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11 February 1970

Materiel Test Procedure 6-3-062
Electronic Proving Ground

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

3450

COMPUTERS, DIGITAL

1. OBJECTIVE

The objective of this document is to describe the service test procedures to obtain operational performance data and information to determine the degree to which digital computers meet the military characteristics expressed in the applicable Qualitative Materiel Requirement (QMR) or Small Development Requirement (SDR), and the suitability of the test item for use by the Army.

2. BACKGROUND

The electronic digital computer, as defined in AR 320-5, is a machine or group of interconnected machines (input, storage, computing, control, and output devices) which uses electronic circuitry in the main computing element to perform arithmetic and/or logical operations automatically by means of internally stored or externally controlled programmed instructions.

The Field Artillery Digital Computer (FADC) is an electronic digital computer especially designed to solve field artillery problems, such as the gunnery problem. As such, it is a component of the field artillery system. This system consists of all of those elements that are necessary to obtain the desired tactical effect on a target, and includes weapons, target acquisition, survey, ballistic meteorology, communications, mobility, logistics, fire control and coordination, automatic data processing, ammunition, organization, and employment.

The field artillery system, therefore, effects the mission of field artillery, which is to provide continuous, flexible, timely, and accurate fire support to the force commander by destroying or neutralizing, in priority, those targets that jeopardize the accomplishment of his mission.

One FADC, such as Gun Direction Computer M18 (FADAC), was developed primarily to compute firing data accurately and rapidly for artillery weapons from data inputs defining target location, weapon location, and prevailing conditions of equipment, material, and weather.

The principal advantage gained in using a digital computer to solve the gunnery problem is the significant improvement in the accuracy and flexibility in the delivery of surprise fires. This is possible because the final computer solution can be based upon an electronic simulation of the trajectory using existing ballistic conditions data, thereby resulting in a higher probability that the first actually-fired round will be on target.

Although designed originally for a specific use in the field, the FADC can be used generally as a tactical digital computer for such other applications as survey computation, weapon-effects analysis, sound and flash

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ranging, triangulation in photogrammetry, and meteorological data reduction. Limited only by the size of its memory unit (8,192 words for FADAC), the computer can also be programmed for general military usage. A simplified block diagram of the digital computer is shown in Figure 1.

In order to determine whether developmental digital computers' operational characteristics and capabilities are in conformance with current military requirements, the commodity must be tested objectively under planned field operational conditions by service personnel.

3. REQUIRED EQUIPMENT

a. Simulated tactical environment, including:

1) Firing ranges
2) Surveyed targets and reference points

b. Maintenance support facility.
c. Weapons, for example:

1) 105-mm Howitzer
2) 155-mm Howitzer
3) 8-inch Howitzer
4) 175-mm Gun.

d. Ammunition for each weapon, as required.
e. Vehicle for transporting or mounting test item, as required.
f. Sound recording equipment.
g. Communication facilities, as required.
h. Photographic equipment, still and motion picture (black and white or color.)
i. Stopwatches.
j. Meteorological instrumentation.
k. Instrumentation (after calibration), consisting of the following integral equipment:

1) Time meter
2) Error indicators

l. Associated equipment, for example:

1) Computer table with integral power connection panel.
2) Power cable and reel assembly.
3) Generator set, gasoline, or other suitable power unit (primary).

m. Associate software, for example:

1) Prepunched program tape kit (105-mm Howitzer, for example)
2) Meteorological data tape
3) Clear memory tape permanent storage

