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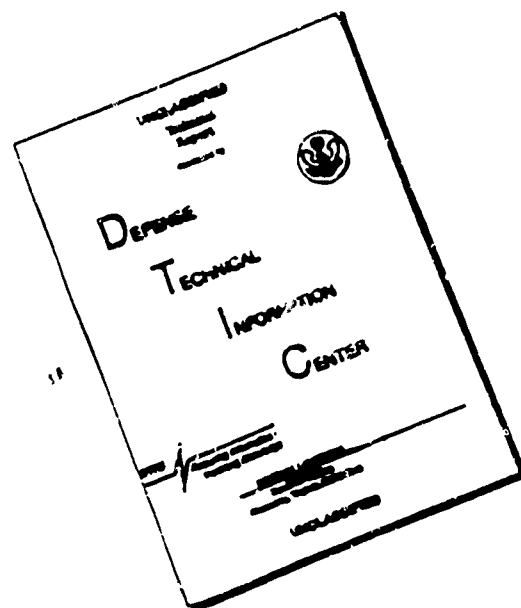
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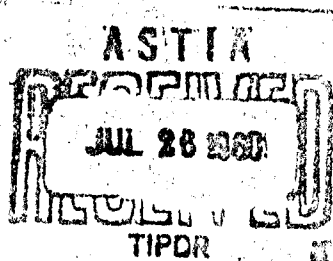
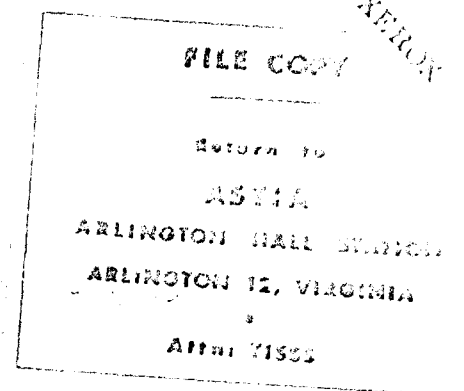
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VOLUME I

**PARTS
SPECIFICATION
MANAGEMENT
FOR
RELIABILITY**



MAY 1960

AD HOC STUDY GROUP ON PARTS SPECIFICATION MANAGEMENT FOR RELIABILITY
OFFICE OF THE DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING AND
OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE SUPPLY AND LOGISTICS

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Volume I

PARTS SPECIFICATION MANAGEMENT FOR RELIABILITY

Volume I.
Task Assignment
Recommendations
Subtask Reports

Volume II.
Concepts and Objectives
Prototype Specifications
Form and Instructions

Ad Hoc Study Group on Parts Specification Management for Reliability
Office of the Director of Defense Research and Engineering
and
Office of the Assistant Secretary of Defense (Supply and Logistics)
Washington 25, D. C.

May 1960

PSMR-1

FOREWORD

The fast-changing state of the electronics art, together with increasingly complex equipments demanding high reliability, has created the need for (1) additional requirements in electronic parts and tubes specifications, (2) faster coordination of parts specifications, (3) the establishment of technical characteristics data for dissemination to design and logistics personnel and (4) a complete review of the parts specifications program to ensure compatibility with the reliability program. These basic needs were recognized and reported by Task Group 5 of the Advisory Group on Reliability of Electronic Equipment in its report dated 4 June 1957.

Accordingly, the Ad Hoc Study Group on Parts Specifications Management for Reliability was established by a memorandum of agreement dated 14 July 1958 under the joint sponsorship of the Office of the Assistant Secretary of Defense (Research and Engineering) and the Office of the Assistant Secretary of Defense (Supply and Logistics). The basic objective of the study was to analyze the recommendations of the AGREE Task Group 5 and advise the sponsors regarding efficient implementation methods and procedures.

This report, which contains the findings and recommendations of the Study Group, is issued at this time for informational purposes only.

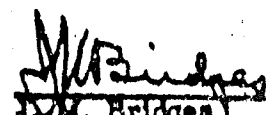
In view of the study's wide scope, the Group's recommendations will exert a major impact on many groups in both government and industry and at levels from management down to the many technical and service activities. Many of the procedures recommended radically depart from methods now used; however, only through these new techniques can we gain the achievable benefits that are needed to meet present design demands.

Moreover, this report indicates that the time schedule is critical and that maximum benefits will be obtained only if the recommendations are carried out immediately. Again, this poses a challenge to all the interested governmental and industrial activities.

The prototype specifications and standard format for design and documentation are offered, not as the ultimate, but as guides to a methodology. In our rapidly advancing technology, new and better developments may be expected by the time the total program outlined in this report can be implemented.

Accordingly, all recipients of this report are urged to use any of this material that may be useful and appropriate to their activities.


Paul H. Riley
Director for Supply Management Policy
Office of the Assistant Secretary of
Defense (Supply and Logistics)


J.M. Bridges
Director of Electronics
Office of the Director of Defense
Research and Engineering

MEMORANDUM FOR Mr. J. M. Bridges, Director of Electronics, ODDR&E
Mr. P. H. Riley, Director for Supply Management Policy,
OASD(S&L)

SUBJECT: Report of the Ad Hoc Study Group on Electronic Parts Specifications
Management for Reliability

The Ad Hoc Study Group on Electronic Parts Specifications Management for Reliability has conducted its study in accordance with your memorandum of agreement dated 14 July 1958 and the related task assignment. The final report of this study is herewith respectfully submitted for your transmittal to the Director of Defense Research and Engineering and the Assistant Secretary of Defense (Supply and Logistics).

As you know, the scope of this study is very broad; the recommendations and implementing actions will exert a major impact on many of our current operations in both government and industry. Though the study's objectives were to attain radical improvements in order to cope with demanding systems requirements and the fast-growing state of the art, the recommended plans and procedures attempt to bring about these radical improvements in an evolutionary manner.

The recommendations are rather specific, detailing an organizational structure and establishing three prototype specifications as well as new procedures for refining the technical documentation of parts characteristics. However, this is simply the framework of the total program. The Group feels strongly that, unless the recommendations are immediately put into effect, many of the achievable gains and benefits will not be realized.

The chairman wishes to acknowledge his indebtedness to all those who so diligently applied their time and efforts to the study and to thank them for their valuable support and cooperation.



Paul S. Darnell
Chairman, Ad Hoc Study Group on
Electronic Parts Specifications
Management for Reliability

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1. INTRODUCTION

1.1 Memorandum of Agreement.

On 14 July 1958, a memorandum (Appendix I) was signed by the Director for Production Policy, Office of the Assistant Secretary of Defense (Supply and Logistics), and the Director of Electronics, Office of the Assistant Secretary of Defense (Research and Engineering),¹ in which they agreed on the need for

... (a) additional requirements in electronic parts and tubes specifications, (b) more rapid coordination of specifications, (c) establishment of technical characteristics data for dissemination to design and logistics personnel and (d) a complete review of the parts specifications program to insure compatibility with the reliability program.

1.2 Task Assignment.

They further agreed that "the solution to these problems should be undertaken in the manner delineated in Enclosure (1)," which was "Task Assignment for an Ad Hoc Study on Parts Specification Management for Reliability." The task assignment outlined the study's sponsorship and the conditions of administrative support and specified the membership of the study group. The problem to be evaluated by the study was stated as follows:

Increasingly more complex electronic equipments demanding high reliability have created the need for additional requirements in the parts and tubes specifications. The specifying of reliability in quantitative terms requires the introduction of reliability requirements into both equipment and component specifications as well as the development of practical and economical test procedures to verify compliance with the specifications. In addition, quality control procedures should include features to insure maintenance of reliability levels throughout production runs.

To enable designers to develop equipments which will meet quantitative specification of reliability for equipments and systems it is essential that design guidance and application data such as component failure rates as a function of time and environment be made available to engineering groups. There is a great need to obtain and disseminate these technical characteristics of components as quickly as possible.

In the interests of economy, procedures must be designed and developed which will avoid duplication of acceptance tests.

¹Now the Office of the Director of Defense Research and Engineering.

The basic objective of the study was "to analyze the recommendations established by the AGREE Task Group 5 in order to advise the Assistant Secretaries of Defense (R&E) and (S&L) regarding efficient implementation methods and procedures."² The following were included:

- (a) Recommend criteria and methods for specifying the reliability of parts and tubes in terms of failure rate as a function of time, environment and circuit application severity.
- (b) Survey the methods used in preparation of parts and tubes specifications as well as coordination procedures and practices. This survey shall be made to suggest changes which would accommodate the specification of reliability level and its allied reliability assurance requirements. Procedures proposed shall be to enhance rapid and full specification coordination within the Military Departments and with industry.
- (c) Review of Qualified Products List (QPL) and Qualification Testing Procedures to evaluate: (1) If qualification is being properly implemented. (2) Adequacy of tests with respect to the reliability requirements and quality control procedures included in the specification. (3) Provisions for avoiding any duplication of Qualification Testing by various contractors.
- (d) Recommend reliability assurance test procedures to verify compliance with the reliability level specified.
- (e) Recommend a program and methodology for obtaining technical characteristics and test data of parts including failure rate data and the procedure for making this data available to designers and logistics personnel.
- (f) Investigate the need for a document other than the specification to provide design guide information such as parts and tube application curves (including failure rate curves or data as a function of circuit application severity level and environment). Such a document would provide design guide information as opposed to the firm specification requirement data mentioned above.

Finally, the task assignment called for a report of the conclusions resulting from the study for consideration by the sponsoring Assistant Secretaries of Defense.

1.3 Subtask Assignments.

The main task assignment was broken down into subtasks to ensure a thorough coverage of the many problem areas. The subtasks are as follows:

1. Incorporation of reliability requirements in specifications, including test requirements to assure reliability levels defined.

²"The Findings and Recommendations of Task Group No. 5," Reliability of Military Electronic Equipment, Report by Advisory Group on Reliability of Electronic Equipment, Office of the Assistant Secretary of Defense (Research and Engineering), 4 June 1967, Unclassified.

