse environments.

c. To reduce the amount of testing in adverse natural environments, assurance must be obtained that chamber testing has been fully exploited.

Environmental testing of vehicles and components are in part conducted during the various phases of their development. In the earliest stages, the design agency may chose to prove that certain components can perform adequately under the climatic extremes by either conducting its own tests or requesting that the tests be performed by USATECOM. This will usually occur during the

EDT or CE phases.

Upon receipt of the prototype for ET, the ET agency will perform all those environmental tests required by the QMR or SDR that are within the capabilities of its environmental chambers. The ET agency will utilize all of the data from earlier testing conducted by USATECOM agencies sponsored by the design agency, providing data results are usable and no modifications have been made that will affect test results. The ET agency may use data from earlier testing conducted by the design agency provided the data are certified and meet ET test criteria. Though the design agency may resort to certain overtests, it is normally the policy of the ET agency to confine itself to simulating the realistic conditions specified in AR 70-38 insofar as possible. Improvised tests involving wind and rain are possible within limitations. No adequate facilities exist in USATECOM for conducting vehicle tests that involve simulating solar radiation, sand and dust, salt spray, or fungus. Such testing must be performed on a component basis or the vehicle sent to a climatic test center. The importance of climatic tests in chambers cannot be overstated because, in addition to the policies stated above, the extreme conditions that are desired are sometimes difficult to schedule at the climatic test sites. In conducting environmental tests, it must always be remembered that AR 70-38 defines climatic conditions, not test procedures. For test procedures, aside from those that are specially deivsed and described in MTP's, MIL-STD-810B will be the document used by the ET agency. The ET agency confines its environmental testing to climatic chambers and those natural environments which it is convenient to utilize.

The climatic test sites (Yuma Proving Ground, Arctic Test Center, and Tropic Test Center) are expected to write the test plans and conduct the tests in their specialized climatic areas. Tests are expected to serve the needs of both the ET and the ST.

Environmental testing should include electronic interference tests, radiation tests, and tests for effects of other natural or manmade physical factors, when appropriate.

Adverse terrain is another major consideration for vehicles. In general, the ET agency will conduct all those tests for which quantitative data can be obtained and for which suitable terrain, either natural or manmade, is available. Thus, tests involving standard obstacles, slopes, mud, swamp, clay, and sand are conducted at the ET agency. The ST agency is concerned with snow, sand dunes, and varying terrain.

When there is a necessity to conduct tests concerned with logistics-over-the-shore or effects of salt water or salt-laden atmosphere, USATECOM usually directs that they be conducted by the U. S. Army General Equipment Test Activity.

6. TEST MANAGEMENT

The USATECOM management system designed to control and monitor test activities and to provide input data for management decision making is called

the Test Resource Management System (TRMS) (USATECOM Regulation 70-8). TRMS is the basis for local management by the individual installation as well as by Headquarters, USATECOM. All test work conducted by USATECOM installations is assigned a TRMS project and test number, and all testing is expected to proceed in accordance with certain milestones. TRMS is used by Headquarters, USATECOM, to:

a. Maintain a 5-year projection of work.
b. Maintain an inventory of active, inactive, and completed work.
c. Authorize the performance of, and schedule, work.
d. Monitor the performance of test work.
e. Aid in the evaluation of requirements and utilization of personnel.
f. Aid in the evaluation of instrumentation and facility requirements.
g. Monitor the expenditure of testing funds.
h. Determine and adjust the workload at each USATECOM installation/activity.

Test priorities are assigned by USATECOM and range from 1 to 6 (though in the TRMS system they are shown as 10 to 60 to provide a second digit for use by the local installation). The priorities (USATECOM Regulation 70-9) are:

CODE 1. Items as designated by the Commanding General, USATECOM, or higher headquarters and all ENSURE items.
CODE 2. Standard items for an active combat zone, including limited production items and product improvement tests of approved items not involving re-type classification.
CODE 3. R&D items being developed for an active combat zone and improved items requiring re-type classification which are required for an active combat zone.
CODE 4. Other standard or limited production items and product improvement tests of approved items not involving re-type classification.
CODE 5. Other R&D items and improved items requiring re-type classification.
CODE 6. Other tests, projects, and studies not specified above.

NOTE: The use of priority codes 1, 2, or 3 for tests assigned to environmental test activities (arctic, tropic, or desert) will be based upon the need for such testing as a prerequisite to use of the test item in an active combat zone.

7. TEST PLANS

For suitability tests, the USATECOM test agency writes a test plan following the guidance provided in USATECOM Regulation 70-24. For customer tests, the test agency may or may not write a test plan depending upon the desires of the customer.

Test plans prepared within USATECOM will provide a concise statement of objectives, test criteria, test methods, data to be gathered, and scope of

required tests. Specific subtests necessary to determine the degree to which an item meets the requirements of the QMR's, SDR's, Technical Characteristics (TC's), abbreviated performance characteristics, Army Regulations, USAMC Regulations, USATECOM Regulations, Military Standards, Military Specifications, etc., will be identified. Subtests required to develop Safety Releases and other safety verification documents will reflect the provisions of USATECOM Regulation 385-6.

Test plans will include all subtests from Volume II of the MTP's required to evaluate the test item in compliance with stated objectives even though test data are to be obtained from other sources (e.g., EDT, field use, etc.).

In MTP Volume II, the approach to writing the test plan is to first refer to the appropriate commodity test pamphlet for the item that is to be tested (e.g., MTP 2-2-100, Trucks and Tractors). This commodity MTP, in turn, lists the common MTP's and other documents suitable for use in testing and evaluating the vehicle.