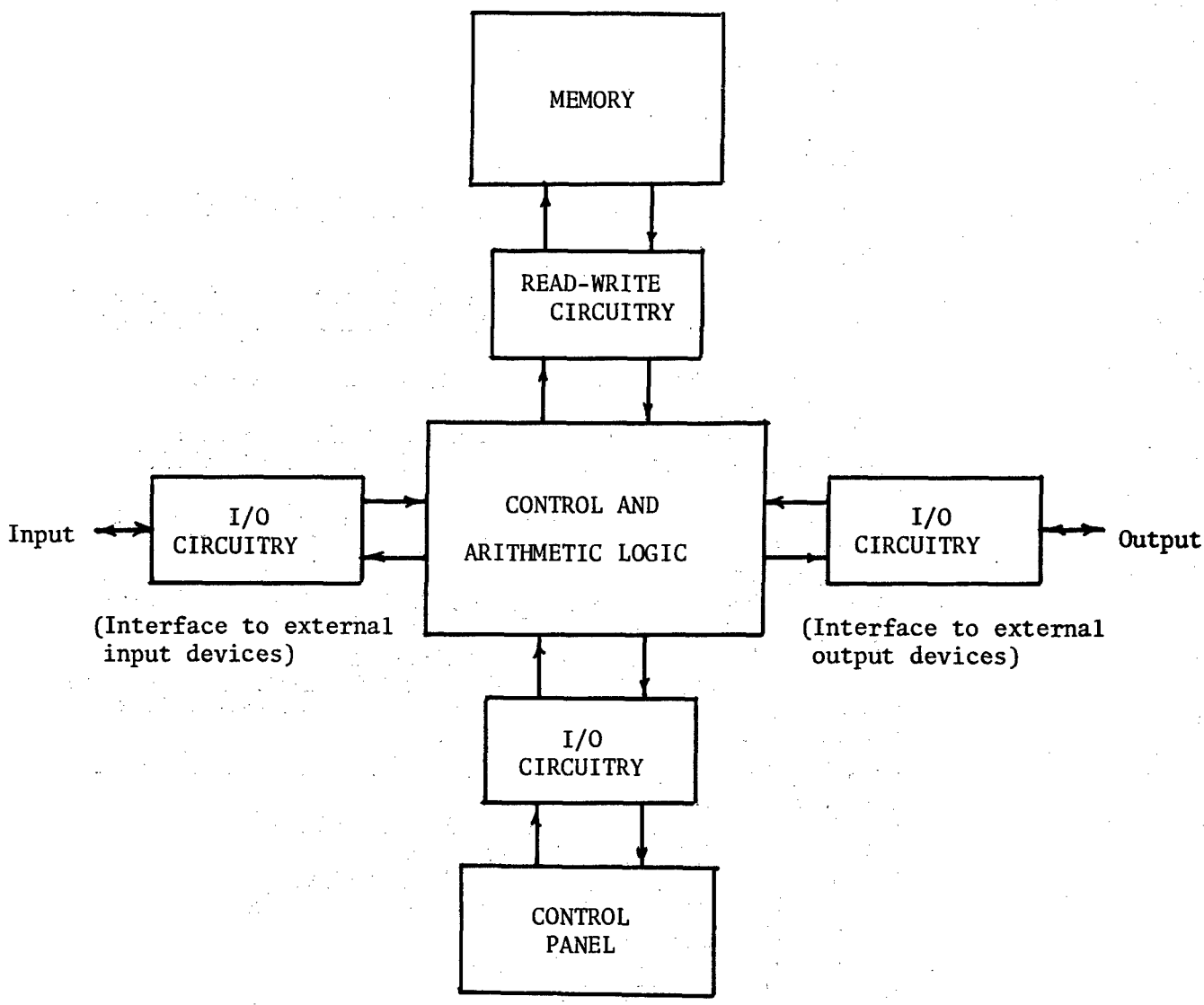

Figure 1. Block Diagram of Digital Computer

4) Clear memory tape temporary storage

n. Auxiliary equipment, for example:

1) Signal data reproducer, AN/GSQ-64.
2) Computer logic unit test set, AN/GSM-70

4. REFERENCES

A. FM 6-3-1, Operation of the Gun Direction Computer M18- Cannon Application.
B. FM 6-40, Field Artillery Cannon Gunnery.
C. FM 6-125, Qualification Tests for Specialists Field Artillery.
D. TM 9-1220-221-10, Operator's Manual: Computer, Gun Direction, M18.
E. TM 9-1220-221-20/1, Organizational Maintenance Manual: Computer, Gun Direction M18.
F. TM 9-1220-221-20/2, Organizational Maintenance Manual: Computer, Gun Direction M18 (Composite Test Tape Program Printout).
G. TM 9-1290-326-12, Operator and Organizational Maintenance Manual: Computer, Gun Direction, M18 Reproducer Signal Data AN/GSQ-64.
H. TM 9-4931-204-12/1, Operator and Organizational Maintenance Manual: Test Set Computer Logic Unit AN/GSM-70.
I. TM 5-6115-211-10, Operators Manual: Generator Set.
J. Price, T.J., Computer, Gun Direction M18 (FADAC) Applications Manual, Technical Note TN-1119, U. S. Army Frankford Arsenal, Philadelphia, Pa., May 1967 (AD 664 137).
K. USATECOM Regulation 385-6, Verification of Safety of Materiel During Testing.
L. MTP 3-1-002, Confidence Intervals and Sample Size.
M. MTP 6-3-500, Physical Characteristics.
N. MTP 6-3-502, Personnel Training Requirements.
O. MTP 6-3-505, Emplacement, Action and March Order.
P. MTP 6-3-506, Durability.
Q. MTP 6-3-509, Effects of Weather.
R. MTP 6-3-510, Transportability.
S. MTP 6-3-513, Qualitative Electromagnetic Interference.
T. MTP 6-3-523, Safety.
U. MTP 6-3-524, Maintenance Evaluation.
V. MTP 6-3-525, Human Factors.
W. MTP 7-3-512, Air Drop Capability.
X. MTP 7-3-515, Air Transportability, Internal.

5. SCOPE

5.1 SUMMARY

5.1.1 Technical Characteristics

The procedures outlined in this MTP provide general guidance for determining the degree to which the test item meets current military requirements for digital computers as expressed in the appropriate QMR, SDR, or other applicable criteria. The cumulative test results together with the results of appropriate common service tests will allow an estimate to be made of the suitability of the equipment to meet the required military needs.

The specific tests to be perfomed, along with their objectives, are listed below:

a. Operational Characteristics -

1) Ensure that the test item is operational, that is, that it will function in accordance with its designed logic and control characteristics.
2) Determine compatibility and operational performance characteristics of the operator/computer when subjected to standard-type sample field artillery problems involving computation of firing data and solution of survey problems.
3) Determine compatibility and operational performance characteristics of the operator/computer when the gunnery team is subjected to standard field artillery service procedures.

b. Qualitative Electromagnetic Interference - The objective of this subtest is to determine the objectionable radiation or emission caused by operation of the test item, and the interference to the test item caused by electromagnetic radiation from other equipment in the system operating environment.

c. Physical Characteristics - The objective of this subtest is to determine the adequacy and suitability of vehicle, van, or shelter when provided or specified for use with the test item.

d. Durability - The objective of this subtest is to evaluate the time in service, failure potential of components, and operational durability limits of the test item during transportation, emplacement and functioning.