2. Specification requirements and test methods or programs other than those specifically directed to reliability considerations, needed to form the basis of qualified product lists, acceptance testing, etc.

3. Methods and procedures for the adequate collection and dissemination of technical information on both parts in use and new items.

4. Specification writing and coordination procedures, to achieve unification and to insure specifications consistent with the full capabilities of the parts.

(f) : : d

5. Procurement and engineering practices of contractors, supply groups and other agencies to insure use of qualified, reliable parts.

It was realized that, regardless of how the division of subtasks was made, mutually exclusive working groups could never be established and that accordingly there would be a need for close coordination among the subgroups' efforts. This was achieved through close cooperation by the subgroup chairmen and by assigning each member of the parent study group to at least two subgroups. (The membership of the study group and the subgroups is listed in Appendix II.)

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2. RECOMMENDATIONS

2.1 Electronic Parts Specifications Management.

(1) An Advisory Group on Management of Electronic Parts Specifications (AGMEPS) should be established as an activity of the Office of the Assistant Secretary of Defense (Supply and Logistics) (OASD-S&L), reporting directly to that Assistant Secretary. The members of the Group should be appointed by him, and their selection should be coordinated with the Director of Defense Research and Engineering (DDR&E). The members should be drawn from representatives of the OASD (S&L), the ODDR&E and the Military Departments and consultants of the Office of the Secretary of Defense (OSD) who are expert in the indicated fields of interest.

(a) Administrative control of the Advisory Group should be delegated to the OASD (S&L) office that has been assigned the responsibility for standardization.

(b) The members selected for the Advisory Group should represent a balanced team, with management and technical experience in the areas of electronic parts, tubes and semiconductors; the electronic-systems design area; and the engineering, procurement and logistics areas of the Department of Defense (DOD).

(c) The chairman of the Advisory Group should be an OSD consultant, rather than a representative of the OASD (S&L), the ODDR&E or the Military Departments, so as to gain a greater objectivity in directing the Advisory Group's activities.

(d) The Advisory Group should maintain liaison with the Advisory Group on Electronic Parts, the Advisory Group on Electron Tubes and other OSD advisory groups that have programs relating to the parts specifications programs.

(e) The Advisory Group should review all proposed DOD programs relating to electronic-parts specification development and technical documentation and the management thereof and should assist the ASD (S&L) by submitting recommendations regarding: 1. the most efficient implementing actions, 2. the most effective program and 3. changes to any proposed programs that will ensure the implementation of this report's detailed recommendations. (Appendix III is a proposed DOD instruction establishing an Advisory Group on Management of Electronic Parts Specifications as recommended herein.)

(2) The Armed Services Electro-Standards Agency (ASESA) should be organizationally relocated in the OASD (S&L), reporting to the S&L office that is responsible for standardization. In this position, ASESA should provide administrative support to the program of electronics-parts specifications management and secretarial support to the AGMEPS. Thus, by providing a single point of responsibility at an OSD level, ASESA's production capacity will be more directly used and its efficiency improved.

(3) The responsibility for parts specifications management as presently established in the OSD should be redefined, if necessary, so that the following functions may be carried on expeditiously and efficiently by the office responsible for standardization, in accordance with the detailed recommendations of this report:

(a) Prepare and recommend DOD policy and program-implementation plans concerning the development of specifications, standards and handbooks for electronic parts and tubes.

1. Recommend priorities and schedules for the specification-development program that will be consistent with the operational needs of the Military Departments.

2. Review all specification programs and actions to ensure their adherence to established schedules.

3. Recommend techniques and guidelines, to be used in preparing military specifications, that will ensure the completeness and adequacy of specifications for procurement. This should include the specification of performance and reliability in standard levels; test plans necessary to prove compliance with specification requirements; procedures for qualification approval; and the development and dissemination of parts application data, including failure rate as a function of time and levels of application severity.

4. Ensure that parts characteristics data, including test data, are collected, analyzed and used in the development of new specifications or the revision of existing ones.

(b) Coordinate the programs on specifications development and technical documentation with the many other programs of the Military Departments, such as the Long Range Parts and Tubes Research and Development Program and the Industrial Mobilization Planning Program. Coordination should be extended to ensure the programs' compatibility with industrial facilities and activities in the areas of parts and tubes.

(c) Establish or revise criteria for initiating and coordinating actions on specifications, to include the following:

1. Approval of a specification for purposes of tri-Service coordination should be based upon a majority vote of the working group and not on unanimous agreement.

2. A specification development or coordination action may be initiated by any one of the following by request to the Secretary of the Advisory Group:

a. OASD (S&L) and ODDR&E groups or any one of the Military Departments

b. The FSC (Federal Supply Classification) assignee

c. A member of the Advisory Group

d. Recognized industry standardization groups. This will normally be in the form of a proposed draft specification submitted to any one of the Military Departments, to the Advisory Group, to the OASD (S&L) or to the ODDR&E.

All requests should be reviewed by the Advisory Group for approval and integration into the over-all specification program.

(d) Resolve areas of conflict in the over-all program and related problems arising in the development of parts specifications. Whenever possible, the Advisory Group should be employed for this purpose.

(e) Develop criteria for the generation of preferred parts lists to be contained in military standards and approved sources of supply for qualified electronic parts lists to be included in military specifications or procurement documents, where applicable.

1. Ensure that preferred parts lists are developed and promptly issued.
2. Ensure that application data, including failure rates, are developed and promulgated.
3. Ensure that a Parts Qualification Activity is established.
4. Ensure that approved sources of supply for qualified electronic parts lists are developed and promptly issued.

(f) Ensure that the financial management of the program is consistent with the foregoing recommendations on programing, implementation and coordination.

1. Recommend funding levels
2. Monitor manpower levels and other expenditures.

(4) Appendix III is a proposed DOD instruction establishing an Advisory Group on Management of Electronic Parts Specifications, as recommended herein.

2.2 Specifications for Reliable Parts.

(1) The OSD and the Military Departments should issue the necessary directives to implement the recommended program, based on the concepts for establishing parts failure-rate levels contained in the report of Subgroup ST-1, and to bring all military electronic-parts specifications up to current design demand.

(2) The prototype specifications and the description of the basic concepts and objectives and explanatory material contained in Volume II should be forwarded to activities that prepare military specifications for guidance in the formulation of new and revised parts specifications.

(3) The prototype specifications and explanatory material in Volume II should also be forwarded to industrial associations for information and guidance.

(4) The concepts outlined in section 1 of Volume II should be applied to all military specifications for electronic parts.

(5) In the promulgation of directives and instructions, the importance of the time element and the need for achieving coordination, without necessarily having full agreement on all detailed procedures and requirements, should be emphasized.

(2) An appropriate time schedule should be established, based upon the importance of the specification and the qualification item. Further, it is recommended that a period of 12 months be considered the objective timetable for implementing these procedures in specifications for essential items.

2.3 Procedure for Qualification Approval.

(1) The procedure for qualification approval of electronic parts and tubes should be revised to establish qualification for a specific reliability level that will be monitored during production.

(2) Prior to the submission of samples for qualification approval, the manufacturer should show evidence that he has the test equipment he needs to conduct all tests required in the specification and that he has satisfactory in-plant process control.

(3) Qualification approval should be given only on submission of sufficient data representative of production quality; furthermore, the manufacturer should conduct all qualification tests under the surveillance of the appropriate government inspection service.

(4) Qualification approval should be re-evaluated periodically by test-data audit; it may also be re-evaluated as a result of changes in the product design or manufacturing process or when the specification requirements have been altered.

(5) Department of Defense Manual M204, Military Qualified Products List, should be revised as required to establish and promulgate a list of approved sources of supply for qualified electronic parts.

(6) The recommended procedure for qualification approval should be applied to all specifications for electronic parts.

(7) Approved sources of supply lists for qualified electronic parts should be made readily available to both parts users and parts manufacturers.

2.4 Acceptance Inspection.

(1) Parts manufacturers should be responsible for all acceptance inspection called for by a specification (see Volume II, section 3).

(2) Equipment manufacturers should require parts manufacturers to conduct acceptance inspection and to supply certified test data with each shipment as objective evidence of the parts' conformance to military specifications.

(3) Each part should be marked, or suitably identified, to indicate that the parts manufacturer has qualification approval and that the part meets the requirements of the specification.

(4) The Department of Defense should act early to standardize an appropriate method for handling the "consumer's risk" problem in military specifications for electronic parts relative to tests other than those for failure-rate inspection.

(5) Another program should be initiated for establishing reliability assurance in military specifications for small lots of expensive items.

(3) A project should be established for specification development and control procedures for identification, design, and test requirements in parts and assemblies. This project should be organized to expedite the implementation of the overall program.

2.5 Design and Procurement Documentation.

(1) A project should be established immediately in the Department of Defense to prepare and issue a policy manual, using as a guide the information contained in Volume II, section 3. The manual should also contain information now found in Manuals M201, M202, M203, M204, M205 and M206, suitable revised to remove present contradictions.

(2) An item-numbering procedure should be established to provide a means of identifying basic parts, taking into account all the ramifications of this problem, including the factors that warrant changing--or not changing--the basic identification as the result of the revision of technical requirements.

2.6 Contractual Data Requirements.

(1) For those items not completely described by military specifications, military contractors and subcontractors should be required contractually to submit copies of their electronic-parts procurement documents (drawings or specifications) to a central organization in the Department of Defense, along with test data substantiating the conformance of these parts to such documentation.

(2) Military contractors and subcontractors should be required contractually to submit copies of their company standards for electronic parts in the format described in Volume II, section 3, to a central organization in the Department of Defense, along with test data substantiating the conformance of these parts to such documentation.

(3) Military contractors and subcontractors should be required contractually to use the test methods of MIL-STD-202 in their electronic-parts procurement documents.

2.7 Military Inspection Practices.

(1) The prime responsibility for acceptance or rejection of electronic parts under an equipment contract should remain with the equipment manufacturer.

(2) Full support should be given to a well-organized training program for government inspectors in which inspectors would receive technical and statistical training commensurate with proper understanding of the device that they are inspecting and the sampling plans being used.

