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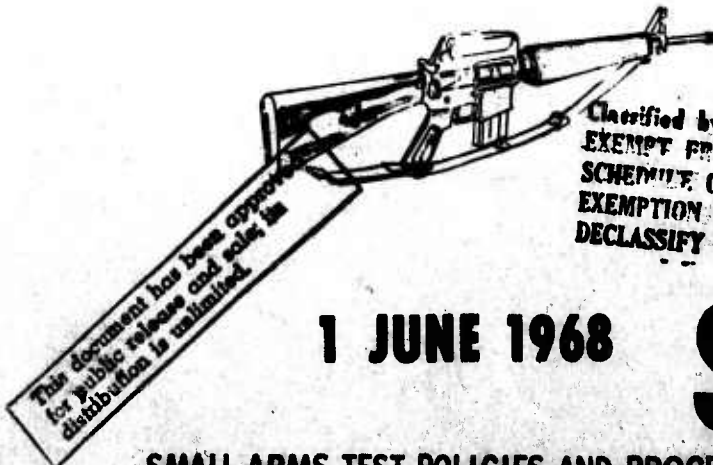
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APPENDIX 1

REPORT OF THE M16 RIFLE REVIEW PANEL



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SMALL ARMS TEST POLICIES AND PROCEDURES A

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DEPARTMENT OF THE ARMY
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WASHINGTON, DC 20310

REPLY TO
ATTENTION OF

DAMA-WSW

1 FEB 1968

MEMORANDUM FOR THE RECORD

SUBJECT: Declassification Action - Report of the M16 Rifle Review Panel (C)
dated 1 June 1968. [REDACTED]

1. The Report on the M16 Rifle Review Panel dated 1 June 1968 was prepared for the Office of the Chief of Staff of the Army, by the Office of the Director of Weapons System Analysis. The Ground Combat Systems Division, Office of the Director of Weapons Systems, Office of the Deputy Chief of Staff for Research, Development and Acquisition, is the successor to the originator of the report.
2. This office has completed a review of subject report and appendices 1 through 11 and has determined classification of Confidential is no longer needed. The report is now Unclassified. Selected extracts of the report are at Enclosure 1.
3. Notification of this declassification will be forwarded to all distribution addressees and a declassified copy will be forwarded to the Defense Technical Information Center, Cameron Station, for file.

1 Encl
as


WILLIAM G. COOMER
Colonel, GS
Chief, Ground Combat Systems
Division

file

[REDACTED]

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Appendix 1

SMALL ARMS TEST POLICIES AND PROCEDURES

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Appendix 1

Small Arms Test Policies and Procedures
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Appendix 1

SMALL ARMS TEST POLICIES AND PROCEDURES

A. Introduction

The purpose of this appendix is to describe changes that have been made in the testing program since 1962 and the policies and procedures as of May 1968; to outline the framework of the policies and procedures within which the M16 rifle was tested and to point out what further changes are needed.

The discussion includes an examination of the requirements of the Army Test Program; responsibilities for testing; standards of testing; control and coordination of test programs; and distribution of test reports; test procedures, as they pertain to small arms. It does not include matters pertaining to propellants (see Appendix 4), nor does it cover budgeting.

This appendix provides the framework for the analysis of M16 rifle tests and test procedures contained in Appendix 2.

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B. Test Policies and Procedures

As Applied to the M16 Rifle, 1962-1966

Although the M16 rifle was first tested by the U.S. Army Infantry Board (USAIB) and the Development and Proof Services (D&PS) in 1958, 1962-66 was the period during which key rifle decisions were made.^{1/} It was also a period when considerable change in the administration and organization of testing took place. Both logistic and combat development activities were being reorganized and more centralized. Test names and test objectives were changed, and although the most significant of these changes have been pointed out in this discussion, it will be well to remember that while the name of a test may have been retained, the test methods have sometimes changed so that tests of the same name conducted on different dates may not be comparable.

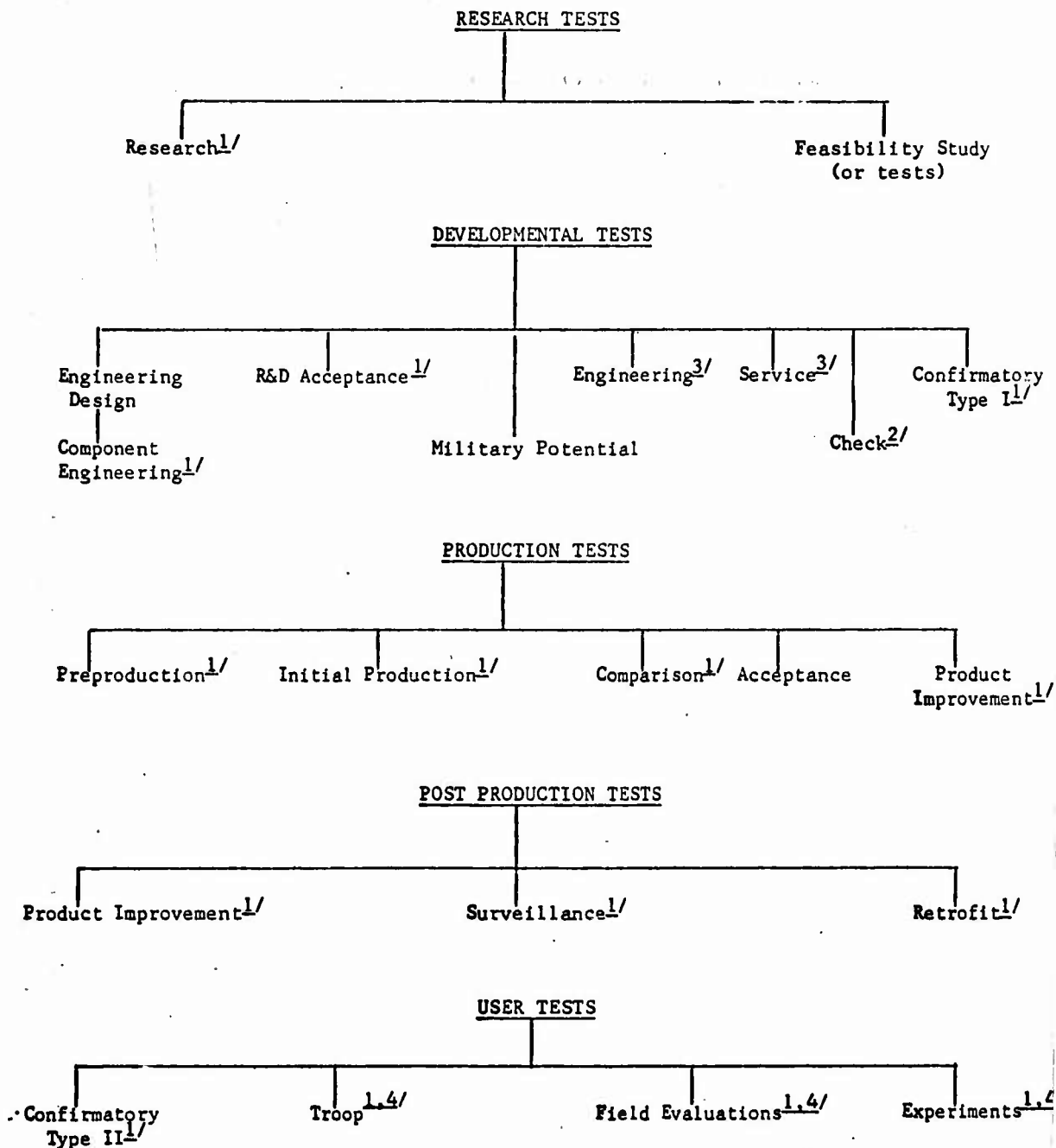
Requirements For Testing

The five sets of tests in the Army Test Program (1963) are shown in Figure 1-1. Note that certain tests may or may not have been required. These tests may not have been required if the objectives of the tests were satisfied by other tests as they were accomplished.