e. Transportability - The objective of this subtest is to determine the suitability of the test item for movement in tactical situations by those modes common to the Army.

f. Adverse Conditions/Effects of Weather - The objective of this subtest is to determine the capabilities and limitations imposed upon the operation of the test item caused by exposure to extremes of weather and terrain.

g. Maintenance - The objective of this subtest is to determine the accessibility and susceptability of the test item to the accomplishment of the scheduled and non-scheduled maintenance tasks over the entire period of service testing, and needs for specialized tools and instruments to accomplish assigned levels of maintenance, and to determine the mission reliability of the test item in terms of failure-free operation time, mean time between failures, maintenance down time, and mean time for repair.

h. Safety - The objective of this subtest is to determine the safety hazards encountered during transportation, emplacement, functioning,

and recovery of the test item throughout the period of testing.

i. Human Factors - The objective of this subtest is to determine the design operational features of the test item conducive to error and delay in mission accomplishment by user personnel.

j. Emplacement and Displacement - The objective of this subtest is to evaluate the physical aspects of transporting, installing, and displacing the test item in different types of terrain relative to time, manpower, and vehicle requirements.

k. Personnel Training Requirements - The objective of this subtest is to determine the scope and effectiveness of pre-test training associated with operation of the test item and needs for additional training in the same or different fields.

l. Adequacy of Instruction Manuals - The objective of this subtest is to determine whether the instruction manuals conform to the applicable Army Regulations and are suitable for training operating and maintenance personnel possessing the required basic skills.

5.1.2 Common Service Tests

Not included in this MTP are the following Common Service Tests which apply to these commodities:

a. MTP 6-3-501, Pretest Inspection for Service Test
b. MTP 6-3-504, Ease of Installation and/or Rigging Operations
c. MTP 6-3-507, Reliability
d. MTP 6-3-512, Compatibility with Related Equipment
e. MTP 6-3-517, Electrical Power Requirements

5.2 LIMITATIONS

This document is limited to the service testing of tactical digital computers whose operational, functional, and physical requirements are described by the applicable military characteristics. This testing is designed to be performed by military personnel of appropriate MOS level.

6. PROCEDURES

6.1 PREPARATION FOR TEST

a. Select and schedule suitable transportation and simulated tactical operational areas at representative environmental locations as required by applicable test directive, test procedure and corresponding MTP.

b. Upon establishing the scheduled availability of the test item coordinate the availability of the following:

1) Engineering safety or other safety statement.
2) Maintenance support facilities, spare parts, and personnel.
3) Equipment, special facilities, and instrumentation with special attention to timely provision of additional supplies or special equipment not readily available at the test site. For example, fire direction center and firing battery. See

FM 6-40 (Chapter 31).

c. Select test equipment having ideally an accuracy of at least ten times greater than that of the function to be measured, that is in keeping with the state-of-the-art, and with calibrations traceable to the National Bureau of Standards.

d. Record the following information:

1) Nomenclature, serial number(s), manufacturer's name and function of the item(s) under test.
2) Nomenclature, serial number, accuracy tolerances, calibration requirements, and last date calibrated of the test equipment selected for the tests.

e. Ensure that all test personnel are familiar with the required technical and operational characteristics of the item under test, such as stipulated in Qualitative Materiel Requirements (QMR), Small Development Requirements (SDR), and Technical Characteristics (TC).

f. Review all instructional material issued with the test item by the manufacturer, contractor, or government, as well as reports of previous tests conducted on the same types of equipment, and familiarize all test personnel with the contents of such documents. These documents shall be kept readily available for reference.

g. Prepare record forms for systematic entry of data, chronology of test, and analysis in final evaluation of the test item.

h. Prepare adequate safety precautions to provide safety for personnel and equipment, and ensure that all safety SOP's are observed throughout the test and that the item has successfully completed MTP 6-3-523, Safety.

i. Prepare a sufficient number of sample field artillery problems (computational tasks) including input (announced) data and obtain or prepare standard solutions, as provided in FM 6-3-1 (Appendix D) and FM 6-125 (Chapters 2 and 3).

j. Obtain or prepare statements of gunnery team simulated missions (surprise fire, adjust-fire, fire-for-effect, registration, and multiple-fire). For example, see FM 6-40.

k. Prepare a test item sample plan sufficient to ensure that enough samples of all measurements are taken to provide statistical confidence of final data in accordance with MTP 3-1-002. Provisions shall be made for modification during test progress as may be indicated by monitored test results.

l. Ensure that arrangements for supporting and participating agencies, activities, and facilities have been made, and that authorization for electromagnetic radiation at specific frequencies, power levels, and modulations for required periods as necessary has been obtained.

m. Ensure that appropriate security measures are instituted as required to safeguard classified materiel and data.

n. Thoroughly inspect the test item for obvious physical and electrical defects such as cracked or broken parts, loose connections, bare or broken wires, loose assemblies, bent critical parts, and corroded plugs or

jacks. Check for continuity of wire terminations to ensure that wiring is connected to the proper terminals, and that no damage will result when power is applied. All defects shall be noted and corrected before proceeding with the test.

o. Ensure that the following software (see Appendix A) is readily available, or prepared, as applicable:

1) Check-out routine tape (if self-test routine is not built in).
2) Applicable program (solution-instruction) tapes.