(3) Government inspectors should be encouraged to assist parts suppliers in obtaining expeditious resolution of problems relating to the interpretation of specifications. Inspectors and parts manufacturers should report problems of specification interpretation to the agency that prepared the specification. This feedback will initiate the appropriate changes in the specifications.

(4) The government inspection service should verify the accomplishment of in-plant qualification-approval tests.

2.8 Procedure of Approval of Military Specifications

(1) A controlling program should be established to result in a "normal" schedule time of 45 weeks (from inception to completion of printing) for full military and industrial coordination of electronic-parts specifications.

(2) Approval of the preparation and issuance of limited-coordination military specifications should be made the responsibility of an office at the OSD level instead of the individual Military Department.

(3) Approval of the preparation and issuance of limited-coordination military specifications should be based upon a satisfactory justification prepared by the Military Department concerned.

(4) A suitable record of activities relating to electronic-parts specifications throughout the Military Departments should be maintained by an office at the OSD level, for reference purposes and to prevent duplicating activities in this field.

(5) Existing definitions, regulations and, perhaps, the name "limited coordination military specifications" should be revised to ensure that they will be binding upon all other Military Departments immediately upon issuance, except that a period of 60 days will be allowed any Department to show why the specification is not satisfactory for its use.

2.9 Procurement and Engineering Practices

(1) Effective administrative control should be established to ensure that prime contractors make maximum use of an abbreviated listing of standard reliable parts in equipment design.

(2) The styles and types of standard reliable parts should be restricted to a considerably greater degree than is currently true of military standards in order to minimize the test load inherent in establishing failure rates.

(3) Consolidated procurement of standard reliable parts should be established for replacement purposes.

(4) A study of the details of stock binning down through all levels of the supply system from stock control point to field repair activities should be instituted, directed specifically toward ensuring appropriate first-in/first-out stock control and the maintenance of information on identity and age of parts.

(5) The standardization manuals should be modified to include those procurement policies that are of concern to specification writers and essential to the adequate preparation of specifications.

(c) The electronic storage of field reporting system should be fully covered

- (1) increase the ratio of reported failures to total failures;
 - (b) provide for better analytical recognition of primary failures;
 - (c) provide for analytical criteria of misapplications; and
 - (d) make mandatory the recording of elapsed-time readings and the inclusion in these readings of operating time for units not failing.
- (2) The Military Departments should establish as standard that military equipment incorporate elapsed-time indicators where feasible.
- (3) The Military Departments should standardize one elapsed-time indicator for use in electronic equipment.
- (4) A bibliography of reports should be prepared and maintained in a state of constant revision to provide "visibility" of investigative efforts on electronic parts on a current basis, whether military or nonmilitary.
- (5) A comprehensive program to evaluate electronic parts should be established to obtain failure-rate data as a function of circuit and environmental stress.

(1) A central organization should be set up for the collection and dissemination of technical information on electronic parts defined by military specifications.

3. BACKGROUND AND DISCUSSION OF RECOMMENDATIONS

3.1 Parts Specification Management.

When one reviews the problems stemming from the Military Services' failure to prepare adequate specifications--or from the preparation of inadequate specifications--and the background of the problems, one inevitably concludes that they stem primarily from unsuitable and inadequate specification organization and management on the part of the Department of Defense and the Military Services and only secondarily from technical inadequacies.

A review of this nature emphasizes the unfortunate fact that, because of budgetary, personnel or other Departmental programs, the Military Services have considered parts specification and standardization programs only as part-time efforts and have not given them the status, attention and resources that they deserve in view of the tremendous dollar savings and greater equipment reliability they could make possible. Effective specification organization and management would have assured to such programs the attention warranted by these potential advantages. It is true that, even if there were such a specification organization and management, we would still be concerned with problems of reliability and cost, but they would be of a far less critical magnitude than they are today.

If, for example, we review the procedure for specification coordination, to justify the inordinately long time of up to 18 months that is occasionally required, we find a specification organization and management that is totally unable to cope with the simple problem that arises when an individual in one of the Military Services will not agree to some particular wording in a specification suggested by someone in another Military Service. Because he will not agree and because there is no suitable procedure for reconciliation, coordination cannot be completed and the disapproving Military Service is accused of noncooperation.

Supposedly, there is an assignment of responsibility in specification organization and management to handle just such problems. Whether it can do so may quickly be decided from analyses presented in this report section concerning the time required for coordination and the unjustifiable number of existing limited-coordination specifications.

Now, we may ask, "Why are practically all military parts specifications out of date, as far as industry know-how is concerned?" In seeking a reply, we find a responsibility assignment in specification organization and management which permits plans for future revision and development of specifications to be generated at a nontechnical level, with no suitable over-all development program to ensure consonance between the various plans submitted by the many specification-writing groups. It is true that those plans are reviewed several times--and finally at a high level, but whether such reviews are meaningful and productive can quickly be determined if one asks for a copy of the general program to keep specifications up to date with the state of the art or by reviewing the summary information contained in this report concerning needed changes to military parts specifications to bring them up to date.

Again, if we ask, "Why are faults that were originally recognized for the component or product specifications directed to the responsibility of the manufacturer?" the responsibility is dependent on specification organization and management that are not appropriate. The responsibility of the manufacturer is to be held responsible, even to the formulation of recommendations for solving the problem.

Certainly, the most serious problem relating to military parts specifications is the need for suitable specification management. Section 2 of this volume presents recommendations leading to the establishment of a suitable management organization for military parts specifications.

3.2 Specifications for Reliable Parts.

Military parts specifications have been subjected to a considerable amount of criticism in recent years by persons seeking to improve the reliability of military electronic equipment. The criticism is partially justified. In general, the claim that the specification does not represent reliable items can be traced (1) to a failure to ensure full compliance with the specification requirements or (2) to the application of the item in a way that was never intended and was not covered by the specification's requirements.

Nevertheless, it is felt that, to a considerable degree, the basic specification structure and administration, as well as the excessive time required to modify or supersede specifications, contribute to military specifications' inability to provide the required degree of protection and to keep pace with the state of the art. It is believed that a major overhaul in the present system of specification preparation and administration and the injection of some radical new concepts in specification structure, objectives and requirements are long overdue.

To assure with a reasonable degree of confidence the attainment of the extremely low failure rates of electronic parts demanded by current military equipments requires the testing of such large quantities of parts that it is impractical to require this assurance on a lot-by-lot basis. It is therefore proposed to include in parts specification some new procedures for the accumulation of life-test data, over an extended period of time, from the tests carried out in the acceptance inspection. Failure rates are to be computed from these accumulated data. The specification will establish several graduated failure-rate levels.

When sufficient data have been accumulated to assure with a high degree of confidence that the actual failure rate is less than one of the established levels, the manufacturer may apply to the qualifying agency for certification of this failure rate. As the several failure-rate levels are represented by different part numbers, this certification permits the manufacturer to supply items under the applicable number. Certification is retained only as long as the manufacturer maintains the established failure rate. Thus, the certification assures the purchaser that the applicable failure-rate level has been demonstrated and is being maintained.

3.3 Procedure for Qualification Approval

Current procedures for qualification approval provide little, if any, assurance that items purchased and represented on Qualified Products Lists can or will be supplied by the manufacturer in accordance with the specification.

...the manufacturer's ability to produce the item in quantity. This situation is the reason behind the frequent references to qualification approval as the granting of a "birth certificate." Unfortunately, equipment manufacturers, unaware of this situation, have too often placed ill-founded confidence in the QPL listing, accepting it as an assurance of the product's ability to meet all specification requirements.

To correct this situation, a number of changes are proposed in the procedures for setting up and maintaining these lists. Because these changes will not only require evidence of the inherent ability of the product to meet specified requirements but will also provide reasonable assurance of the manufacturer's ability to produce and deliver satisfactory items without excessive delay, it is proposed that the listing be called "Approved Sources of Supply for Qualified Electronic Parts List." This proposed new name for the present QPL is used in the discussion of this report's recommendations solely to prevent confusion.

The principal changes in the proposed concept of qualification are as follows:

(1) In addition to submitting qualification test data or samples for initial approval, the manufacturer must provide evidence that he possesses adequate production and test facilities and that he employs sound procedures for process and quality control.

(2) The specifications shall provide for separate identification of items having different established failure-rate levels by using different part numbers. (This point is discussed more fully in the report on Subtask 1, section 4.) The initial qualification approval must be based on tests of an adequate number of units for a long enough period to establish with a prescribed confidence that the failure rate is lower than the highest level provided by the specification. The units tested should be representative of production quality. Approval for the failure-rate level is based upon data accumulated from the lot acceptance tests.

(3) Assurance of continued conformance with the specification must be provided to the qualifying agency, thus ensuring the continual re-evaluation of the approval. This is done by routine submission of test data collected during acceptance inspection. The need for re-evaluation of approval (either for the certification of a lower failure-rate level or the loss of certification of the currently held level) will be determined on the basis of the test data submitted.

3.4 Acceptance Inspection.

Current practice in acceptance inspection relies heavily on statistical sampling plans. The relationship between the probability of acceptance and lot quality depends on the size of sample tested and the number of failures permitted, and it is completely described by the operating characteristic (o. c.) curve for the combination selected. There is an infinite number of possible combinations of sample size, allowable failures and lot sizes.

The subsidiary documents associated with the specification should include (1) item requirements sheets, providing all the detailed requirements necessary for use of the specification in procurement of the specific items listed therein, (2) military standard sheets, indicating those items designated as standard items by the military, and (3) application data sheets containing all the information required for proper use of the part in equipments. Furthermore, these documents should be printed in a manner permitting the users to reproduce them easily.

In addition to furnishing complete sets of engineering drawings, contractors are normally required to submit their purchased part specifications and substantiating test data to the procuring activities for review and approval.