Test plans are submitted by the test agency to USATECOM Headquarters for approval.

Local guidance for writing test plans may exist, e.g., MTD Procedure 705-17.

8. TEST REPORTS

A variety of types of reports are used to document vehicle test results. Guidance is provided by USATECOM Regulations 70-23 and 70-24 and local documents such as MTD Procedure 705-6. Briefly, applicable reports are:

a. Formal Report: A final comprehensive report covering conclusions and recommendations.

b. Partial Report: A formal report that covers only a special phase of testing.

c. Letter Report: A report in a letter form used to expedite transmittal of results when requested by the customer.

d. Interim Report: A progress report in letter form that follows a significant testing event or period of time.

e. Equipment Performance Report (EPR): A report prepared on AMSTE Form 1025 which lists every test failure; classifies it as a deficiency, shortcoming, or suggested improvement; and transmits it to the test sponsor and USATECOM within 72 hours of the incident.

9. ADVANCING TEST METHODOLOGY AND FACILITIES

Test agencies must be constantly alert to the need to update and improve test methods, test instrumentation, and test facilities. For example, part of the test agency's mission is to develop and improve test procedures and methods with a view to increasing the efficiency, validity, and reliability of tests.

In practice, not only management, but every supervisor, test director, technician, engineer, vehicle mechanic, driver, and specialist should be concerned with this matter, making proposals through channels. Advancing test methodology is accomplished by these principal means:

a. Maintaining a continuing program to update, revise, and add to the MTP's. This will be based upon studies conducted, availability of new technology (e.g., practical laser application), review of effectiveness and efficiency of existing methods, new requirements for vehicles, and the need for methods to test items embodying new technological developments and new capabilities (e.g., an air cushion vehicle).

b. Submitting "Requests for Approval of Test Methodology Research Investigations" per USATECOM Regulation 70-12. This program is designed to provide funds to conduct studies leading to improved methodology. Local implementation includes MTD Procedure 728-29.

c. Maintaining the Instrumentation Master Plan (USATECOM Regulation 700-5) which is a 5-year plan maintained by each installation listing its facility and instrumentation deficiencies and designating requirements for correction, modernization, and cost of each improvement. Local implementation includes MTD Procedure 210-2.

d. Submitting "Requests for Approval of Research and Development of Instrumentation Tasks" (USATECOM Regulation 70-11) to permit studies leading to improved instrumentation applications or development of new instrumentation. Local implementation includes MTD Procedure 700-9.

e. Submitting ideas through the Incentive Awards Program.

f. Instituting value engineering actions to eliminate unnecessary, costly, or nice-to-have features with regard to test programs, test items, facilities, instrumentation, and test methodology (USATECOM Regulation 700-1). Local implementation includes MTD Procedure 728-6.

10. POLICY ON USE OF MTP's

MTP's are a collection of documents that describe the test procedures utilized by USATECOM in conducting engineering tests and service tests of Army materiel. These procedures are also used in other suitability tests for which USATECOM has test plan responsibility including initial production tests and check tests. In addition, they are suitable for customer tests such as engineer design tests, preparation, comparison, and product improvement tests. In customer tests, however, the customer is given the option of changing test conditions and methodology as he sees fit.

It is to be emphasized that the MTP's are a guide to current testing technology and are not regulatory in nature. When unusual test requirements exist or when new and improved procedures have been devised, appropriate testing procedures will be used by the test activity. To accomplish the stated objectives of this program, however, it is incumbent upon all users of these MTP's to recommend changes when required to insure the technical accuracy, adequacy, and currency of the documents.

REFERENCES

1. AR 70-10, Test and Evaluation During Research and Development of Materiel.
2. AR 70-38, Research, Development, Test, and Evaluation of Materiel for Extreme Climatic Conditions.
3. AR 71-3, User Field Tests, Experiments and Evaluation.
4. AR 320-5, Dictionary of United States Army Terms.
5. DA Pam 11-25, Life Cycle Management Model for Army Systems.
6. AMCR 70-7, Test and Evaluation of Materiel.
7. AMCR 715-509, Quality Assurance Technical Procedures.
8. MIL-STD-810B, Environmental Test Methods.
9. USATECOM Regulations:

   a. 10-18, Aberdeen Proving Ground, Aberdeen Proving Ground, Md.
   b. 70-8, Test Resource Management System (TRMS).
   c. 70-9, Test Priorities.
   d. 70-11, Research and Development of Instrumentation.
   e. 70-12, USATECOM Test Methodology Research Investigations (RCS STEPO-160).
   f. 70-23, Equipment Performance Reports (EPRs).
   g. 70-24, Documenting Test Plans and Reports.
   h. 385-6, Verification of Safety of Materiel During Testing.
   i. 700-1, Value Engineering.
   j. 700-5, Instrumentation Master Plan.
   k. 705-11, Authorized Testing Terminology.

10. MTD Procedures (Aberdeen Proving Ground):

   a. 210-2, Technical Testing Resources.
   b. 700-9, Research and Development of Instrumentation.
   c. 705-6, Preparation and Distribution of Technical Reports.
   d. 705-17, Policy, Preparation and Distribution of Test Plans.
   e. 728-6, Value Engineering and Cost Reduction.
   f. 728-29, Test Methodology Research Investigations.

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11. SUPPLEMENTARY NOTES
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12. SPONSORING MILITARY ACTIVITY
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13. ABSTRACT

This Background Document provides general testing background information relative to the testing of Tactical Land Vehicles and certain special vehicles. It applies to Wheeled, Tracked and Special Purpose Vehicles.

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