¹ During the period 1958-62, the Chief of Ordnance had the responsibility for Development and Proof Services and the Commanding General, USCONARC, had the responsibility for the boards.

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FIGURE 1-1 - FIVE SETS OF TESTS (1963)



1 May or may not be required.

2 Required if a retest is needed because of deficiencies found in service test.

3 May be integrated.

4 Not materiel tests, although they normally furnish materiel data.

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The objectives of the Army Test Program during the period of the M16 rifle testing and procurement actions (about 1958 to 1968) were to insure that new materiel met the approved Qualitative Materiel Requirement (QMR), Small Development Requirement (SDR) or other requirement documents; and to determine what changes were required to make new materiel suitable and safe for Army use.^{2/}

In addition to these two broad objectives, there were particular Army regulations on safety, reliability, maintainability, maintenance support planning, airdropping and air portability. These regulations provided general guidance for materiel but did not provide specifications for actual test objectives.^{3/}

Test requirements published by Headquarters, Department of the Army (DA) were oriented almost exclusively toward Army-developed materiel.

Satisfactory regulatory guidance was generally provided research and development tests except at Headquarters, DA level. However, little policy or guidance was provided for production tests, postproduction tests, or tests of unmodified commercial items.^{4/} The policy was that service testing of unmodified

2

AR 70-10, 18 Dec 62.

3

AR 705-25, 8 Jan 63; AR 705-26, 16 Apr 63; AR 705-35, 20 Oct 67; and AR 750-6, 21 Aug 64.

4

Change 1 to AR 700-35, 25 Aug 67.

1-4

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commercial items could be abbreviated in nature but there was no further discussion of this type of test.^{5/} Policy and guidance were therefore insufficient for the smooth introduction of commercially developed items into the Army.

Responsibilities for Testing

No one DA staff agency was responsible for all policies pertaining to testing. Coordination at Headquarters, DA, was accomplished by conferences and reviews; each staff agency prepared test policies within its own initiative.

The Chief of Research and Development (CRD) had primary DA Staff responsibility for research and developmental testing.^{6/} The M16 rifle was a procurement of equipment and missiles-Army (PEMA) and not a developmental item, therefore the Deputy Chief of Staff for Logistics (DCSLOG), not CRD, had primary staff responsibility for M16 tests.

The DCSLOG had primary DA staff responsibility for production and postproduction testing.

Deputy Chief of Staff for Military Operations (DCSOPS) had primary DA staff responsibility for troop tests and the programming of Type II confirmatory tests.^{7/} In 1962, when the Office of the

⁵ AR 70-10, 18 Dec 62.

⁶ Ibid.

⁷ Ibid.

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Assistant Chief of Staff for Force Development (ACSFOR) was created, its responsibilities included those formerly assigned to DCSOPS, but were somewhat broader in scope. ACSFOR also was assigned primary DA staff responsibility for determining the overall military worth of Army materiel.

The Commanding General, USAMC, was responsible for detailed planning, coordination, and supervision of research, development, production, and postproduction tests.^{8/}

Commodity commanders and project managers were responsible for planning and performing research, developmental (except engineering, service, and check tests, which were the responsibility of USATECOM), production, and postproduction (except initial production) testing.^{9/} They were also responsible for initiating action to correct deficiencies discovered during testing, for evaluating and distributing results of the tests listed above, and for preparing the coordinated test plan (CTP).^{10/} The Project Manager, Rifles, ^{11/} was specifically responsible^{12/} for all phases of research, development, procurement,

⁸ USAMR 70-7, 30 Jan 64. USCONARC had responsibility for planning execution, evaluation, and reporting of confirmatory tests. The USAMC also nominated items of materiel for confirmatory tests.

⁹ AMCR 70-7, 30 Jan 64.

¹⁰ A CTP for the M16 was not prepared until the Small Arms Weapons Systems (SAWS) test in 1965.

¹¹ Formerly Project Manager, AR15.

¹² USAMC, AR15 Project Manager Charter, 6 Mar 63

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production, distribution, and logistical support for the rifle and accessories; management of the PEMA program for the M16 rifle, accessories, components, and ammunition peculiar to the rifle system until it was type classified standard A.^{13/}

The U.S. Army Test and Evaluation Command was responsible for independent evaluation of engineering, service, check, and Type I confirmatory tests, and for establishing test objectives, preparing and approving test plans, and conducting these tests.^{14/} USATECOM also includes in the test plans provisions for testing in environmental chambers (located at Aberdeen Proving Ground) or at remote (tropic, desert, or Arctic) field sites.^{15/} The M16 was tested in the Arctic and in environmental chambers but it was never tested at the tropic or desert test center.

USATECOM was further responsible for conducting other tests for commodity commanders and project managers upon request, and for assisting troop commanders in the preparation of confirmatory test plans and the collection of materiel test data from troop tests and field evaluations.

13 USAMC Project Manager Charter, 15 Oct 64.

14 AMCR 70-7, 30 Jun 64.

15 AR 705-15, 4 Oct 62.

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USATECOM was also authorized to perform tests of materiel or equipment for defense contractors or private industry, when such tests were clearly in the interest of national defense and when they were approved by the commanding general of a USAMC major subordinate command and under regulations to be issued by the Director of Research and Development, USAMC.^{16/}

U.S. Army Combat Developments Command (USACDC) was responsible for submitting to DA recommendations for troop tests and field evaluations, including specification of the quantity of new materiel required, the test plan, the test site and the test costs (after coordination with USCONARC).^{17/}

The U.S. Continental Army Command (USCONARC) was responsible for identifying and providing troop units to conduct confirmatory tests, troop tests, and field evaluations.

Standards of Testing

Standards of testing included prescribing the severity and duration of tests, sample size, statistical and scientific methodology, and instrumentation. The DA requirements, which were general in nature, were specific only to the extent of stating that:^{18/}

1. The best available scientific methodology be embodied in the test planning, programming, execution, evaluation,

¹⁶ Change 1 to USAMCR 70-7, 30 Jan 64.

¹⁷ AR 70-10, 18 Dec 62; USACDCR 71-7, 21 Jun 66; and USACDCR 71-8, 15 Jun 66.

¹⁸ AR 70-10, 18 Dec 62.

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and reporting.

2. Progressive modernization programs for test procedures be maintained.

3. Test methodology produce factual data to prevent personal bias from influencing the results.

4. Confirmatory and troop testing be conducted under conditions simulating tactical operations by a platoon or larger unit.

USAMC requirements concerning standards were also general in nature. In fact, USAMC has found that test standards during 1962-66 were deficient in several respects:

1. Technical guidance for the development and execution of a cohesive life cycle test program was not provided.

2. Explicit test planning and design doctrine requisite to optimum test effectiveness was not established.

3. The minimum sample size to demonstrate item performance with the exception of munitions was inadequate.

4. Sample ranges and risk were not fully recognized.

5. The tendency to establish test item requirements by rote was evident.

6. Production materiel was not subjected to tests comparable in intensity to engineering-service tests.

7. Tests were not always applied to successive generations of equipment (R&D prototypes, soft and hard tooled production models) as necessary to insure that test results would predict the performance which could be expected from subsequent generations of models.^{19/}

Controls and Coordination

This section considers specific test controls, such as who approves

¹⁹ MFR, USAMC, 21 Dec 66, Subj: Briefing to Commanding General AMC, re: Standards of Testing for AMC Materiel, Ltr, Hq, USAMC, 16 Feb 65; Ltr, USAMC, AMCRD-DM P, 10 Jan 66.

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test requirements, test plans, test reports, and type classifications, and the mandatory coordination associated therewith. There are, of course, many other general controls over testing activities, such as the assignment of responsibilities, the setting of standards, and the approval of budgets.

DA principal control was that it had final approval authority for type classification of all materiel, including approval of the engineering and service tests, because the reports of these tests had to accompany the type classification recommendation.^{20,21/} Another control was that DA had a representative on in-process reviews (IPR).