Contractor's specifications and standards clearly represent a tremendous resource for military agencies in their preparation of revised and new specifications. However, this presents certain immediate difficulties, because the volume of the material is so great that it can be used effectively only by machine methods for storing, comparing and retrieving the data. Further, the data may be difficult to compare, even by machine methods, unless there is more uniformity in format and more standardization of test methods.

3.7 Acceptance Inspection Practices.

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manufacturers even pretend to run all the tests. If for any reason a test is difficult to conduct, even when the parts are standard parts, the manufacturer (parts maker) knows that he has parts that comply with the military specification.

As part of a system to assure that all test requirements have been carried out (especially in the area of reduction of cost to the Defense budget), the military inspectors can provide most valuable assistance. By monitoring and reporting, they can eliminate duplication in the efforts of many buyers in assuring that the tests, as evidenced by the test data supplied have been properly conducted.

3.8 Procedures for Coordinating Specifications.

Unless radical changes can be made in the procedures now established for coordinating specifications, we must accept (1) coordinated specifications one to one and one-half years out of date, (2) a continuing growth in the number of limited-coordination specifications and (3) a vast increase in the use of nonstandard parts.

An up-to-date specification covering a type of new item with potential multiple uses can be written in a matter of weeks. Yet, based on the present established procedures, it would be extremely unlikely that coordination agreement could be reached and the specification made available to the military contractor in less than 18 months. This specification, which was a good one initially, is then unsuitable for use when issued because of the delay.

The recent rapid growth in the number of limited-coordination specifications stems directly from this delay and from the desire of each Military Service to supply a measure of guidance in parts selection to its contractors. The general unhappiness with the coordination procedures felt by both the Military Services and industry has culminated in a recent almost unbelievable public statement by a representative of a Military Service that "it proposes to continue issuance of its own limited coordination specifications with only a token effort toward their coordination."

The confusion and increased cost to the Defense budget resulting from limited-coordination specifications are very real to all contractors who have contracts with all three Military Services. Many examples can be cited of duplicative limited-coordination specifications that caused complete retesting of identical items. The very sad fact is that, in spite of the duplicating specifications and the duplicate testing, the parts manufacturers make only a single type of item, which they supply (and also separately test) to all the duplicating specifications.

Can there be any doubt concerning the need for, and benefits of, coordination?

3.9 Procurement Practices.

There is no doubt that the logistic problems of the Military Services relating to electronic parts exert a significant effect on the over-all reliability of the military electronic equipment. Even when the equipment manufacturer uses only standard parts, there are very real logistic problems in trying to keep the stock bins filled with "fresh" stock. (It has been estimated the cost to the Military Services of purging the stock bins of "old" electronic parts would be 100 million dollars.) When the equipment contractor uses nonstandard parts, the logistic problems become almost insuperable.

Most electronic building equipment of the type which has a long life requires repair and maintenance have experienced repeated reports of equipment failures, or "down time," which are often traced to a failure in some component tied to the "substitution of the wrong part, an 'old' part or a part of less than equivalent characteristics."

3.10 Sources and Source Listing of Technical Information

A considerable amount of research and development on electron devices (tubes and semiconductors) and electronic parts is sponsored by agencies within the Department of Defense. Interim progress reports and final development reports on these activities are normally required by the sponsoring military agency, all of which are listed by the Armed Services Technical Information Agency, including abstracts for the unclassified (security) reports. Further, some of the unclassified reports are listed, with abstracts, in the U.S. Government Research Reports.

The kind of data of concern in this study for items defined by military specifications, however, is properly characterized as "evaluation" and is normally not considered as "research and development"; therefore, it is rarely obtained from studies sponsored under the research and development effort. Such data as exist are obtained from qualification testing (in-plant or in government laboratories) or from special evaluation studies sponsored by military agencies, either as in-house work or by contract.

For several years, certain trade-association committees have addressed themselves to the task of preparing industry specifications and related documents (1) for items currently available but not defined by military specifications and (2) for items not available but needed to satisfy the current design demand. Related to the latter effort is the need for the military to recognize industry standards and specifications as a bona fide technical description acceptable for procurement of industry standard items by contractors (and subcontractors) and by the government in direct procurement. This need was recognized by the Department of Defense and resulted in the current coordination effort on an instruction relating to the use of standardization documents issued by industry groups.

The specification and standardization projects of the trade association relate to items needed by the electronic-equipment industry for use in their military equipment designs; and substantiating data showing that articles exist, as defined by the industry specifications and standards, are generated for the most part by the users and are limited to what the manufacturers.

3.11 Exchange of Technical Data

There can be little doubt of the potential good inherent in proposals for the exchange of technical data. The actual benefits to be realized, however, from any such exchange depend on several factors. The first factor, and probably the most important for maximum realizable benefits, is the mechanics of the system of information storage, retrieval and dissemination. Too much complexity can result in little or no use of what may be extremely valuable information. The second factor in the need to collect, store and retrieve information is a standard format and standard test procedures. The output of electronic accounting machines can

never be better than their input, and the output cannot be as efficient as the user understands the language as it is in the output. When these two most important factors can be integrated, a tremendous saving in man hours, equipment and dollars can be realized in reducing present situations involving multiple testing.

4. REPORTS ON SUBTASK ASSIGNMENTS

SUBTASK 1

1. Summary

A new concept has been developed for the incorporation of procedures for determining failure rates into component-parts specifications. Utilizing acceptance test data, these procedures provide a means for failure-rate certification when sufficient data have been accumulated. These procedures have been incorporated into a prototype capacitor specification and prototype specification sheets for a miniature receiving tube. In addition, the technical changes required to incorporate the concept into the current military specification on relays are included. (All these documents are published in Volume II of this report.)

2. Statement of Mission

This subgroup was assigned the responsibility for the "incorporation of reliability requirements in specifications, including test requirements necessary to assure the reliability levels defined." The subgroup found it necessary to limit its efforts to the formulation of concepts, principles and techniques for reliability assurance in the preparation of part procurement specifications. No effort was devoted to detailed acceptance limits for various types of parts, nor to determining or evaluating new performance tests necessary for military use of the parts.

3. Basic Premises

The efforts of the subgroup were based on the following premises:

(1) That the parts manufacturer is responsible for assuring the parts user that his product conforms to the requirements of the applicable military procurement specification.

(2) That parts manufacturers can be provided with facilities where necessary to perform product acceptance tests in accordance with the requirements of the applicable part acceptance-test specifications. This is necessary if we are to achieve any significant reduction in the amount of acceptance testing performed by parts users.

(3) That part acceptance-test specifications are based on some level of acceptable part reliability and that the specification for a particular part contains the necessary measurement tests and acceptance standards to give assurance of that particular level of reliability.

(4) That effort is directed toward formulating specifications that can be used for acceptance testing of parts that can be currently manufactured in quantities and in a time period sufficient for military needs. Military part performance requirements that cannot be satisfied by currently manufactured parts, either

because of their known inherent incapability or because of a lack of understanding of their true capability, shall have a means or an incentive for their attainment other than an acceptance-test specification.

(5) That effort will be confined to the long-life, nominal-stress types of military applications. Dependence will be placed upon application information and reliability trade-off guides on any given part for the short-life, high-stress types of applications. The reason for this is that the problem will be entirely too great for the current effort if the many and various high-stress types of applications are considered. In the main, the total quantity of parts consumed in these applications to date is believed to be quite small in comparison with the more conventional uses of parts.

(6) That primary consideration will be given to the specification controls that affect the operation of parts with respect to time, as contrasted with the initial-operation (or zero-hour) type of controls. The reason here is that the primary concern is to assure part reliability and that the direct approach to this is through suitable life-test controls. The initial-test (or zero-hour) type of control, is valuable to assure product interchangeability, and it is otherwise necessary in the event that life tests under certain operating conditions are impractical. Conceivably, this could be the case with the impact type of shock tests or other severe environmental conditions.

(7) That the lot-acceptance type of specification controls will be considered for parts that normally lend themselves to a high production rate or to an essentially continuous production, even though at a relatively low rate. In the latter case, the specification may employ a process-average or a quality-history type of concept.

(8) That reliability assurances will be incorporated for various levels of stress severity (both circuit and physical environments) that cover the bulk of military requirements. Reliability tests will be optimized by statistical techniques.

4. Incorporation of Failure Rates Into Specifications

4.1 Proposed Basic Concept for Reliability Specification.

To assure the high orders of reliability of a part demanded by current military equipments with a reasonable degree of confidence, such large quantities of parts must be tested that it is entirely impossible economically to require this assurance on a purely lot-by-lot basis. It is obvious that any specification concept, no matter how correct from a statistical standpoint, is doomed to fail if it does not take adequate cognizance of economic practicability. It is therefore evident that the assurance of parts reliability can only be achieved by building, on a long-time basis, a confidence in the quality history of a manufacturer's product. From this it was concluded that the major change in concept necessary to provide for reliability assurance is the accumulation of failure information over an extended period of time.

While this concept will probably require the modification of current procedures for qualification approval and acceptance testing, the changes in general will be minor, primarily involving the modification of sampling plans to make them consistent with the failure-rate levels specified.

The accumulation of failure data over an extended period of time, however, makes it necessary to include in the specification entirely new procedures to provide for the generation and recording of the data and the determination and certification of failure rates. It is felt that the primary source of these data should be the regular acceptance tests performed in connection with production inspection. In addition, by requiring the extension of life tests beyond their normal end point to a maximum determined by the expected life, or by increasing the number of items tested, the necessary data can be generated more rapidly. From these data, failure rates may be computed with a high level of confidence.

When the computed failure rate is less than one of the specified levels, the manufacturer should be certified as a supplier of the component part at this failure level. The specification should provide for a series of failure levels in steps graduated down to the lowest practicable figure.

4.2 Examples of Reliability Specifications.

To demonstrate the principles embodied in the basic concept just described, studies were conducted to determine the changes that would be required in the current applicable military specifications for three specific types of electronic parts in order to incorporate this concept into the specifications. The parts selected were:

Paper-dielectric capacitors
Miniature receiving tubes
Relays

These three items, representing high, medium and low production rates, were selected to provide features representative of the wide range of problems inherent in the subgroup's mission.