6.2 TEST CONDUCT

NOTE: Performance assessment shall be accomplished throughout this test primarily by observers equipped with the means of recording visual, aural, and judgemental observations and related time factors. Observer activities shall not interfere with or influence in any manner, the functions of test item.

6.2.1 Operational Characteristics

a. Utilizing an average trained crew, emplace the test item in a typical tactical operational site and verify correct power source, necessary test instrumentation and inter-connection cabling, and that the equipment is aligned if necessary as specified in the pertinent operating instructions to ensure, insofar as possible, it represents an average equipment in normal operating condition.

b. Apply power to the test item and accomplish a manual routine check-out by performing the series of manual tests using the control panel in accordance with the particular computer instructions to verify operation of the manual logic and control.

NOTE: This will generally involve testing single commands to ensure that each performs satisfactorily.

c. Record the following:

1) "Successful" or "unsuccessful" completion of check-out routine for the following conditions.

   a) Normal check-out.
   b) Normal check-out with momentary power switch-off. Note whether check-out routine has been retained in permanent storage channel.
   c) Check-out under "marginal" conditions.

2) Description and number of errors (parity, overflow) and malfunctions which occur during test runs.
3) Time for successful normal check-out (min/sec).

d. If a programmed check-out is not built into the computer, enter such a taped check-out routine into the permanent storage channels of the computer memory unit employing an input device such as Signal Data Reproducer, AN/GSQ-64.

e. Start the programmed check-out operation in accordance with the procedure for the particular computer.

f. Record data as in Step c.

g. Announce a sample field artillery problem including input data to the operator/computer.

NOTE: Problem shall include the following:

1) Computation of firing data, such as:

a) Optimum charge
b) Deflection
c) Time of flight
d) Fuze setting
e) Quadrant elevation

2) Solution of survey problem-types, such as:

a) Traverse
b) Intersection
c) Observer orientation

h. Enter the sample problem data into the computer in accordance with the procedures given in FM 6-3-1 (Appendix D) and FM 6-125 (Chapters 2 and 3) and observe and time the subsequent execution or solution of the problem.

i. Record the following:

1) Solution obtained for sample field artillery problem.
2) Execution time (min/sec) for problem solution.
3) Description and number of errors (parity, overflow) and malfunctions which occur during performance of computational tasks.
4) Critique statement by the test officer for each problem execution.
5) Statement of operator opinion, as to ease of operation and suitability of the computer to accomplish its intended function.

j. Conduct the system test (gunnery teams operations, with the operator/computer in the fire direction center) in accordance with standard field artillery service practice procedures designated in FM6-40, Chapter 31.

NOTE: 1. Conduct the system test for the following simulated missions:

a. Surprise-fire (against a target of opportunity).

b. Adjust-fire.
c. Fire-for-effect.
d. Registration (precision, mean-point-of-impact, high-burst).
e. Multiple-fire, as limited by safety and firing range factors.

2. Duties of personnel and sequence of operation will probably vary in the fire direction center depending upon the particular FADC under test. For example, the respective duties of personnel and sequency of operation employing FADAC for fire missions are extracted from FM 6-3-1 and given in Appendix A.

k. Record the following:

1) Announced data to the operator/computer during each simulated mission.
2) Output data (solutions) provided by the operator/computer during each simulated mission.
3) Execution time (min/sec) for each operator/computer simulated mission.
4) Critique statement by the test officer that each simulated mission was completed in either a satisfactory, unsatisfactory, or excellent manner, or was not completed.
5) Concise analysis by the test officer following each simulated mission, including a statement of the good points and the undesirable features (for example, violations of procedure). The analysis should follow generally the sequence of the simulated mission but it should not be a round-by-round discussion.

l. Repeat steps (a) through (k) utilizing several different test crews in order to obtain a sampling of test times.

6.2.2 Qualitative Electromagnetic Interference Test

a. Deploy electronic systems/equipments, of representative tactically collocated types to the item under test, at various distances (slant range) and orientations with respect to the test item.

b. Operate the systems at intervals during the test phases outlined in paragraphs 6.2.1, and determine their effect on the test item and the test item's effect on the systems in accordance with the procedures given in MTP 6-3-513.

6.2.3 Physical Characteristics

a. Subject the item under test to physical characteristics determination according to the procedures given in MTP 6-3-500.

b. Throughout the entire testing period, monitor any vehicle, van or shelter provided as part of or specified for use with the test item with

respect to its adequacy and suitability for the intended mission.

c. Record narrative comments, obtained from all test personnel through daily observation, interview and questionnaire, concerning the following:

1) Equipment arrangement and mounting.
2) Ventilation, heating and air conditioning.
3) Lighting and blackout provisions.
4) Acoustical properties.
5) Protective features (CBR).
6) Roadability and safety.
7) Any other features which might affect the overall adequacy, suitability and physical characteristics of the test item.

d. Measure and record space required for:

1) Equipment (including integral and external antenna systems)
2) Power sources
3) Operator and maintenance activity

6.2.4 Durability

a. Throughout the entire period, monitor the durability characteristics of the test item in accordance with the procedures given in MTP 6-3-506. Ensure that the test item has been subjected to at least the following exposures:

1) Transport vehicles, paved roads - 500 miles
2) Transport vehicles, secondary roads - 100 miles
3) Tactical vehicles, cross-country - 100 miles

b. In addition to the data specified in MTP 6-3-506, observe and record at 100-mile intervals, or at the end of the exposure, the incidence of defects in the test item and its components, including:

1) Inoperable electronic equipment (damaged enclosures, loose or broken connections, foreign material accumulations, damaged components).
2) Damaged or worn mechanical parts, to include component packaging, (bent or broken handles, and fasteners, defective seals, sluggish or restrained mechanical action).