USATECOM had approving authority over plans for engineering and service tests (ET/ST).^{22/} USATECOM was also required to coordinate CTP actions directly with USACDC. For the M16, DA approved the SAWS plan and test, which in effect fulfilled the objective of the ET/ST.

USACDC was responsible for and controlled troop tests, field evaluations, and experiments. For example, USACDC conducted a field experiment with the M16 as part of the Small Arms Weapons Systems study at the U.S. Combat Developments Command Experimentation Command, Fort Ord, California.

Distribution and Use of Test Reports

DA had the following specific requirements for test reports:^{23/}

²⁰ AR 70-10, 18 Dec 62.

²¹ DA approved classification of the M16 as Standard A on 23 February 1967.

²² AMCR 70-7, 30 Jan 64.

²³ AR 70-10, 18 Dec 62.

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Engineering and service test reports were forwarded to DA along with recommendations for Standard A type classification. DA also required that these ET/ST reports go to USACDC for review. These reports were evaluated at IPR's to determine whether sufficient action had been taken or what action was still necessary to correct deficiencies found during tests.

For production and postproduction tests there was no DA requirement for distribution of test reports. For the M16, some but not all of the results of these tests were distributed to DA and USACDC.

For confirmatory tests, if conducted, DA required that reports be forwarded to ACSFOR. There were no confirmatory tests recommended, conducted or needed for the M16.

For troop tests and field evaluations, reports were sent to DCSOPS (later ACSFOR) for approval.

USATECOM established the distribution of materiel test reports for which it had responsibility, although there were many mandatory requirements for distribution, such as those established by DA. For tests which USATECOM performed for others, the agency requesting the test established the distribution of the report.

Test Procedures

Prior to 1962, the procedures used for service testing duplicated

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in part those used in engineering testing. For example, service tests duplicated the engineering test procedure of firing weapons from bench rests. Procedures and methodology, for specifying such things as the size of the sample and the physical test conditions (amount of mud or dust), were normally designed by individual agencies and their application tended to be quite stereotyped. These and other shortcomings were recognized by USATECOM in 1964,^{24/} and by the Study of Army Test and Evaluation (SATE) study in 1966. There have been gradual improvements in test procedures. The testing of the M16 is discussed in Appendix 2.

²⁴ USATECOM Policy Statements No. 21 and 22, 17 Apr 64.

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C. . Current Policies and Procedures

Any discussion of the policies and procedures now specified by regulations or other directives must take into account some changes that have been approved but not yet published in regulations.

Since 1965 several studies have been made, ranging from Army logistics systems in general to test practices in particular. Among the more relevant were: The Study of Army Test and Evaluation conducted by the Chief of Staff, Army, in May of 1966, and known as the SATE study; the Report of the Department of the Army Board of Inquiry on the Army Logistics System, better known as the Brown Board report 1 March 1967; the Report of the Committee of Four, February 1967;^{25/} the Standards of Testing for USAMC Materiel, December 1966;^{26/} and the USAMC study of July 1967, Improvement in Testing Methodology and Instrumentation.^{27/}

Requirements for Testing

The program is still oriented almost exclusively toward materiel development by the Army with little provision for commercially developed materiel. The comparatively minor changes that have been made in the names of the five sets of tests are indicated in Figure 1-2; the tests and their sequence in relation to the total life cycle and

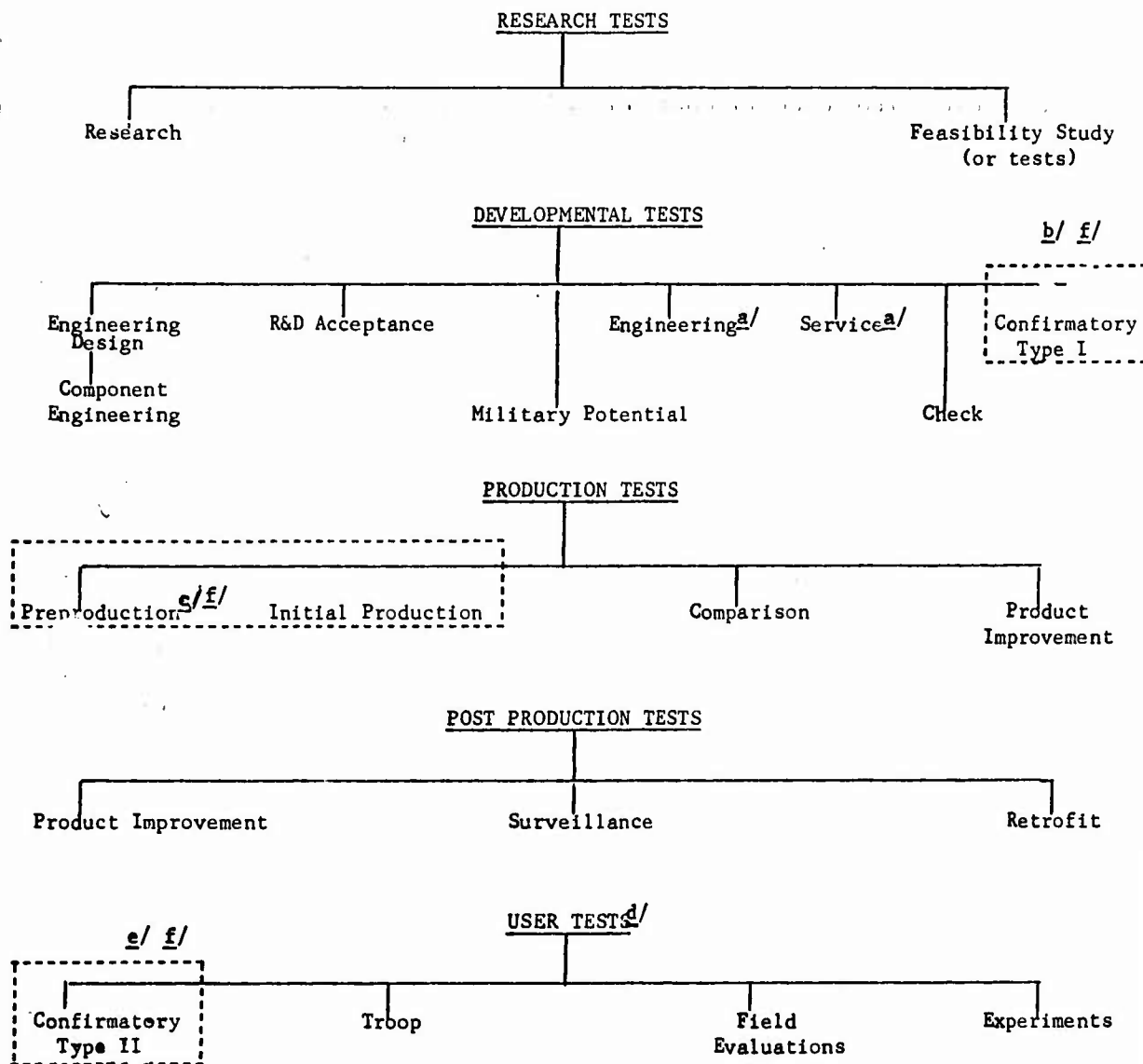
²⁵ CSM 67-51, 9 Feb 67.

²⁶ MFR, USAMC Quality Assurance Briefing for CG, USAMC, 21 Dec 66, Standards of Testing for USAMC Materiel.

²⁷ Contract DA EA 18-68-C-004, effective 31 Jul 67.

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FIGURE 1-2 - FIVE SETS OF TESTS (Current 1968)



a. ET/ST may be integrated.

b. The name Confirmatory Type I is being deleted and the purpose of this test is being integrated into preproduction and initial production tests (Draft AR 70-10, 28 Feb 68).

c. CRD is being made responsible for supervision and approval and DCSLOG is being made responsible for programming and budgeting of these tests (Draft AR 70-10, 28 Feb 68).

d. ACSFOR is responsible for User Tests to include confirmatory tests (AR 71-3, Feb 68).

e. The name Confirmatory Type II has been changed to Confirmatory Test.

f. Dotted lines indicate changes.