The studies were conducted by three separate groups of representatives chosen from industry and the military. They followed a unified approach, which is outlined in Volume II, section 1, "Concepts and Objectives for the Preparation of Prototype Specifications Embodying Failure-Rate Requirements." This document describes an integrated procedure for the initial qualification, acceptance and failure-rate certification of parts, essentially consisting of the following three parts:

(1) Qualification approval, employing sufficient samples in the life tests to establish that the failure rate is less than a specified nominal figure: Since this is only a one-time test which permits the manufacturer to initiate the data-accumulation process, the nominal failure rate will be somewhat high and the confidence level of the determination low (80 percent or less). The actual sample size and test duration will be based mainly on economic practicability. In these as well as the acceptance and failure-rate certification tests, maximum use is made of acceleration factors established on the best available data, experience and engineering judgment.

(2) Acceptance tests, performed on a lot-by-lot basis, with sample sizes set to provide a reasonable confidence level that the failure rate is less than some nominal value: For the failure-rate level at which initial qualification approval is granted, the confidence level is higher than that employed in the qualification tests (80 to 90 percent). For the lower failure rates, certification of the established

Failure level will have been based on accumulated data on production lots, with a high confidence level (90 to 95 percent) for the determination. The confidence level for the failure rate may, of course, be revised and sample sizes determined on the basis of economic practicability.

(3) Failure-rate tests, providing for the accumulation of life test data over an extended period of time: These data are generated from the acceptance tests and extensions of them. Failure rates are computed from the accumulated data at a high (90 to 95 percent) confidence level. Beginning with the initial failure rate specified for the qualification tests, a series of graduated failure-rate levels is established. It is provided that, when the computed failure rate falls below one of the established limits, the manufacturer will receive certification of this from the qualifying activity. This document further provides that five "established failure levels" should be used, the highest to be no higher than that presently specified in the current corresponding military specification. The other levels should be 1, 0.1, 0.01 and 0.001 percent per 1000 hours. The instructions indicated that these levels were to be applied at the maximum rated operating conditions. Further, the groups were instructed to provide derating information, if possible, in cases where the lowest failure rates given above were either beyond the state of the art at maximum rated conditions or where it was impractical to establish the level directly because of the unit hours of test required.

In formulating guidelines for these studies, consideration was given to the application of new sampling plans to the initial (Group A) tests of the specification, instead of using Standard MIL-STD-105. At present many groups are seriously thinking of abandoning or modifying the acceptable quality level (AQL) of "producer's risk" philosophy in favor of sampling plans based on either the lot tolerance percent defective (LTPD)--or "consumer's risk"--concept, or on the acceptable defective level (ADL)--or "indifference point"--concept. In view of the amount of attention being given to this problem by other groups, no attempt was made to incorporate any of these new philosophies into the acceptance test procedures, other than those for life tests. It is recognized, however, that in future formulation of procurement specifications the adoption of such sampling plans must be seriously considered.

Volume II, section 4, is a complete specification covering capacitors of a type currently covered by Specification MIL-C-14157. This prototype specification includes not only the concept discussed herein but also reflects the changes in format and administrative procedures recommended by Subgroups ST-2 and ST-4. Section 5 of Volume II indicates the type of technical changes required in Specification MIL-R-5757C to incorporate the failure-rate concept and states the technical basis for these changes. Section 6 consists only of prototype specification sheets for Specification MIL-E-1 that are required to apply the failure-rate concept to one type of miniature receiving tube.

It must be clearly recognized that these prototype specifications (in sections 4, 5 and 6 of Volume II) and the associated item requirements sheets were prepared chiefly to exemplify the application of the basic concept to an actual specification. To do this in the time available, it was necessary to make many compromises in details which either are not pertinent to the basic objectives (e.g., details of test procedures, dimensional requirements) or, while pertinent, are a somewhat arbitrary choice (e.g., the confidence levels for acceptance tests in the capacitor specification). These details can and should be resolved in the normal processes of specification coordination. The prototype specifications are not intended to be considered as first drafts of revised specifications for the parts concerned nor to be

referred to a specification group for coordination and promulgation as new or revised specifications for these parts. Rather, they are meant to serve as examples of this new approach to specifying reliability and to guide the specification-writing activities in the formulation of all new parts specifications. It must also be recognized that, since the prototypes are primarily intended to illustrate principles, the application of these principles to specifications for other types of parts will necessarily call for some modification of the technical and administrative details to fit the specific item.

To illustrate this, the life-test (failure-rate) sampling plans for the prototype specifications were developed to exemplify a method for proving conformance with the reliability requirement in parts specifications. The technology of life-test sampling plans is experiencing rapid development, with continual improvement. Therefore, users of this report must bear in mind this rapidly changing technology and make use of the latest statistical techniques and improved plans.

5. Conclusions

- (1) The reliability of electronic parts can be measured, specified and controlled by means of suitable procurement specifications.
- (2) Reliability assurance, as related to the procurement of electronic parts of high orders of reliabilities, requires the life testing of large quantities of parts for long periods of time, testing time and quantity depending upon the service operating time for which reliability assurance is desired and the required level of reliability.
- (3) Most segments of the electronic-parts manufacturing industry do not at present have the facilities for the performance of life tests on a scale that will ensure the levels of reliability that parts can now attain.
- (4) In order to incorporate reliability requirements in specifications, new procedures are needed to provide a mechanism for accumulating a large amount of life test data on the product and its effective use.
- (5) Data can be accumulated by maintaining a continuous record of acceptance tests, supplemented by additional test data if necessary.
- (6) The specification of failure rate should be based on discrete, graduated failure-rate levels. There should be a means of certifying the manufacturer when he submits adequate evidence that the indicated failure-rate level has been achieved.

6. Recommendations

It is recommended that:

(1) The Department of Defense issue the necessary directives to implement the recommended program, based on the concepts for the establishment of parts failure-rate levels contained in this report, and to bring all military electronic-parts specifications up to current design demand.

(2) The prototype specifications and the description of the basic concepts and objectives and explanatory material contained in Volume II should be forwarded to activities that prepare military specifications for guidance in the formulation of new and revised parts specifications.

(3) The Department of Defense prepare and issue, for the guidance of activities preparing military parts specifications, a manual of instructions containing the detailed procedures to be followed in the revision of specifications in accordance with the concepts and objectives developed in this study.

(4) The prototype specifications and explanatory material in Volume II also be forwarded to industrial associations for information and guidance.

(5) The concepts outlined in section 1 of Volume II be applied to all military specifications for electronic parts.

(6) The Department of Defense establish an appropriate time schedule based upon the importance of the specification and the coordination time; further, that a period of 12 months be considered the objective timetable for implementing these procedures in specifications for important items.

(7) In the promulgation of directives and instructions, the importance of the time element and the need for achieving coordination, without necessarily having full agreement on all detailed procedures and requirements, be emphasized.

SUBTASK 2

1. Summary

Subgroup ST-2 investigated and submitted recommendations on:

- (1) Procedures and definitions for the establishment of approved sources of supply for qualified electronic items lists
- (2) Military inspection practices
- (3) Acceptance inspection

2. Statement of Mission

This subgroup was assigned "specification requirements and test methods or programs other than those specifically directed to reliability considerations, needed to form the basis of qualified products lists, acceptance testing, etc." Subsequently, the work was divided into three areas:

- (1) A review of qualification approval procedures as they relate to the individual manufacturer's products; this became section 3 of this report, "Procedures and Definitions for Establishing Approved Sources of Supply for Qualified Electronic Parts Lists."
- (2) A study of over-all military inspection procedures, which became section 4 of this report, "Military Inspection Practices."
- (3) A study and evaluation of present specification inspection procedures, which became section 5 of this report, "Acceptance Inspection."

3. Procedures and Definitions for Establishing Approved Sources of Supply for Qualified Electronic Parts Lists

3.1 Statement of the Problem.

Over the past several years, as a result of a misinterpretation of the intent and significance of "Military Qualified Products Lists" (as applied to electronic parts), an unwarranted confidence in the ability of electronic items so listed to meet all specification requirements has repeatedly caused delays in the delivery of items to using design activities and has increased the cost and reduced the reliability of military electronic equipment. Many studies, some made five years ago,³ have

³Report of Signal Corps Ad Hoc Subcommittee on Procurement of Component Parts and Enclosure 2, "Discussion of the Problem," SIGEL-DE-2, 8 July 1954.

shown the need to clarify the intent and significance of such lists when applied to electronic items. As such clarification and the addition of other requirements result in an entirely different concept of "qualification," the title "Approved Sources of Supply for Qualified Electronic Parts Lists" has been selected to distinguish the following approval procedure from earlier procedures.

3.2 Summary of Policy.

Because of the possible variations in design and quality of electronic items and the nature of the tests for them, and also to increase the assurance that there will be no delay (beyond that normally and routinely experienced in the delivery of items being purchased), certain inspection is required prior to the award of a contract. This "Qualification Inspection" may be accomplished in advance of and independently of any specific procurement action. Manufacturers of items that pass the qualification inspection shall be considered to be "approved," and the item listed shall be an item with "Qualification Approval"; they shall be identified, together with the items tested, on Approved Sources of Supply for Qualified Electronic Parts Lists. Since qualification approval will proceed on a continuing basis, the manufacturer and his product will be subject to constant re-evaluation, which will mean his continuation on the list or his removal therefrom. To establish an approved sources of supply list on an electronic part, a specification must exist for it that includes the requirement for qualification approval, specifies qualification inspection and includes the additional details necessary to the administration of the program for the specific item.

3.3 Justification for Need.

The only justification for including qualification approval requirements in an electronic item specification and for establishing an approved source of supply for qualified electronic parts list is the following:

Delay (beyond that normally and routinely experienced in the procurement of an item) would be experienced if some evidence of the ability of the manufacturer to produce the item were not available at the time of issuance of the purchase order.