6.2.5 Transportability

a. Subject the item under test to the transportability procedures given in MTP 6-3-510.

b. Utilizing appropriate tactical vehicles, transport the test item from a supply point to an emplacement site under daylight conditions.

c. Observe and record activities and times required to traverse the following applicable routes, for the distances noted:

1) Pavement - 50 miles
2) Secondary roads - 100 miles
3) Cross-country terrain - 50 miles

d. Repeat steps (b) and (c) above, under conditions of darkness (blackout).

e. Determine the air transportability and air drop capability of the test item in accordance with applicable sections of MTP's 7-3-512 and 7-3-515 , with attention to the following:

1) Adequacy of provisions and instructions for lifting or otherwise loading the test item in or on transport aircraft.
2) Suitability and adequacy of provisions and instructions for blocking and tie-down.
3) Suitability and adequacy of provisions, including materials and instructions, for rigging the test item for airdrop.

f. In addition to data required by applicable portions of MTP's 7-3-512, 7-3-515, record the following:

1) Narrative comments, supported by photographs, relative to experience with loading and tieing down the test item inside aircraft, or rigging the test item for external transportation by aircraft. Cover unloading from aircraft as well.
2) Narrative comments, supported by photographs, covering experience with airdrop of the test item, including rigging, air drop operations, and final condition of the test item after drop.

6.2.6 Adverse Conditions/Effects of Weather

a. Subject the test item to the effect of weather procedures given in MTP 6-3-509.

b. Repeat the procedures given in paragraph 6.2.1 under the following conditions, as applicable:

1) Darkness (blackout).
2) Conditions not previously encountered in the course of testing to include:

a) Moderate temperatures with rain.
b) Frigid temperatures with:

(1) Snow
(2) Sleet or icing conditions

c) Hot temperatures with:

(1) High humidity
(2) Low humidity

6.2.7 Maintenance

a. Throughout the conduct of all testing as outlined in this MTP, maintain a record of performance of scheduled and unscheduled maintenance as prescribed in the appropriate test item maintenance instructions. Assessment of all maintenance factors shall be accomplished in accordance with MTP 6-3-524 with special attention to record accuracy.

b. Compare all replacement parts and components provided with the test item with anticipated and actual requirements, evaluating spare parts requirements under actual operating conditions.

c. Record the requirements for additional tools and instruments, shortcomings in authorized tools and instruments, and needs for specialized tools and instruments to accomplish assigned levels of maintenance.

d. Record all repair parts used, man hours and elapsed time required, and level of skill demanded.

e. Starting with the initial assembly, set-up, and check-out of the test item upon receipt at the test agency, maintain a complete log of all assembly, installation, operation, disassembly, and maintenance activities for the purpose of reliability analysis. The log shall include the following information:

1) Number of times the test item is assembled and installed from the field transport configuration.
2) Number of times the test item is disassembled and repacked in the field transport configuration.
3) Hours of operation, daily and cumulative.
4) Equipment failures and malfunctions, including chronological data required to determine failure-free operating time, mean time between failures, maintenance downtime, and mean time for repair.
5) Effect of failures on the operational test conduct.

6.2.8 Safety

a. Throughout the conduct of all testing as outlined in this MTP, monitor all safety aspects associated with the test item in accordance with MTP 6-3-523.

b. In addition to data required by MTP 6-3-523, record narrative comments concerning the following:

1) Confirmation of safety release under conditions as specified in USATECOM Regulation 385-6.
2) Analysis to establish that no forseeable hazards are present during testing or operation of the test item.
3) Inspection for high voltage hazard control and adequacy of protective provisions to include interlocks and warning placards.
4) Evaluation of any safety hazards, including radiological hazards, associated with storage, transportation, operation and maintenance of the test item.

6.2.9 Human Factors

a. Throughout the conduct of all testing as outlined in this MTP, monitor and appraise human factors for the purpose of identifying design or operational features conducive to error and delay in mission accomplishment by user personnel in accordance with the procedures given in MTP 6-3-525.

b. Observe and record activities and average times of phases of the computing mission as accomplished by average trained crews.

6.2.10 Emplacement and Displacement

a. With the test item packed for field transit, transport the component items, auxiliary items, and personnel to a test site by the selected means (surface or air), and utilizing an average trained crew, install the test item complete and ready for operation in an applicable tactical situation in accordance with the instructional manual and MTP 6-3-505.

b. Observe and record the activities and times required to:

1) Dismount or otherwise make ready the test items, starting from the transportation configuration, and perform pre-operational adjustments.
2) Install the test items.
3) Energize or prepare the test item for operation.

c. Repeat Steps (a) and (b) above, adding or subtracting one crew member for each trial, until the minimum and optimum crew sizes required to emplace the test item are established.

d. Utilizing the optimum crew size as determined above, recover the test items from an emplaced battlefield situation.

e. Observe activities and record times required to:

1) Disassemble the test item in an approximate reverse order to assembly.
2) Secure the component parts/subassemblies in the configurations prescribed for transit.
3) Load the test item assemblies and other equipment on the selected vehicles and accomplish movement to the next test site or test termination point.

f. Repeat Steps (d) and (e) above, at least three times, rotating the crew assignments for each trial.

g. In addition to data required by applicable portions of MTP 6-3-505, record the following for each emplacement/displacement trial:

1) Items handled
2) Vehicles used
3) Description of terrain traversed
4) Weather conditions

6.2.11 Personnel Training Requirements

a. Throughout the conduct of all testing as outlined in this MTP, monitor and evaluate all test item crew members and organizational maintenance personnel in accordance with MTP 6-3-502.

b. In addition to the data required by MTP 6-3-502, record narrative comments concerning the following training factors:

1) Scope and effectiveness of pre-test training.
2) Needs for additional training in the same or different fields.