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the purpose and scope of each test are in inclosure 1-1.

The objectives of the Army Test Program are:

To insure that an item meets the approved operational, technical and safety requirements in the environments in which it will be used, as specified in the approved requirements document^{28/} and to determine changes required to make the new materiel suitable for Army use (e.g. to insure maintainability).^{29/}

The following additional objectives are being added to the above, as a result of the SATE and Brown Board studies:^{30/}

To determine the degree to which new materiel for Army use meets each characteristic of an approved Qualitative Materiel Requirement (QMR) or Small Development Requirement (SDR) or other requirements document.

To determine if any changes are required to make new or existing materiel safer or more suitable for Army use prior to item production.

To validate provisions for human factors, skill, and knowledge requirements used to support training plans and qualitative and quantitative personnel plans.

To determine characteristics of actual equipment which provides a basis for preparing individual and unit training objectives, methods and plans; for developing training aids and devices; for formulating maintenance concepts; and for preparing documentation.

To provide input to the determination of the overall military worth of developmental materiel.

To establish a baseline for future requirements when

- 28 Qualitative materiel requirement, small development requirement, or other statement of requirement such as a separate letter.
- 29 AR 70-10, 18 Dec 62.
- 30 Draft AR 70-10, 28 Feb 68.

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considered in light of technological, operational, and logistical advances and requirements.

Requirements for Testing. Other than the broad guidelines and general objectives of the test program specified above, DA testing prior to the Brown Board and SATE study include one major specific requirement: a Coordinated Test Plan (CTP) must be written by the developing agency, and approved by DA (OCD), for the engineering and service tests (ET/ST) when a Research and Development Test and Evaluation (RDTE) development project is initiated.^{31/} The Brown Board and the SATE study made several recommendations that would increase the scope and detail of DA testing policy; for example, they suggested that the scope of the CTP be expanded to include not just ET/ST, but all development tests. These changes are being drafted.^{32/} However, DA (DCSLOG) has not proposed any further regulations for production and postproduction testing, (including product improvement tests).

Several USAMC testing policies have been amplified and tightened, even in the frequent absence of DA guidance. USAMC has prescribed testing during each phase of the life cycle of materiel and recently has added substantial requirements for the

31 AR 70-10, 18 Dec 62.

32 Draft, AR 70-10, 28 Feb 68.

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testing of product improvements. Significant new policies are:

That testing include all critical components and major assemblages of end items which are being considered for significant modification, regardless of whether or not a model redesignation is involved.

That testing include all equipment modifications which changed performance characteristics, effectiveness, operational capabilities of the item to any substantial degree, or when the modification, engineering change order or product improvement has a significant impact on fund resources to be expended or saved.^{33/}

Responsibilities for Testing

Within the DA, primary staff responsibility is assigned to ACSFOR for the overall life cycle management of materiel, type classification actions and user tests;^{34/} DCSLOG for postproduction tests, production tests, and logistical support aspects of all materiel tests; and CRD for research and developmental tests. DCSLOG and CRD have overlapping responsibilities for preproduction and initial production tests.^{35/}

USAMC is responsible for the detailed planning, coordination, and conduct of all materiel tests previously described.^{36/} USAMC is

³³ Ltr, USAMC, 15 Jul 67.

³⁴ CSM 66-418, 20 Sep 66.

³⁵ AR 70-10, 18 Dec 62.

³⁶ Page 6.

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responsible for insuring that "adequate provision" be made for test and evaluation of all product improvements.

Overall responsibility for a specific project within USAMC remains with the appropriate commodity command or project manager throughout the entire development, production, and deployment cycle of assigned materiel. After USATECOM provides an independent evaluation of prototype materiel through ET/ST, the commodity command or project manager concerned is responsible for making corrections, resubmitting the item for test when necessary; and starting action leading to type classification.

USATECOM is responsible for the establishment of test objectives, preparation of the test plan, conduct and report of the test, and the evaluation and distribution of the report of ET/ST, check, and initial production tests.^{37/} After July 1967 USATECOM was assigned the additional responsibility of conducting an independent evaluation and determining the suitability of product improvements.^{38/} The product improvements on the M16 were made prior to this time.

The USACDC role in testing activities is being increased. A change to regulations is being staffed that will make USACDC the approving authority for the Service Test Plan. Currently, USACDC is responsible for testing and evaluating doctrine and organization in troop tests and field evaluations.^{39/}

³⁷ USAMCR 70-7, 30 Jan 64.

³⁸ Ltr, USAMC, Release of Equipment, 15 Jul 67.

³⁹ AR 71-3, 5 Feb 68.

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USCONARC continues to be responsible for providing units to conduct troop tests, field evaluations, and confirmatory tests. Regulations are being drafted that will make USCONARC a voting member of IPR and system status evaluation (SSE).

Standards of Testing

In recent years there have been numerous studies undertaken and drafts written of new policies and procedures regarding test standards. Principally the SATE study, in 1966, pointed out many serious deficiencies, especially the need for more scientific methodology and instrumentation.

Improved policy has been published by DA on maintainability and reliability standards.^{40/} Several studies are underway in USAMC to develop improved test methodology and instrumentation. The program has been executed slowly due mainly to the overriding priorities of current Vietnam actions.

Specific progress is being made in some areas; for example, nearly a hundred of the new Materiel Test Procedures (MTP's) have been written and distributed; an instrumented small arms range is under development at Fort Benning; USATECOM has established an orientation course on materiel testing, for both scientific and technical personnel;^{41/} USAMC directed in February 1966 that the

⁴⁰ AR 705-50, 15 Sep 67.

⁴¹ USATECOM Ltr, 27 Mar 67, Subj: USATECOM Orientation Course on Materiel Testing (TECOM College).

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number of items to be tested should be "sufficient to provide statistically the greatest level of confidence in predicting the future performance";^{42/} USAMC is also preparing new regulations, as a result of work done by an ad hoc committee which studied standards of testing in 1966.^{43/} For highlights of this study see Inclosure 1-2.

Control and Coordination

There have been many attempts in recent years to improve the control and coordination of testing. A materiel life cycle model was approved which should provide for more disciplined procedures for control and coordination of all materiel actions. The life cycle model provides for formal in-process reviews at five specific points in the life cycle: concept formulation, contract definition, prototype system, development acceptance (after engineering and service tests), and production validation (after initial production). As of May 1968, however, not all of the many implementing regulations had been published.^{44/}

DA retains approving authority for new materiel by approving type classification actions. DA is represented at in-process reviews, and reviews test results that accompany recommendations for type classification. The Materiel Requirements Review Committee (MRRC) provides DA coordination and review of particularly costly or critical developments. The Chief of Staff Army, or the ACSFOR, as appropriate,

⁴² USAMC Ltr, 25 Feb 66, Adequacy of Test and Evaluation Practices.

⁴³ MFR, USAMC, 21 Dec 66, Standards of Testing for AMC Materiel.

⁴⁴ The principal regulation on testing policy, AR 70-10, has been rewritten extensively and is being staffed.

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makes the decision based on recommendations of the MRRC. The formal IPR is followed by a System Status Evaluation (SSE) conducted by general officers from USAMC, USACDC, and USCONARC to verify the utility of the system.^{45/}

USAMC has set stringent controls on defects found in testing. For example, USATECOM is required to provide commodity commanders and project managers with reports which include failures, deficiencies, shortcomings, and suggested improvements discovered during all tests conducted by USATECOM. Commodity commanders and project managers are required to acknowledge receipt of such reports and to report action taken to CG, USAMC.

USAMC has established certain controls for materiel after type classification. Commodity commands assign a field representative who accompanies initial distribution to the field to report any deficiencies found as the item goes into service.^{46/}

A salient change is that USATECOM is now required to evaluate all product improvement tests and to make a recommendation on the suitability for issue of the equipment tested.