3.4 Significant Factors.

When an approved source of supply for qualified electronic parts list is based on conformance to the specific requirements stated herein, there can be a high degree of confidence that the following are of significance:

(1) That the manufacturer made a quantity of the items which met the requirements of the specification at one time and, from all available acceptance inspection records, continues to do so.

(2) That the manufacturer possesses--or has the use of--satisfactory test equipment for all tests required by the specification.

(3) That the manufacturer maintains satisfactory in-plant process control.

(4) That it may reasonably be assumed that a manufacturer so listed will be able to deliver items meeting the specification requirements in a reasonable length of time.

3.5 Basic Requirements.

(1) The entire test program outlined in a specification shall be divided into (a) qualification inspection and (b) acceptance inspection. These two types of inspection may be further divided into several groups, each group having different sampling rates and tests.

(2) The specification shall provide for separate identification of parts having separate levels of failure rates by the use of different part numbers. The failure-rate levels used shall be chosen from the following:

Failure rate per 1000 hours: X% (varying with the item)
1.0%
0.1%
0.01%
0.001%

Note: The failure-rate level specified is the maximum at the 90% confidence level (10% consumer risk) and shall be on the maximum rated use condition.

(3) The specification shall include requirements for the submission of failure-rate information to the approving activity and for in-plant process control and adequate facilities, either by referencing another specification or by including the details. Initial assurance of conformance shall be provided the approving activity by the manufacturer concurrently with his routine reporting of acceptance inspection results.

(4) Initial qualification approval for a specific failure-rate level shall be given when failure-rate information obtained from completed qualification inspection tests justifies that specific level and when all other associated specification requirements have been met.

(5) Continued qualification approval for a specific failure-rate level, or for a change to a lower or to a higher specific failure-rate level, shall be based upon failure-rate information obtained from acceptance inspection tests and upon conformance with all other associated specification requirements.

(6) The specification must contain instructions on how a manufacturer receives his very first listing when he has no order or contract. It is suggested that he give notice to whoever controls the specification that he is ready to start initial qualification inspection, with inclusion on an approved sources of supply list as his goal. He then starts, with or without an order.

3.6 Re-evaluation Approval.

The qualification approval procedure will ensure that the manufacturer and the manufacturer's product will be continually re-evaluated. Consequently, the

specification must include the details of the kind and number of failures that will result in removal from the approved sources of supply list. Re-evaluation will also be necessary when:

- (1) The manufacturer has modified the item;
- (2) The manufacturer has instituted a design change in the material used or in his processing;
- (3) The specification requirements for the item have been amended or revised sufficiently to affect the character of the item.

3.7 Using Design Activities' Lists of Standard Parts and Approved Sources.

Most using design activities (equipment contractors) maintain a list of standard parts and approved sources for their own use. These should not be confused with the parts approved on Military Qualified Products Lists. Where a using design activity will agree to working arrangements under specific contracts or groups of contracts with a particular contracting activity, it is possible that the use of a specific using design activity's approved sources list might simplify approval procedures for nonstandard parts. The specific contracts or groups of contracts, in this case, should recognize the existence of the using design activity's list and should define when and how it can be used.

3.8 Recommendations.

It is recommended that:

- (1) Department of Defense Manual M204, Military Qualified Products List, be revised as required to establish the approved sources of supply list.
- (2) The qualification approval procedure described before be applied to all specifications for electronic parts.
- (3) Approved Sources of Supply for Qualified Electronic Parts Lists be made readily available to both parts users and parts manufacturers.
- (4) The Armed Services Procurement Regulations (ASPR) be revised, as applicable, to be consistent with the preceding recommendations.

4. Military Inspection Practices

In this section of the report, the subgroup evaluates current inspection practices and suggests improvements. The inspection function is so important that the best specification is meaningless to the user of electronic parts unless this is recognized and the function supported to ensure that specification requirements are fully enforced.

4.1 Present Inspection Policies.

The Department of Defense's quality-assurance policy is to provide government source inspection for products shipped to Defense using activities and, where necessary for government inspection purposes, for those parts that are shipped to an equipment manufacturer's plant for incorporation into equipment to be supplied on a government contract.

In keeping with the general government inspection policy (ASPR-14-001 and DOD Instruction No. 4155.9) "to assure the most economical inspection of subcontracted supplies consistent with protection of product quality," ASPR-14-185 states that the primary purpose of government source inspection is to assist the government inspector at the equipment manufacturer's plant in determining the conformance of supplies with contract requirements; it does not relieve the equipment contractor of any of his responsibilities under the contract.

Where government inspection is currently required, DOD Instruction No. 4155.9 provides uniform Department of Defense policies and procedures for procurement inspection of items covered by military specifications. It establishes a policy that suppliers to the government shall be responsible for performing the examinations and tests set forth in the specifications to substantiate the parts' conformance to specification requirements; that suppliers have adequate test facilities or make arrangements for the use of suitable test equipment; that the government inspector make optimum use of the contractor's test records; and that the government inspector see that a product verification inspection is conducted to show that the supplier's records represent the true quality of the product.

Section V of the Instruction provides that the extent of government inspection may be adjusted to reflect a number of factors, including the amount and technical specialties of available government inspection manpower, the quality history of the product, the item's complexity, etc. To further ensure the most economical and effective use of government inspection efforts, the Instruction establishes a policy that government inspection at subcontractors' plants is required only when such inspection is necessary to assist the government inspector at the prime contractor's plant in determining whether subcontracted supplies conform to contractual requirements.

In summary, DOD quality-assurance policy places on the prime contractor the responsibility for ensuring product quality, including the quality of any part produced by a subcontractor, and provides for government inspection at subcontractors' plants when it is necessary to "assure the most economical inspection of subcontracted supplies consistent with protection of product quality."

4.2 Effectiveness of Current Inspection Practices.

To obtain a picture of current inspection practices, this subgroup took advantage of the results of a questionnaire circulated by Subgroup ST-5 to approximately 30 equipment manufacturers. To obtain more information, Subgroup ST-2 circulated special questionnaires to about 25 equipment manufacturers and 20 parts manufacturers. The results can be summarized as follows:

Equipment manufacturers purchase approximately 50 percent of the electronic parts used to military specifications; government source inspection is requested on approximately 35 percent of all parts other than tubes or semiconductor devices. (Government source inspection is mandatory on all electron tubes and semiconductor devices sold to military specifications.)

Although some equipment manufacturers depend on government source inspection as a "guarantee" of minimum quality level, using the QPL as a shopping list, they buy from the lowest bidder and conduct little, if any, incoming inspection. Others who are engaged in missile work or have equipment contracts specifying reliability levels require thorough incoming inspection on all tubes and parts that

have had government source inspection. Some typical replies, representative of the majority, follow:

Company A--Government source inspection "...merely keeps the parts vendor alert that basic quality 'assurance' audit continues to be made. In some cases it is actually detrimental in that certain vendors claim immunity to the return of defectives that we find in the received lots, on the basis that 'Government inspector accepted the lot, based on the data taken, and therefore we have no further responsibility.'"

Company B--"No assurance that parts are in compliance. All too often most vendors have only part-time government inspection, and, therefore, assurance of product quality is not possible."

Company C--Government source inspection "...probably helps control general inspection procedures and broad conformance to specifications. Does not give us much assurance that a specific part meets requirements to which it was ordered."

Company D--"Utility [of government source inspection] questionable--we will 100% or sample test all items received even though items have been government source inspected."

Company E--"For the most part, Source Inspection provides little or no material benefits to the contractor. It does not relieve him of any responsibilities for the quality of the parts or afford him any avenue of come back on the vendor in the event of malfunctions. It appears primarily a routine providing a paper satisfaction and the intangible benefits of a surveillance system. The occasional reported findings of an inspector at source regarding inadequacy of a vendor's test equipment serves a useful purpose but this information should be obtainable by a far less costly procedure."

Company F--"Reasonable assurance that the components inspected and shipped meet the specified requirements. Limitation of effectiveness is imposed by the inspection system itself and the technical capability of the monitoring personnel."

Responses from parts manufacturers threw light on several different facets of the problem: They thought highly of the average government inspector and indicated that he would have little, if any, trouble keeping up with the state of the art; that the quality of government inspection was high in their respective plants; and that only a small portion of military specifications contain provisions difficult to interpret. (The exception was the capacitor specification, and almost every capacitor manufacturer commented on the difficulties it created for both the inspector and the company.) An almost overwhelming response was indicated for the introduction of in-plant qualification approval testing under the supervision of the government inspector.

Some typical replies from parts manufacturers on the advantages and disadvantages of government source inspection are interesting:

Company P--"Advantages include a certain amount of prestige with some customers, especially when Qualification Approval leads to inclusion on

Qualified Products Lists and when purely military types or products can be promoted. Source inspection usually means more detailed testing and inspection on lot-by-lot basis rather than being able to apply usual methods and procedures of quality control. This is a disadvantage and government source inspection does not eliminate customer complaints by any means. Many customers also perform a receiving inspection, and questions of correlation of test data arise too often."

Company Q--"A good government source inspection tends to raise the level of quality of product. Company inspectors and production people are more careful due to the fact that they see a government inspector on the premises."

Company R--Government source inspection "...decreases customer necessity for extensive testing; insures government agencies of quality level on direct purchases where their facilities do not permit testing. We are agreeable to furnishing Government inspector information that will not be made available to a civilian customer."

Company S--"The government would be farther ahead by employing fewer, more intelligent and better educated inspectors."

"The implication of quality by Government 'acceptance' of a military product is misleading particularly if a sampling plan is used. The practice of shipping 'accepted' lots to military customers and rejected lots to civilian customers is also misleading since the basic production quality is inherent in both cases because the probability of defectives is essentially the same. The only job of government inspection should be the assurance that the manufacturer utilizes good quality control procedures, has qualification approval for the product, and is manufacturing the product to a military specification. Acceptance of the product should be the responsibility of the customer."

"With regard to 'in-plant' qualification approval, there is no doubt that the procedure can be speeded up by the use of the manufacturer's facilities, but the test should be supervised by a government laboratory--not the local inspector."