6.2.12 Adequacy of Instruction Manuals

a. Throughout the entire testing period, review all operation and maintenance manuals furnished with the equipment for compliance with applicable Army Regulations, and utilize the manuals for classroom instruction and as references throughout the tests.

b. Record narrative comments concerning adequacy of the manuals with respect to:

1) Accuracy
2) Completeness
3) Clarity
4) Ease of use
5) Effectiveness of prescribed methods

6.3 TEST DATA

6.3.1 Preparation for Test

Data to be recorded prior to testing shall include but not be limited to:

a. Nomenclature, serial number(s), manufacturer's name, and function of the item(s) under test.

b. Nomenclature, serial number, accuracy tolerances, calibration requirements, and last date calibrated of the test equipment selected for the tests.

c. Damages to the test item incurred during transit and/or manufacturing.

d. Record the following for all service personnel:

1) Rank
2) MOS
3) Training Time
4) Experience in months

6.3.2 Test Conduct

a. Data originating in all tests and phases shall be recorded in the following forms, as appropriate.

1) Operators', observers', and test officers' logs
2) Narrative comment and observations
3) Maintenance records
4) Photographs; still and/or cine
5) Diagrams
6) Tape recordings

b. All data items shall be properly identified annotated with respect to:

1) Test, subtest, test phase
2) Source
3) Time
4) Pertinent correlative information

c. Security classification shall be determined for each data item and appropriate security measures applied.

d. Data to be recorded in addition to special instructions given in succeeding paragraphs for each subtest shall include:

1) Test item sample size (number of measurement repetitions)
2) Instrument or measurement system mean error stated accuracy

6.3.2.1 Operational Characteristics

Record the following:

a. "Successful" or "unsuccessful" completion of check-out routine for the following conditions:

1) Normal check-out.
2) Normal check-out with momentary power switch-off. Note whether check-out routine has been retained in permanent storage channel.
3) Check-out under "marginal" conditions.

b. Description and number of errors (parity, overflow) and malfunctions which occur during test runs.

c. Time for successful normal check-out (min/sec).

d. Solution obtained for sample field artillery problem.

e. Execution time (min/sec) for problem solution.

f. Description and number of errors (parity, overflow) and malfunctions which occur during performance of computational tasks.

g. Critique statement by the test officer for each problem execution.

h. Statement of operator opinion, as to ease of operation and suitability of the computer to accomplish its intended function.

i. Announced data to the operator/computer during each simulated mission.

j. Output data (solutions) provided by the operator/computer during each simulated mission.

k. Execution time (min/sec) for each operator/computer simulated mission.

l. Critique statement by the test officer that each simulated mission was completed in either a satisfactory, unsatisfactory, or excellent manner, or was not completed.

m. Concise analysis by the test officer following each simulated mission, including a statement of the good points and the undesirable features (for example, violations of procedure). The analysis should follow generally the sequence of the simulated mission but it should not be a round-by-round discussion.

6.3.2.2 Qualitative Electromagnetic Interference Test

Record the following:

a. Data as required by applicable portions of MTP 6-3-513.

6.3.2.3 Physical Characteristics

Record the following:

a. Data as required by applicable portions of MTP 6-3-500
b. Narrative comments concerning the following:

1) Equipment arrangement and mounting.
2) Ventilation, heating and air conditioning.
3) Lighting and blackout provisions.
4) Acoustical properties.
5) Roadability and safety.
6) Protective features (CBR).
7) Any other factors which might affect overall adequacy, suitability and physical characteristics of the test item.

c. Space required for:

1) Equipment
2) Power sources
3) Operator and maintenance activities

6.3.2.4 Durability

Record the following:

a. Data as required by applicable portions of MTP 6-3-506.

b. Incidence of defects in the test item and its components at specified intervals.

6.3.2.5 Transportability

Record the following:

a. Data as required by applicable portions of MTP 6-3-510.

b. Times for accomplishment of transit and transit speed in miles per hour, annotated to define type of terrain and mode of transport.

c. Data as required by applicable portions of MTP's 7-3-512, and 7-3-515.

d. Narrative comments pertaining to loading and tieing down of test item inside the aircraft, rigging the test item for external transportation by aircraft, and unloading the test item from aircraft.

e. Narrative comments pertaining to airdrop of the test item.

6.3.2.6 Adverse Conditions/Effects of Weather

Record the following:

a. Data as required by applicable portions of MTP 6-3-509, annotated to show adverse conditions as applicable.

6.3.2.7 Maintenance

Record the following:

a. Data as required by applicable portions of MTP 6-3-524.

b. Performance of scheduled and unscheduled maintenance.

c. Requirements, shortcomings, and needs for specialized tools and instruments.

d. Repair parts used, man hours and elapsed time required, and level of skill demanded.

e. Number of times test item is assembled and installed from the field transport configuration.

f. Number of times test item is disassembled and repeated in the field transport configuration.

g. Hours of operation, daily and cumulative.

h. Equipment failures and malfunctions, including chronological data required to determine failure-free operating time, mean time between failures, maintenance downtime and meantime for repair.

i. Effects of failures on the operational test conduct.