USACDC continues to be responsible for conducting and coordinating troop tests, field evaluations and field experiments. USACDC continues to review and advise on all coordinated test plans.^{47/}

45 Draft 70-10, 28 Feb 68.

46 USAMCR 700-35, 18 Jun 65.

47 USACDCR 71-8, 15 Jun 66 and Draft, AR 70-10, 28 Feb 68.

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Distribution and Use

The current draft DA testing regulation requires USAMC to distribute developmental test reports to DA (OCDR), USACDC and USAMC. Also, the new Logistical Doctrine and Systems Agency will receive reports for all developmental tests through initial production tests for independent review of logistical implications.^{48/}

ACSFOR receives, staffs and approves the reports of system status evaluation actions, which evaluate test reports and IPR recommendations.

DA also requires that reports of user tests be forwarded to USAMC, USACDC and USCONARC for coordination, as applicable, and to DA (ACSFOR) for approval.

The USAMC distribution of test reports has been generally satisfactory.

USATECOM continues to distribute reports for tests falling within its area of responsibility to appropriate commodity commanders or project managers, USACDC, and to designated USACDC agencies. The appropriate commodity commander or project manager determines the distribution for research, engineering design, comparison, and postproduction test reports. USATECOM continues to prepare the final report of each confirmatory test and to send the report to Hq, USAMC, USCONARC, USACDC, and the appropriate commodity commanders and project managers.

⁴⁸ Draft AR 70-10, 28 Feb 68.

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The director of a troop test or field evaluation is required to prepare a report and to distribute copies to: USCONARC, USACDC, the USACDC agency that monitored the test, and USATECOM, if requested. USACDC then determines the USACDC command position on the test report, based on the USACDC agency evaluation, and forwards the report to ACSFOR for approval.^{49/}

Developmental test reports are reviewed at IPR's, SSE's, and MRRC's prior to being forwarded to ACSFOR; the actions are then reviewed by the MRRC, as applicable, and recorded by the Materiel Status Committee (formerly Technical Committee). In USAMC, project managers and commodity commanders are responsible for the evaluation of test results and for all subsequent actions resulting from those tests. They are required by CG, USAMC to take corrective action or state why none is required, on all deficiencies reported in tests conducted by USATECOM when USATECOM acts as an independent tester.

Test Procedures

There have been gradual improvements in test procedures, although problems still exist. Four general types of procedures have been evolving: engineering, service, production-postproduction, and user. Particular test procedures may be applied to tests other than the one suggested by the procedure name; for example, service test procedures are normally used for check tests. Engineering and service test procedures are outlined in this Appendix, Inclosure 1-3. Production

⁴⁹ USACDCR 71-8, 15 Jun 66.

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and postproduction test procedures are discussed in Appendix 5. User test procedures are adapted to answer the objectives of a particular test, and they vary from test to test. Heavy reliance is placed on questionnaires and observations.

In summary, the AR15 (M16A1) project manager position was established in March 1963 and the AR15 (M16A1) weapon was established as a PEMA project upon being type classified for limited production in May 1963. The principal tests on the AR15 (M16A1) from 1963 until the present were product improvement tests. The SAWS tests conducted in 1965 served as the Engineering and Service tests. No Department of the Army policy guidance for product improvement testing existed until 25 August 1967 when change 1 to AR 700-35, Product Improvement of Materiel, was published. At the USAMC level the only guidance on product improvement testing prior to July 1967 was the requirement to test improvements that required a change in model nomenclature. This requirement pertained to only one product improvement on the M16A1^{50/}. USAMC guidance on product improvement testing was not strengthened until July 1967. Therefore, Army policy for testing of the M16A1 was inadequate prior to July 1967.

The fact that deficiencies existed in Army testing policy was recognized by the Army Staff and USAMC as early as 1965. As a result, study efforts were directed to determine the deficiencies

50 The forward bolt assist assembly.

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and to recommend steps to correct the problems. Recommendations of the study efforts, which were approved by the Chief of Staff, Army, and the Commanding General, USAMC, currently are being translated into policy. For example, the new regulation on testing during the developmental and acquisition phases of the life cycle, AR 70-10, was still in the draft preparation stage on 31 May 1968. It will require time before all of the new testing policies are put into action at all levels of the Army that are concerned with testing and before it can be determined if these steps will, in fact, correct the identified deficiencies.

Some policies pertaining to testing during the small arms life cycle are still insufficient. For example, no DA regulatory guidance exists for production and post production testing and DA guidance on product improvement testing is limited to the requirement that provision for such testing be included in plans for product improvements.

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D. SUMMARY AND ANALYSIS

The following is a tabulated extract of the past and present status of the Army test programs. This synopsis includes the various aspects of requirements, responsibilities, standards, controls, distribution and procedures, as they relate to the testing program. Key actions pending and possible shortcomings are noted in the remarks column. Highlights are carried forward to Section E, Conclusions.

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PAST

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REMARKS

1. Army Test Program

Army lacked overall materiel life cycle system and integrated test program. Many problems occurred by default.

Overall life cycle system being developed but not in effect yet.

Several implementing actions (e.g.; organization, personnel, and procedural changes) will be needed to accompany the policy changes.

The Army materiel development system and hence also the test program were oriented almost exclusively to Army-developed systems. This was satisfactory for Army-developed items but insufficient for the smooth introduction of commercially-developed items.

No change.

The draft Army testing regulation (AR 70-10) has strengthened the guidance for the introduction of commercially-developed items. It assigns responsibility for military potential testing to USAMC, therefore, in reality to project managers, and commodity commanders. Another important aspect of the draft regulation is the detailed funding guidance provided for the introduction of commercially-developed items.

2. Objectives of Test Program

Objectives of the Army test program were not definitive.

Several supplementary objectives have been spelled out.

The objectives of the Army test program in the draft testing regulation (AR 70-10) are appropriately expanded, and are sufficiently definitive.

3. Requirements for Testing

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No DA requirement existed to insure that product improvements, be tested or evaluated.

PRESENT

DA has required that provision be made for testing of product improvements and USAMC has taken action to require that all product improvements judged important a/ be tested, and that all such tests be independently evaluated by USATECOM. Those judged not important are not required to be tested.

Insufficient HQ DA policy existed for production and postproduction tests.

No change.

No requirement existed for the overall coordination of testing and comprehensive test planning throughout life cycle. The only requirement for a Coordinated Test Plan (CTP) was for ET/ST testing.

Being corrected in the Draft AR 70-10.

REMARKS

Because of the proprietary nature of the project manager's position, he alone should not judge the importance of a product improvement, and thereby establish the testing requirement. Perhaps USATECOM comment should be required as to the need for testing product improvements.

DA guidance for research and development testing is provided in AR 70-10. No DA regulation provides guidance for production quality assurance tests, although these tests are being conducted.

New life cycle management system will help correct this; CTP will cover all developmental testing not just ET/ST.

-
- a An important product improvement is one which changes functioning, or the operational capabilities of an item.

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PAST

Insufficient procedures existed for obtaining comprehensive feedback as early as possible on performance after issue to troops.

PRESENT

USAMC has strengthened the guidance pertaining to assigning a representative who accompanies initial distribution to the field, to report any deficiencies found as the item goes into service.

REMARKS

4. Responsibilities for Testing

Staff responsibilities for testing were spread among DCSOPS (later ACSFOR) DCSLOG and CRD. Continuity was lacking in life-cycle management.

Test evaluation actions were fragmented

Many testing responsibilities were appropriately given to Commodity Commanders and Project Managers. However, little provision existed for a double check on product improvement tests.

ACSFOR has overall life cycle responsibility.

IPR is now followed by SSE for evaluation and review.

USATECOM conducts independent testing or evaluation for engineering, service, product improvement and confirmatory tests.

USATECOM's independent role continues to be strengthened through USAMC Command policy.

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5. Standards of Testing

In general there was little meaningful emphasis on standards.

PRESENT

This subject has received command emphasis. USAMC has conducted comprehensive "Standards of Testing" study and is working on policies and procedure to put recommendations into action.