4.3 Recommendations.

(1) The prime responsibility for acceptance or rejection of electronic parts under an equipment contract should remain with the equipment manufacturer.

(2) Full support should be given to a well-organized training program for government inspectors in which inspectors would receive technical and statistical training commensurate with proper understanding of the device that they are inspecting and the sampling plans being used.

(3) Government inspectors should be encouraged to assist parts suppliers in obtaining expeditious resolution of problems relating to the interpretation of specifications. Inspectors and parts manufacturers should report problems of specification interpretation to the agency that prepared the specification. This feedback will initiate the appropriate changes in the specifications.

5. Acceptance Inspection

Four major areas requiring attention are: (1) provision of adequate quality assurance in small lots of expensive items, (2) early standardization of a method to handle the consumer's risk problem, (3) improvement of quality-assurance requirements in specifications and (4) extensive use of certified test data.

5.1 Quality Assurance in Small Lots of Expensive Items.

Electronic-system reliability is usually influenced by a few expensive items, for example, gyros or magnetrons. For this kind of item, specification of quality assurance becomes difficult because of the expense of the required tests. It has often been shown that this cost in many cases can be a minor item compared to the cost of system unreliability in the field. Consequently, statistical techniques (such as chain sampling and sequential sampling) and contractual guarantees should be thoroughly investigated with a view to optimizing reliability assurance for each situation.

5.2 The 90-percent Confidence Level in Sampling Plans.

Sampling plans are used as a means of deciding whether to accept a lot of items when only a sample of the lot has been examined, thereby obviating the necessity of testing each item in the lot. As currently employed, the sampling plans in Standard MIL-STD-105 indexed by AQLs permit very wide variation in the discrimination between "good" and "bad" lots at the 90-percent level of confidence (consumer's risk = 10 percent) for different lot sizes. Because of this, buyers generally prefer a sampling plan that will guarantee a stated maximum percent of defective items for lot quality, whether 100 or 10,000 items make up a lot. Specification of lot quality in terms of percent defective or in terms of failure rate at the 90-percent level of confidence, however, assures the buyer a more meaningful guarantee by a given sampling plan, even though the AQL may be more typical of the actual quality of the product.

The Electron Tube Panel of the Aerospace Industries Association, which has been concerned with this problem for some time, has suggested with the Electronics Industries Association that a standardized approach be adopted to present the needed information for the use of specification writers. Accordingly, the Office of the Secretary of Defense and the three Military Departments are working on a project to provide this information in the next revision of Standard MIL-STD-105, which is expected in June 1960.

5.3 Improved Quality-Assurance Requirements in Specifications.

Inasmuch as the majority of acceptance-inspection problems appear to stem from inadequately defined specification requirements, the DOD program now being developed should be supported to ensure the incorporation of unambiguous and practical quality-assurance requirements that would give the required levels of reliability in each new specification. A guide for specification writers should be provided that would outline procedures for achieving these ends.

5.4 Certified Test Data.

The use of certified test data is not a new concept; the subgroup recommends that the wider use of this technique would be useful in reducing the amount of testing by the purchaser of electronic parts.

5.5 Recommendations.

(1) Statistical techniques (such as chain sampling and sequential sampling) and contractual guarantees should be thoroughly investigated with a view to their use in giving greater quality assurance in military specifications for small lots of expensive items.

(2) The 90-percent level of confidence (consumer's risk = 10 percent) should be used for specifying failure rates in electronic parts specifications.

(3) The DOD program for ensuring the incorporation of unambiguous and practical quality-assurance requirements that would give the required levels of reliability in new specifications should be supported. In this program, provision shall be made that government inspectors conducting audits of parts manufacturers' facilities, quality-control programs and spot checks of outgoing product quality should determine conformance to military specification requirements. The degree and frequency of such audits and checks should be prescribed in the individual specifications.

(4) A guide or manual for specification writers, outlining appropriate procedures for including reliability- and quality-assurance requirements in parts specifications, should be developed to expedite the implementation of the over-all program.

(5) Equipment manufacturers should require parts manufacturers to supply certified test data with each shipment as objective evidence of the parts' conformance to military specifications. Each item should be marked or suitably identified, possibly with a symbol having a government copyright, indicating that the parts manufacturer has qualification approval and that the part meets a military specification.

(6) Equipment manufacturers should make maximum use of certified test data.

SUBTASK 3

1. Summary

This report by Subgroup ST-3 contains detailed recommendations and supporting data for (1) the collection of test data (including failure-rate data) from all Military Service contractors and subcontractors, (2) the use of such data for preparing revised and new military specifications and (3) the establishment of a program to obtain and publish failure-rate data for designers of electronic equipment.

2. Statement of Mission

Subgroup ST-3 was assigned the task of studying "methods and procedures for the adequate collection and dissemination of technical information on both parts in use and new items."

3. Definitions

For the purpose of this report, technical information comprises the terms defined as follows:

Application data for parts in use - Those technical characteristics that the designer should consider in choosing and applying the part in his design. Some application data are included in Volume II (section 6) of this report and, as such, have been helpful to the designer. Other characteristics that should be considered as application data (or use-limitation data) are derived from the requirements in the related specification.

Basic failure rate - That failure rate established as a requirement for acceptance, as contained in parts specifications, and determined from the tests required in the specification and as a function of the conditions required by such tests.

Predicted or application failure rate - The basic failure rate modified by the conditions of circuit and environmental stress, to the extent that these stresses differ from those established for determining the basic failure rate. (It is intended that the predicted failure rate for parts will be the failure rate used in the computation of equipment or system failure rates.)

Observed failure rates (defined) - Those failure rates calculated from equipment or system failures, for example, in demonstrations of mean time between failures of equipment or systems.

Technical information on new items - This does not differ in principle from the foregoing except that (1) the mass of available data may be significantly less owing to limited experience with the item and (2) such items are defined generally by other than military specifications, i.e., users' and/or manufacturers' drawings or specifications. The technical information for new items, therefore, must include the defining document (users' and/or manufacturers' drawings or specifications) but is not limited to such documents.

4. Sources and Source Listings of Technical Information

4.1 Military Field Failure Data.

The intended purpose of Department of Defense Instruction No. 3232.2, "Electronic Equipment Failure Data Reporting System and DD Forms 787 and 787-1," dated 23 February 1956, as stated in paragraph IV, is to:

- A. Identify high-failure rate parts and tubes within specific equipments, including determination of misapplication.
- B. Avoid the use of inferior parts, tubes and materials in vital military electronic equipment.
- C. Identify equipments, circuits, parts, and tubes which are particularly reliable.
- D. Predict maintenance requirements.

The instruction further states that:

The success of such a failure reporting system in reflecting reliability, performance, and maintainability data is dependent on the system being utilized uniformly to report all failures and the rapid transmission of the reported failures to the proper corrective action agencies within each Department and the producers.

Since this report concerns only the reliability of electronic parts, only that aspect of the aforementioned instruction will be discussed.

An examination of various studies and critiques of this Department of Defense reporting system discloses the following facts:

- (1) Widely varying ratios of parts failures to parts issued (or replaced?) have been experienced--16 to 52 percent.^{4, 5}

⁴"Data Collection and Evaluation," by Donald W. Sharp, Arinc Research Corporation, Proceedings of the Fifth National Symposium on Reliability and Quality Control in Electronics, January 1959.

⁵A Summary of Reliability Prediction and Measurement Guidelines for Shipboard Electronic Equipment, Vitro Laboratories Technical Report No. 98, 15 April 1967.

(2) It is not evident that the failures reported are a representative sample of the total failures.

(3) The "hours in service" information is usually missing.⁶

(4) A distinction may not be made between primary and secondary failures.

(5) Only by scientific (or engineering) analysis of equipment failures by expert technicians can the field reliability failure rates be determined.

(6) A certain few of the supplementary codes identified as "types of failure" are not types of failure but are in reality "causes of failure."

It is presumed that:

(1) The supply activities of the Military Service may be able to use the analysis of data from their reporting systems to predict maintenance requirements.

(2) Certain problem areas may become evident on the basis of relative failure occurrence.

However, it must be concluded that field reliability failure rates cannot be obtained by analysis of these data, since:

- (1) Not all failures are reported;
- (2) The failures reported may not be properly identified as primary;
- (3) "Operating time" may be missing or insufficiently accurate;
- (4) Misapplications cannot be properly identified;
- (5) Operating time of units that have not failed is not provided.

4.2 Monthly Catalog of United States Government Publications.

This catalog⁷ lists documents printed by or for the U.S. Government Printing Office. Also listed are "processed" documents (i.e., publications reproduced by duplicating processes other than ordinary printing, e.g., mimeograph, multigraph, planograph, rotograph, multilith), but these publications cannot be secured from the Superintendent of Documents and requests should be addressed to the issuing office identified in the catalog.

Under the provisions of the Printing Act of January 12, 1895, all government publications are entered in the Monthly Catalog; administrative and confidential (or restricted) publications, however, are omitted.

Publications are grouped by the preparing or responsible bureau, service or agency.

⁶See Footnote 4.

⁷For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C., \$0.25 per copy; subscription price per year, \$3 (including index).

Documents of particular interest within the framework of this study are normally of the "processed" type, and where indicated are for sale by the Office of Technical Services (OTS), Department of Commerce. Some publications are further identified by ASTIA (Armed Services Technical Information Agency) AD numbers. (ASTIA services are described in section 4.3 of this subgroup report.)

Publications relevant to this study are listed under the following headings and subheadings:

Air Force Department

Air Force Cambridge Research Center (AFCRC)
technical note (TN) series
technical report (TR) series
Rome Air Development Center (RADC)
technical note (TN) series
Wright Air Development Center (WADC)
technical note (TN) series
technical report (TR) series

Army Department (publications)

Defense Department

Military handbook (MIL-HDBK) series
(Office of the Assistant Secretary of Defense (Supply and Logistics))
Military standards (MIL-STD) series
Standardization manuals (M) series

Navy Department

Ordnance Bureau, Navy
Ships Bureau
Aeronautics Bureau, Navy
NAVAER 900,000 series (publications)

4.3 Armed Services Technical Information Agency.

ASTIA was established to provide technical-information services for Department of Defense agencies and their contractors.