6.3.2.8 Safety

Record the following:

a. Data as required by applicable portions of MTP 6-3-524.

b. Narrative comments concerning the following:

1) Confirmation of safety release
2) Analysis of foreseeable hazards
3) Adequacy of protective provisions
4) Evaluation of present safety hazards

6.3.2.9 Human Factors

Record the following:

a. Data as required by applicable portions of MTP 6-3-525.
b. Test phases on motion picture film.
c. Times of accomplishment of phases in hours and minutes.
d. Narrative comments pertaining to capability of average trained crews to complete missions under all assigned conditions.

6.3.2.10 Emplacement and Displacement

Record the following:

a. Data as required by applicable portions of MTP 6-3-505.
b. Emplacement and displacement phases on motion picture film.
c. Times of accomplishment of emplacement and recovery in hours and minutes.
d. Items handled.
e. Vehicles used.
f. Description of terrain traversed.
g. Weather conditions.

6.3.2.11 Personnel Training

Record the following:

a. Data as required by applicable portions of MTP 6-3-502
b. Narrative comments concerning:

1) Scope and effectiveness of pre-test training.
2) Needs for additional training.

6.3.2.12 Adequacy of Instruction Manuals

Record the following:

a. Narrative comments concerning the accuracy, completeness, clarity, ease of use, and the effectiveness of the prescribed methods of the manuals.

6.4 DATA REDUCTION AND PRESENTATION

Processing of raw test data shall, in general, consist of organizing, marking for identification and correlation, and grouping the test data according to subtest title. Test criteria or test item specifications shall be noted on the test data presentation to facilitate analysis and comparison. Where necessary, test data measurement units shall be converted to be compatible with units given by test criteria or specifications.

Pertinent data shall be extracted from daily activities logs and notes and collated for presentation in chart, graphic, and narrative form, as appropriate.

The data reduction process shall be accomplished by manual and/or automatic processes, employed as appropriate to the nature and form of the raw data. Insofar as possible, Automatic Data Processing (ADP) methods and facilities should be used to facilitate extraction of data pertinent to various test parameters in differenct combinations. However, ADP methods may not be feasible or economical for small scale tests.

Common service test factors shall be treated individually in a separate section or in supplements or annexes if they are of sufficient scope, importance, and/or complexity. Each subject supplement shall include the applicable supporting data.

Equipment evaluation usually will be limited to comparing the actual test results to the equipment specifications and the requirements as imposed by the intended usage. The results may also be compared to data gathered from previous tests of similar equipment performed under similar conditions.

A written report shall accompany all test data and shall consist of conclusions and recommendations drawn from test results. The test engineer's opinion, concerning the success or failures of any of the functions evaluated shall also be included. In addition, equipment specifications that will serve as the model for a comparison of the actual test results should be included.

If the equipment is found to be unacceptable, reasons for its unacceptability shall be forwarded along with remedial suggestions for its improvement.

Table A-1 Duties of Battalion Fire Direction Center Personnel (During Firing)

Sequence	S3	Chief of fire direction	Computer operator	Vertical control operator	Computer/ recorder	Radiotelephone operator	Switchboard operator
1	Supervises activities of section personnel.	Supervises activities of section personnel.			Records fire mission data on computer's record.	Receives and records fire mission.	Operates switchboard.
2			Enters target data.	Plots target on grid sheet or map.			As required.
3	Issues fire order						
4			Enters target altitude announced by the VCO.	Determines and announces target altitude and orienting data for batteries to fire	Sends orienting data and preliminary commands to batteries.	Sends message to observer.	
5			Enters required mission overrides.				
6			Computes and announces firing data. Checks VCO orienting data.	Computes site and prepares for manual backup, as directed.	Sends remaining fire commands to batteries.		

(Continued on page A-2)

Table A-1 (Continued)

Sequence	S3	Chief of fire direction	Computer operator	Vertical control operator	Computer/ recorder	Radiotelephone operator	Switchboard operator
7					Receives SHOT from the batteries.	Transmits SHOT to the observer	
8			Enters OT direction, if required. Enters observer corrections and announces firing data.		Sends subsequent commands to the batteries.		
9	Orders replot of target, as required.		Assists VCO in target replot	Assists computer operator in target replot.	Records data for replot on computer's record.		
10			Stores target, as required.	Updates firing chart, as required.			

NOTES: 1. When two artillery units employ the M18 and check data prior to firing, the Fire Direction officer controlling the mission may announce the altitude selected for the target prior to the target number in the Fire Order.

2. The S3/FDO of the unit or headquarters controlling the mission, when using the M18, carefully analyzes all aspects of the mission before making a decision to accept or override the selection by the computer of the charge to be fired. Further, if a decision is made to override the selection by the computer of the charge to be fired, the charge selected should be announced in the Fire Order and passed to all other units employing the M18 for the Mission.