Several improvements have been made:

- CTP has been created and its use is mandatory.
- Standard Materiel Test Procedures (MTP's) have been updated.
- Guidance has been published on maintainability and reliability.

USATECOM has established training courses for both supervisory and technical personnel.

Sample sizes were inadequate.

CTP is now to include size of sample to be used. USAMC is doing research on sample sizes vs. risks.

REMARKS

Implementing regulation, AMCR 700-_____ has not yet been approved (in AMC staffing since August 67).

An analysis of the statistical design of small arms tests is contained in section D, Appendix 2, and the conclusions drawn therefrom are contained in Section E, Appendix 2.

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<u>PAST</u>	<u>PRESENT</u>	<u>REMARKS</u>
6. <u>Control & Coordination of the Test Program</u> Control & coordination were normally accomplished by routine staff actions on a case-by-case basis. Few controls existed for evaluation of commercially-developed items to determine military worth, or to compare with on-going RDTE projects. Materiel defects were not always surfaced during evaluation. Within Hq, USAMC, no single staff element was responsible for controlling and coordinating test actions.	SSE's and MRRC's, as applicable accomplish many aspects of coordination and control, following all formal IPR's. Draft AR 70-10 establishes DA guidance on military potential testing and the Army small arms program establishes procedures to compare commercially developed items with on-going RDTE projects (See Appendix 10). USATECOM is now required to perform independent and objective evaluation for product improvement tests. No change.	Key implementing regulation, Draft AR 70-10, is being staffed. Further study is underway at USAMC.

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7. Distribution and Use of Test Reports

Commodity Commanders, and Project Managers determined distribution of own test reports and determined their own corrective actions.

8. Test procedures were in some cases the same for engineering and service testing.

Sample sizes were frequently insufficient for subtests.

Procedures were often used by rote. Tests were often on only one type of condition instead of over a range of conditions.

The USA Infantry Board had a continued shortage of military personnel with field experience with small arms.

PRESENT

USATECOM now receives and evaluates all product improvement test results. Draft AR 70-10 requires that all developmental test reports are furnished to HQ DA (OCD), USACDC and USCONARC for use by IPR's and SSE's.

Separate service test procedures are being used.

No change.

No change.

No apparent change.

REMARKS

Service test procedures are still under study.

An analysis of the statistical design of small arms tests is contained in Section D, Appendix 2, and the conclusions drawn therefrom are contained in Section E, Appendix 2.

Same as above.

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E. Conclusions

The principal conclusions of this appendix are:

1. Army policy for testing of the M16 system has been inadequate.
2. Many past deficiencies in Army testing policy have been surfaced by studies and boards. Policies designed to correct most of these deficiencies have been drafted.
3. Army policy pertaining to product improvement and post production tests needs improvement.

Minor conclusions concerning Army testing policies and procedures, as they pertain to the small arms life cycle, are in the following subparagraphs:

a. Army Test Program

The former lack of an overall materiel life cycle system is apparently being corrected by the current development of a life cycle management model with provisions for integrated testing, evaluation, and review.

The Army test program, and related materiel development actions, have been and still are oriented to Army-developed items. The appropriate types of tests exist, such as the military

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potential test; yet it appears that special major measures, such as the SAWS tests, were needed in the past to obtain a thorough evaluation of commercial items against on-going Army-developed items.

b. Requirements for Testing

Army policy did not, and still does not, provide significant guidance for quality assurance production tests.

The Army requirement for coordinated test planning is being expanded to include all developmental testing, not just engineering and service test as in the past.

The shortcoming concerning product improvements apparently will be partially corrected by USAMC's requirement that all significant product improvements be tested, and that all test results be independently evaluated by USATECOM.

The need for earlier feedback on field performance will apparently be filled by improved USAMC procedures for newly issued materiel.

c. Control and Coordination

In general, many control and coordination problems of the past are being solved by the implementation of the recommendations of the Brown Board, SATE Study, Committee of Four Study, and "Standards of Testing for USAMC Materiel" study.

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d. Test Procedures

Separate procedures are now being used for both engineering and service testing. Previous practice called for using essentially the same procedures.

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ARMY TESTS

DA STAFF		TEST		RESPONSIBILITY		RESPONSIBILITY		FUNDING		PURPOSE	
RESEARCH		RESEARCH		CRD		AMC, PM/CC		CRD, (RDTE)		To confirm concepts and to further research projects and tasks. (AR 70-10, AMCR 70-7)	
FEASIBILITY		CRD		AMC, PM/CC		CRD, (RDTE)		To determine by a process of technical examination and study, the possibility of attainment of an end item. (AR 320-5, AMCR 70-7)			
ENGINEERING DESIGN (Component)		CRD		AMC, PM/CC		CRD, (RDTE)		To obtain data necessary for initial design of the prototype item or specific component thereof and to determine inherent structural properties, including the effect of environmental stresses. (AR 70-10, AMCR 70-7)			
R&D ACCEPTANCE		CRD		AMC, PM/CC		CRD, (RDTE)		To insure that the specifications of the development contract have been fulfilled. Acceptance of the item for engineering testing is contingent on this test. (AR 70-10, AMCR 70-7)			
MILITARY POTENTIAL		CRD		AMC, PM/CC or TEOOM		AMC/CRD (RDTE)		To determine whether the materiel or equipment has military potential. A test of an item for which no definitive characteristics have been established. (AMCR 70-7)			
ENGINEERING		CRD		AMC, TEOOM		CRD, (RDTE)		To provide data for use in further development and to determine the technical performance, safety characteristics and maintenance suitability of the item. This test is conducted by a separate agency (not the developing agency). (AR 70-10, AMCR 70-7)			
SERVICE		CRD		AMC, TEOOM		CRD, (RDTE)		To determine, under field conditions, to what degree the item will perform the mission described in the QMR. This test provides the bases for type classification. (AR 70-10, AMCR 70-7)			
CHECK		CRD		AMC, TEOOM		AMC/CRD (RDTE)		To determine whether major deficiencies found in the Service Test have been corrected, these deficiencies being of such a nature that the item was found unsuitable for type classification. (AR 70-10)			

Enclosure 1-1 (Cont'd)

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ARMY TESTS

PRODUCTION	PREPRODUCTION	DCSLOG	AMC, PM/CC/ TECOM	DCSLOG (PENA)	To verify production drawings, processes, and materials. (AR 70-10)
PRODUCTION	INITIAL PRODUCTION	DCSLOG	AMC, PM/CC/ TECOM	DCSLOG (PENA)	To verify the adequacy and quality of the item when manufactured according to production drawings and mass production processes. A test of items from the first production run. (AR 70-10)
	ACCEPTANCE	DCSLOG	AMC, PM/CC/ TECOM	DCSLOG (PENA)	To determine conformance of the product to specifications prior to acceptance. (AMCR 715-509, AMCR 70-7)
	COMPARISON	DCSLOG	AMC, PM/CC	DCSLOG (PENA)	To compare production line samples to the standards. This test is conducted as a quality assurance measure. (AMCR 715-509, AMCR 70-7)
	PRODUCT IMPROVEMENT	DCSLOG/ OCD	AMC, PM/CC/ TECOM	DCSLOG/ OCD (RDTE/PENA)	To verify that essential military characteristics have not been adversely affected by the modification and that revised specifications have been met. (AR 700-35, AMCR 70-7)
	PRODUCT IMPROVEMENT	DCSLOG/ OCD	AMC/CC (TECOM)	DCSLOG (PENA/O&MA)	See product improvement above.
POST PRODUCTION	SURVEILLANCE	DCSLOG	AMC, CC	DCSLOG	To determine if deterioration of materiel has taken place during storage.
	RETROFIT (Recondition)	DCSLOG	AMC, CC	DCSLOG	To assure that renovated, repaired, overhauled, or rebuilt materiel meets appropriate specifications. (AMCR 70-7)

Enclosure 1-1 (Cont'd)

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ARMY TESTS

US	CONFIRMATORY	ACSFOR	CONARC/AMC, TECOM	ACSFOR (OSMA/PEMA)	To obtain equipment performance experience which will minimize unexpected equipment failures in combat. Conducted under field conditions by operational Army units equipped with early production models. (AR 71-3, AR 70-10)
	TROOP	ACSFOR	CONARC/CDC	ACSFOR (OSMA/PEMA)	To evaluate, in the field, organizational concepts, techniques, and tactics or to gain further information on materiel. (AR 71-3)
	FIELD EVALUATIONS	ACSFOR	CONARC/CDC	ACSFOR (OSMA/PEMA)	To examine, under normal operating conditions over an extended period of time, new and/or revised doctrine and organization. (AR 71-3)
	FIELD EXPERIMENTS	ACSFOR	CDC	ACSFOR (OSMA)	To evaluate, under controlled conditions, doctrine and organization related to a specific problem area. (AR 71-3)

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Highlights of USAMC Study "Standards of Testing"

In 1966, CG, USAMC directed a study of "Standards of Testing".