Table A-2 Duties of Battery Fire Direction Center Personnel

Sequence	Fire direction officer	Computer operator	Vertical control operator	Computer/ recorder	Radiotelephone operator
1	Supervises activities of section personnel.			Records fire mission data on computer's record.	Receives and records fire mission.
2		Enters target data.	Plots target on grid sheet or map		
3	Issues fire order.				
4		Enters target altitude announced by VCO	Determines and announces altitude and orienting data	Sends orienting data and preliminary command to the battery.	Sends message to observer.
5		Enters required mission overrides.	Computes site and prepares for manual backup, as directed.		
6		Computes and announces firing data. Checks VCO orienting data.		Sends remaining fire commands to the battery.	
7				Receives SHOT from the battery	Transmits SHOT to the observer.
8		Enters OT Direction, if required. Enters observer corrections and announces firing data.		Sends subsequent commands to the battery.	
9	Orders replot of target as required.	Assists VCO in target replot.	Assists computer operator in target replot.	Records data for replot on computer's record.	
10		Stores target as required.	Updates firing chart, as required.		

Table A-3 Data for Replot Procedures

Sequence	S3	Chief of fire direction	Computer operator	Vertical control operator	Computer/ recorder
1	Supervises activities of section personnel.	Checks and supervises preparation of replot data.			
2			Causes FADAC to display initial replot location		
3			Announces target coordinates to VCO.		
4				Plots target on map and announces altitude to computer operator.	
5			Enters target altitude announced by VCO.		
6			The computer operator and the VCO perform the duties in sequences 2, 3, 4, and 5 until the target altitude displayed by the FADAC and the target altitude determined by the VCO agree within 1 meter. The last altitude announced is entered into FADAC.		
7	Directs the computer operator to store the target, if desired.				Records data for replot on computer's record.
8			Stores target in FADAC, as directed by S3.	Plots target on the firing chart, as directed by the S3.	

Table A-4 Duties of Fire Direction Center Personnel in Precision or Time Registration

Sequence	S3	Chief of fire direction	Computer operator	Vertical control operator	Computer/ recorder	Radiotelephone operator
1	Supervises activities of section personnel.	Checks and supervises preparation of registration data.				
2	Directs that registration be fired. Selects registration point and observer. Issues fire order				Enters data on computer's record. Sends preliminary fire commands to the battery.	Sends appropriate part of the fire order to the observer.
3			Enters registration coordinates and altitude.	Plots registration point on grid sheet.		
4			Computes and announces firing data.	Computes site and prepares manual backup.	Transmits remaining commands to battery.	
5			Enters OT direction		Receives SHOT from the battery.	Transmits SHOT to the observer.
6			Enters observer corrections		Records observer corrections	Receives corrections from the observer.
7			Perform duties in steps 4 through 6 until completion of impact registration.			

(Continued on page A-6)

Table A-4 (Continued)

Sequence	S3	Chief of fire direction	Computer operator	Vertical control operator	Computer/ recorder	Radiotelephone operator
8	Directs that time registration be fired.		Adds an UP 20 for time registration		Applies fuze correction to time of flight	Alerts observer for time registration.
9			Recalls registration point.		Manually computes adjusted time.	
10			Enters adjusted data. Applies a DOWN 20 and causes the FADAC to compute the registration corrections.			
11	Announces the batteries and charges for which to store registration corrections.		Stores corrections for batteries and charges in the FADAC as directed.			
12		Computes firing data to targets and checkpoints throughout zone of responsibility.	Assists computer/recorder in computing GFT settings.	Computes GFT settings based on firing data determined by FADAC.		

Table A-5 Duties of Fire Direction Center Personnel In High-Burst or Mean-Point-of-Impact Registration

Sequence	S3	Chief of fire direction	Computer operator	Vertical control operator	Computer/ recorder	Radiotelephone operator
1	Supervises activities of section personnel.	Checks and supervises preparation of registration data				
2	Directs that registration be fired. Selects registration point. Issues fire order.					
3			Enters 01, 02, and registration point. Causes FADAC to compute orienting data for 01 and 02.	Plots 01, 02, and registration point.	Alerts battery to fire.	Alerts observers at 01 and 02.
4			Announces 01 and 02 orienting data.	Manually checks 01 and 02 orienting data.	Transmits preliminary fire commands to battery.	Transmits orienting data to 01 and 02.
5			Causes FADAC to compute firing data. Announces firing data.		Transmits remaining fire command to the battery.	
6	Coordinates firing with observers.				Receives SHOT from the battery.	Transmits SHOT to 01 and 02.

(Continued on page A-8)

Table A-5 (Continued)

Sequence	S3	Chief of fire direction	Computer operator	Vertical control operator	Computer/ recorder	Radiotelephone operator
7			Recalls 01 and 02 locations in FADAC.		Records 01 and 02 data and computes mean directions and vertical angle.	Receives and announces data from 01 and 02.
8			Enters mean directions and vertical angle. Causes FADAC to compute HB or MPI location. Announces location.	Plots mean directions to HB or MPI. Checks location of MPI or HB with FADAC location.		
9			Enters the adjusted data and causes FADAC to compute registration corrections.			
10	Announces batteries and charges for which to store registration corrections.	Stores corrections for batteries and charges as directed				
11			Computes firing data to targets and checkpoints throughout zone of responsibility.	Assists computer/recorder in computing GFT settings.	Computes GFT as settings based on firing data determined by FADAC.	

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13. ABSTRACT

This Army Service Test Procedure describes test methods and techniques for evaluating the operational performance and characteristics of Digital Computers as related to the criteria expressed in Qualitative Materiel Requirements (QMR), Small Development Requirements (SDR), or other appropriate design requirements and specifications. The objective of such evaluation is to determine the suitability of the tested item for service use by the U. S. Army.

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