Highlights of the report were:^{55/}

Early in the study it became apparent that principles underlying a rational test program had never been explicitly established within AMC. Although the Commodity Commands and the Test and Evaluation Command have established in-house test guidance, the coalescence of AMC's test effort into a totally coordinated test program has not been accomplished.

Emphasis....was placed on the following:

- A. Adequacy of current AMC Regulations defining the test and evaluation process.
- B. Field execution of the test program in accordance with AMC staff guidance.
- C. Utilization of statistical methodology for determining test item requirements.
- D. Relationship of tests to decision points.
- E. Identification of technical risks.
- F. Optimization of test information.

With respect to the number of test items made available for Engineering/Service and initial production tests the committee concluded:

- A. The minimum sample size to demonstrate item performance with the exception of munitions is inadequate.
- B. Sample ranges and risk is not fully recognized.
- C. The tendency to establish test requirements by rote is evident.

The overall conclusions of the committee were:

55. MFR, AMCQA, sub: Briefing to CG, USAMC, re: Standards of Testing for AMC Materiel," 21 Dec 66.

Inclosure 1-2

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1. AMC does not have a coordinated test and evaluation program for the life cycle of materiel.
2. AMC does not have a staff activity responsible for the coordination of such a program.
3. The study concepts provide a framework for developing the procedures for a life cycle program.
4. The study concepts provide the baselines for establishing "Standards of Testing" for AMC Materiel.
5. This study is in harmony with the decisions made by the Chief of Staff (Army) on the SATE Study.

The CG, USAMC approved, in part, the concept of the study, assigned to USATECOM responsibility for developing and executing the plan for establishing standards of testing. In a letter to CG, USATECOM he described a two-step approach.^{56/}

The first step will require that you, in conjunction with the commodity commanders, apply rationale (developed in the Standards of Testing Study) to one major end item for each command and develop a model test program for the end item selected.

...The second step...will be the application of this rationale to all AMC materiel.

The commodity commanders were informed of the above approval^{57/} and directed to furnish expertise to USATECOM to assure the end item selected receives the proper in-depth treatment. A draft AMC regulation^{58/} was developed as a result of the Standards of Testing Study. It has been in staffing within USAMC since August 1967.

56. Letter, AMCQA-S, sub: Standards of Testing, 16 Jan 67.

57. Letter, AMCQA-S, sub: Standards of Testing, 16 Jan 67.
(to Commodity Commanders).

58. Draft, AMC Regulation 700-**, 30 Aug 67.

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Engineering and Service Test Procedures

A. Engineering test procedures measure the inherent structural, electrical, physical or chemical properties^{59/} to eliminate human errors in judgment, and are characterized by the use of: environmental chambers; controlled laboratory, shop, and field trials; statistical methodology; physical measurement techniques; and the use of personnel trained in the engineering or scientific fields. Specific engineering test procedures have changed little over the years; some even date back to 1937.^{60/}

Engineering test procedures are divided into three types: inspection, safety, and functioning tests.^{61/} During inspections critical dimensions such as bore and chamber and critical forces such as trigger pull, firing pin energy, and spring constants are measured and recorded. The safety tests involve firing high pressure test rounds to proof the weapon and comparing peak chamber pressure to that of a standard cartridge; determination of bullet stability values, muzzle velocities, and cyclic rates; and the examining of the weapon performance(feed, extraction, and ejection) under a

59. Engineering tests for small arms are conducted by Development and Proof Services, USATECOM, Aberdeen Proving Ground, Md. Supplemental engineering information on performance of weapons in extreme environments is obtained primarily from testing in the controlled environmental chambers of hot, cold, and humid conditions at Aberdeen Proving Ground, Maryland.

60. Ordnance Proof Manual, Office Chief of Ordnance, 11 Jun 37.

61. USATECOMR 700-700, 11 Jun 66.

Inclosure 1-3

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variety of conditions. When possible, the effects of different lots and types of ammunition are examined. All malfunctions are recorded during each test. The following are the functioning tests usually employed.

Climatic Condition (two weapons each phase)

Hot 155°F (1,200 rounds, fired semiautomatic and automatic).
Cold - 65°F (3,000 rounds, fired semiautomatic and automatic).
Humidity 70° to 105°F with 90 to 100 percent relative humidity (each weapon fires 1,000 rounds - 250 rounds on third, fifth, eighth, and tenth day, without cleaning or maintenance).

Icing. Two weapons are conditioned at plus 20°F, then lightly sprayed with water until 1/8 to 1/4 inch of ice accumulates. Weapon muzzle is closed with tape. An attempt is made to fire a magazine.

Unlubricated Weapon. The weapon is cleaned in dry-cleaning solvent and fired 1000 rounds in an unlubricated condition. The type of fire, automatic or semiautomatic is not specified.

Water Spray. This is an accelerated test to determine the effect of a heavy rainfall on the performance of the weapon. The test consists of a spray of water falling at a rate of about 24 inches per hour. One weapon is fired 6000 rounds. For test conditions, and the weapon exposure times see Figure 1-3.

Salt Water Immersion. This test examines the deleterious effects of salt water on weapon performance. A salt water solution

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Water Spray Test

Test Condition	Exposure Time (minutes)	Cumulative Exp. Time (minutes)	Rain (inches)	Cumulative Rain (inches)
<u>Weapon Horizontal</u>				
Bolt open	5	5	2.0	2.0
Loaded, bolt closed	5	10	2.0	4.0
100 rounds <u>semiauto</u>	4	14	1.6	5.6
Bolt open	5	19	2.0	7.6
Loaded, bolt closed	5	24	2.0	9.6
100 rounds <u>automatic</u>	4	28	1.6	11.2

Weapon Muzzle Up^{a/}

Bolt open	5	33	2.0	13.2
Loaded, bolt closed	5	38	2.0	15.2
100 rounds <u>semiauto</u>	4	42	1.6	16.8
Bolt open	5	47	2.0	18.8
Loaded, bolt closed	5	52	2.0	20.8
100 rounds automatic	4	56	1.6	22.4

Weapon Muzzle Down^{a/}

Bolt open	5	61	2.0	24.4
Loaded, bolt closed	5	66	2.0	26.4
100 rounds <u>semiauto</u>	4	70	1.6	28.0
Bolt open	<u>5b/</u>	75	2.0 ^{b/}	30.0
Loaded, bolt closed	<u>5b/</u>	80	2.0 ^{b/}	32.0
100 rounds <u>automatic</u>	<u>4b/</u>	84	1.6 ^{b/}	

a. Before attempting to fire, hold weapon with muzzle down, unlock bolt slightly, and attempt to remove water accumulated in the bore.

b. Or as required to finish program with at least 32.0 inches cumulative rain total.

Source: USATECOM, TECP 700-700, 11 Jun 66.

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of 20 percent salt, and 80 percent water, by weight, is used. Two test weapons are disassembled, cleaned, lubricated and reassembled. The weapons, with a round chambered are submerged in the salt water solution for 60 seconds along with 600 rounds of ammunition in magazines. The weapons then fire 30 rounds in the semi-automatic mode, and 30 rounds in the automatic mode. They are stored at temperatures ranging from 70°F to 105°F with 90 to 100 percent relative humidity. The firing procedures described above are repeated on the third, fifth, eighth, and tenth day, without cleaning or lubrication.

Dust. Dust testing involves exposing the weapon to a continuous blast of dust for 2 minutes, then firing a full magazine of ammunition. The dust mixture consists of 9 parts of Grade O Albany sand and 1 part of clean silica - core sand. The weapon is cleaned and lubricated, and the muzzle is closed with tape. A round is chambered in weapons fired from a closed bolt. A fully loaded magazine is assembled in the weapon. The weapon and a second loaded magazine are positioned in the dust box that has a blower attached. Dust is poured in the box at the rate of 5 pounds per minute. The weapon is wiped clean with bare hands and an attempt is made to fire the magazine that is in the weapon. If this is not possible because of malfunctions the second magazine is used. If firing is not satisfactory, firing will be attempted with a clean magazine loaded

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with clean ammunition. The number of attempts made to overcome malfunctions, and the number and type of malfunctions are recorded.^{62/}

Sand Drag Test. The sand drag test is conducted to determine the effects of sand on weapon performance. Two weapons are cleaned and lubricated, and the muzzle closed with tape. Each weapon is loaded with a full magazine of ammunition. A round is chambered in weapons firing from a closed bolt. Dust covers are closed. The weapons are then dragged 20 feet in silica core sand, with left sides up, and 20 feet with right sides up, muzzle foremost. An attempt is made to fire the loaded magazine. If malfunctions make this impossible, firing is attempted with a clean magazine loaded with clean ammunition.

Mud. One weapon with muzzle taped, bolt closed, weapon loaded, and a second loaded magazine is submerged for 60 seconds in a mud bath. The mud bath consists of 10 pounds of red clay to 2 pounds of clean river sand to 8 quarts of water. The weapon is cleaned to the extent mud can be wiped off by hand. Then an attempt is made to fire 20 rounds. If malfunctions occur, the second magazine is used. If malfunctions persist the test is continued using a clean magazine loaded with clean ammunition.

Sustained Fire. This test involves determination of the maximum rate and duration of firing that can be accomplished without damage to the weapon, degradation of its performance, or danger to the firer.

62. A dynamic dust test has been used which will better simulate dust conditions around helicopters. During this test dust is blown by a fan while the weapon is being fired.

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Two weapons are fired at the following rates, with cooling after each cycle:

15 rounds per minute for 30 minutes

40 rounds per minute for 5 minutes

The foregoing schedules are fired semi-automatically and repeated automatically. Then two addition cycles are fired with firing times halved and number of rounds doubled for each cycle. Cyclic rates of fire are recorded for weapons that have an automatic fire capability. Projectile velocities are recorded for all types of weapons.

Endurance. Endurance testing usually involves firing the weapon to destruction. The length of life and behavior of all parts are recorded. Parts are replaced when they become unserviceable. The weapon fires a minimum of 6000 rounds, not less than 15 rounds per minute. Cleaning and lubrication are performed at 600 round intervals. During the firing the weapon is held normally, right and left side up, held loosely in the hands, and elevated and depressed to plus 80 and minus 80 degrees respectively.

Accuracy. Five weapons are fired to check dispersion, and the weapon sights. The firing is done at the ranges specified in the Qualitative Materiel Requirements or the test plan. Each weapon fires ten rounds at 4 targets.

Recoil. Recoil tests of weapons determine the energy of recoil and the resultant reaction of the weapon against a man's shoulder

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or mount. Measurements are taken from a ten-round firing trial using one weapon suspended from a ballistics pendulum.

Flash. One weapon fires both semi and full automatic in total darkness. Photographs are taken.

Cook-off. One weapon is fired as rapidly as possible to determine how many rounds are required to produce a cook-off of a live round chambered in a hot weapon. The point of cook-off, when determined, is substantiated by firing confirming trails of one magazine less. Cook-offs are not tolerated during substantiating trials.

B. Service testing is conducted under actual field conditions to determine to what degree the item or system and its associated tools and test equipment perform the mission as described in the QMR, and to determine whether the item or system and its maintenance package are suitable for Army use.^{63/} This test makes use of the observations and judgment of selected military personnel who have a background of field experience with the materiel undergoing testing. The service test procedures now being used for small arms employ 25 to 30 test weapons and 30 test soldiers (6 groups of 5 each) for the subtests listed below.

63. Small arms service tests are conducted primarily by the U.S. Army Infantry Board, USATECOM, Fort Benning, Georgia. Supplemental information regarding man-weapons performance in extreme environments is obtained from testing at the arctic, tropic and desert test facilities of USATECOM.

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Accuracy. The purpose of this test is to determine the shot grouping of the test weapons. A 10-round shot group is fired on targets at distances of 1,000 inches, and 100, 200, and 400 meters.

Day and Night Defense. During daylight teams fire at four realistic target arrays (eight targets each) at ranges from 100 to 600 meters. Semi and automatic fire are used. The number of rounds fired depends on the number of trials required to assess the design features of the weapon. At night a similar exercise is conducted at ranges from 50 to 150 meters. A signature device is used to simulate enemy fire.

Day and Night Attack - The test is conducted on a 200 meter attack range. Fire teams move from prepared positions to succeeding positions and fire at an eight target silhouette array. Targets are five meters apart.

Quickfire - All test soldiers fire a quickfire course containing six silhouette targets. Two targets are located at 20, 40 and 60 meters from the firer. The allotted target exposure time is two seconds for the targets at 20 meters, and 3 seconds for those at 40 and 60 meters. The quickfire technique is employed.

Portability, Transportability and Aerial Delivery - The test soldiers carry the weapons over various types of terrain, and load and unload from various types of army vehicles. They also exit from aircraft in flight.

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Disclosing Effects and Human Factors - Throughout all of the above subtests, the following data are recorded that reflects the system capabilities.

Durability. Replaced broken and/or worn parts are recorded.

Reliability. Malfunctions and stoppages and other information having a bearing on reliability are recorded. Parts breakage and/or wear are also considered in the overall assessment of reliability.

Accessories. Suitability of items such as tools, maintenance equipment, bipod, pouches (ammunition) and bayonet are recorded.

Safety. A safety confirmation is required.⁶⁴ The service test agency evaluates test weapons in all modes of fire and all firing positions, such as standing, kneeling and prone. Observations are made of such things as ejection patterns, possible overheating and other things bearing on safety.

Maintenance. In all subtests the relative ease that the test weapons may be maintained is recorded. The number and type of tools required for maintenance are also recorded.

Position Disclosing Effects. By visual observation, the range at which the firers position can be determined by the muzzle flash at both day and night and smoke during daylight is recorded. All modes of fire are evaluated.

Human Factors. Observations in human factors include accessibility and adequacy of safety features, sharp projections that could

64. USAMCR 385-12, 31 Dec 62.

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cause injury, configuration with respect to pointing and aiming, complexity of operation in firing sequences, comfort in carrying, and other limitations as brought to the attention of test director by test personnel.

Arctic and Tropical Environmental Test.^{65/} The same tests as outlined for temperate zone engineering and service tests are conducted in an actual arctic and tropical environment at selected test sites.

C. Testing of Ammunition and Lubricants. Test procedures for ammunition are similar to those used for the weapon, for both engineering and service testing. The same test procedures are used even when ammunition testing is done subsequently to the weapon tests.

When weapons and ammunition are tested the standard lubricant is used during all subtests that allow lubrication. When a lubricant itself is being tested, the test procedures for the weapons and their ammunition remain normal. The test lubricants are applied to specific weapons to provide a basis for evaluation of weapons performance with each test lubricant.

65. USATECOM, TECP 700-700,

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