All DOD-sponsored scientific and technical reports are cataloged, nearly 200,000 reports being identified by subject and source. Searches may be made of single or multiple subjects (UNITERMS).

Twice monthly ASTIA publishes a Technical Abstract Bulletin whose distribution is limited to Department of Defense agencies and others engaged in the military research program. Entries refer to both classified and unclassified reports received by ASTIA, but classified titles and abstracts are omitted to keep the Bulletin unclassified.

A representative issue of the Bulletin (1 April 1959) lists approximately 1000 reports, categorized in 33 major subject divisions. Two major subject divisions (Division 7 - Electrical Equipment and Division 8 - Electronics and Electronic Equipment) contain reports on electronic parts. In the issue examined 21 titles

(and Abstracts--unclassified) of possible interest out of 90 listings were identified. The timeliness of all 90 reports in these two major subject divisions was examined with the following results:

<u>Percentage of reports</u>	<u>Interval between report publication date and date of Bulletin (in months)</u>
98%	More than 4
77%	More than 6
62%	More than 9

Of the 21 titles of possible interest, only 2 reports contained evaluation data which either include failure rates or from which failure rates may be calculated. The remaining 19 titles of possible interest cover research data or data relative to new product developments, but no failure-rate data per se appear to be included.

4.4 U. S. Government Research Reports.

The following is quoted from the monthly publication U. S. Government Research Reports⁸:

The PB Reports . . . announced in this publication have just been released, usually by agencies of the U. S. Government, for dissemination to the public. In most instances they result from Government or Government-sponsored research.

The Office of Technical Services is responsible, under Public Law 775, 81st Congress, for the collection and distribution of these technical reports in the interest of American science and industry.

The more important reports are reprinted for sale to the public by OTS. Many of the reports are so specialized that the demand for them does not warrant reproduction of printed copies; originals of these documents are deposited at the Library of Congress. There they may be inspected in the Annex Reading Room, or copies may be ordered from the Library in either photocopy or microfilm.

PB reports of special interest to smaller business are abstracted in OTS's monthly Technical Reports Newsletter, available from the Superintendent of Documents, Washington 25, D. C., at \$1 a year domestic, \$1.50 foreign.

⁸Annual subscription \$6 ((\$3 additional for foreign mailing); single copy, \$0.60. In the United States, make remittance payable to the Superintendent of Documents, and mail either to a Department of Commerce field office or to the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Address changes should be sent to the Superintendent of Documents. Outside the United States, make remittance payable to, and order from, the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. Foreign address changes should be sent to the OTS.)

Since 1945 thousands of business firms have used PB reports in their research programs. These reports now constitute one of the world's largest collections of non-confidential technical information, numbering over 250,000 items. OTS has published catalogs of related reports in more than 300 areas of industrial interest. For further information relative to any of its activities, you are invited to write OTS, U. S. Department of Commerce, Washington 25, D. C.

Except to the extent indicated by acknowledgment of authorship, OTS does not edit PB reports, nor does it accept responsibility for the information and conclusions contained in them. If copyrighted material appears, permission for its use should be requested from the copyright owners. Any national security restrictions they may have applied to these reports have been removed. Patents may cover the subject matter of any reports, and the reader is advised to make patent searches before developing applications based on the reports.

A representative issue of the U. S. Government Research Reports (15 May 1959) lists approximately 550 reports, categorized in 98 major subject divisions and subdivisions. Major subject division "Engineering" and subdivision "Electrical and Electronic Engineering" list reports of interest; in the issue examined, 27 titles (and abstracts) of possible interest out of 59 listings in the subject subdivision were identified. The timeliness of all 59 listings was examined with the following results:

<u>Percentage of reports</u>	<u>Interval between report publication date and date of Research Reports (in months)</u>
100%	More than 7
81%	More than 12
49%	More than 24

Of the 7 reports carrying a date 7 months before that of the Research Reports issue, 6 are also identified by ASTIA AD numbers and are therefore listed by ASTIA. Further, of the 59 listings, 37 are also identified by ASTIA AD numbers, and of the 27 reports of interest, 17 are also identified by ASTIA AD numbers.

From this it would appear that the listings in the ASTIA Bulletin are significantly more timely than the listings in the U. S. Government Research Reports.

Of the 27 titles of possible interest, only 4 reports contained evaluation data which either include failure rates or from which failure rates may be calculated. The remaining 23 titles of possible interest cover research data or data relative to new product developments, but no failure-rate data per se appear to be included. There seems to be no comprehensive organized military program for electronic-parts evaluation intended to obtain failure rates as a function of circuit and environmental stress.

4.5 Advisory Groups on Electronic Parts (AGEP) and Electron Tubes (AGET).

These two groups are activities of the Office of the Director of Defense Research and Engineering (ODDRAE), Office of the Secretary of Defense (OSD), and

execute their functions under the supervision, administration and control of the Director of Electronics, ODDR&E.

The membership of AGEF and AGET is composed of civilian consultants to OSD and representatives of the Military Departments and other agencies of the Federal Government.

The method of operation used by AGEF and AGET and their respective working groups is such as to ensure that all phases of military research and development (including test and evaluation, industrial preparedness measures and production refinement) within their specified fields of interest are under continuous review, not only by specialists in the Military Departments but also by the consultants, who are expert scientists and engineers from industry acting in the public interest.

In order to carry on this activity effectively, the advisory groups must have current information on all government-sponsored work within their fields of interest. The information is derived from contract reports, supplemented by periodic visits of members of the technical staffs of the secretariats to contractors' plants for first-hand discussions. These visits frequently elicit information on company-sponsored work, and occasionally uncoordinated developments being supported under "black-box" subcontracts are unearthed. Additional information is obtained from presentations at working-group meetings by contractor employees or representatives of government agencies. Information on foreign work is obtained from foreign technical publications, intelligence reports and presentations by individuals who have recently visited abroad and through mutual exchange agreements with certain countries.

Some AGEF publications are as follows:

3.2 The Advisory Group on Electronic Parts Annual Report for the year 1957, GEP 107/3 classified CONFIDENTIAL, was prepared at the Secretariat and approximately two thousand copies were distributed to personnel of AGEF and to a selected list of individuals, educational institutions, government contractors, and members of the electronics industry.

3.3 In December of 1958 two thousand copies of a document entitled "Capsule Summary of the AGEF Program in the Area of Electronic Parts Materials," GEP 245/1, were made ready for distribution from the AGEF Secretariat, early in January, 1959. Printed directly from punched cards, this document made possible the dissemination of information concerning active and completed projects in the AGEF program in a manner which insured that the information was less than a month old at the time of distribution. It is planned to keep the cards in a state of constant revision and to issue subsequent editions of the Capsule Summary at approximately six-month intervals. ...

To provide a means for disseminating information in the area of electronic parts and materials which does not have its origin in a government-sponsored contract reported to this group, information bulletins and resumes are used. Varying widely in subject matter

these notices provide a medium for the rapid dissemination of information in the possession of the Secretariat. In 1958, 53 of these bulletins were prepared and distributed.⁹

An information service, based on an information file of about 25,000 cards containing data in the area of electronic parts and materials, is now available for AGEF, the government and contractors who have a need to know.

Data is stored on cards by means of a code developed by Secretariat personnel. Information is constantly being revised, updated, and expanded, and every effort is made to keep the data as up to date as possible, but it must be emphasized that the system does not seek out information--it merely stores it! Good reporting is therefore a requirement if the system is to be fully effective.¹⁰

Visibility to AGEF and AGET regarding the development of new items is not complete and is related to the manner in which new items come into existence. Three categories of such items can be identified:

(1) Items developed by the Military Departments, directly funded by identifiable military contracts. The screening and surveillance activities of AGEF and AGET provide significant visibility in this category.

(2) Items developed by or for a prime equipment contractor (to the Military Departments) or a subcontractor, indirectly funded by military contract. Many factors contribute to the lack of visibility for items in this category. Differences in reporting methods and work load, by contractors, subcontractors and the military equipment-procuring activities are among the considerations involved.

(3) Items developed by component suppliers, using their own funds, either to meet a need expressed by an equipment manufacturer (prime or subcontractor) or to meet a need as determined by the supplier based on his own market research.

AGEF and AGET have been aware of the situation with respect to both categories (2) and (3) and are trying to increase their visibility of such items, as indicated by the following paragraph, which appeared in brochures of the two advisory groups published several years ago:

An earnest invitation is extended to industry to register with the AGEF and AGET Secretariats those projects in the area of electronic parts and electron tubes respectively which are under way and which are sponsored by private funds. Such work may be reported in as much detail as desired, and with or without permission to disclose information beyond the acknowledgment that such work is in progress. In other words, an industrial development may be listed with the understanding that inquiries at the Secretariats will be turned over to the company, or that no information whatsoever will

⁹Annual Report for the Year 1958, Advisory Group on Electronic Parts, Secretariat, Moore School Building, 200 South 33rd Street, Philadelphia 4, Pennsylvania.

¹⁰Ibid.

be given out by the Secretariats. The mere fact that a place is now available where such information may be obtained can, when it is functioning fully, save countless man hours and funds through elimination of parallel effort. This point alone should provide justification for whole-hearted participation in this effort by all phases of the electronics industry.

4.6 Recommendations.

(1) New and controlled programs, manned by expert technicians whose sole responsibility is to obtain and analyze failure-rate data, should be established to obtain observed failure rates for typical air, shipboard and ground applications.

(2) The observed failure rates obtained from the programs recommended in (1) should be compared with failure rates obtained from an improved Electronic Equipment Field Data Reporting System to determine whether a correlation exists.

(3) The Electronic Equipment Field Data Reporting System should be improved to

- (a) increase the ratio of reported failures to total failures;
- (b) provide for better analytical recognition of primary failures;
- (c) provide for analytical criteria of misapplications;
- (d) make mandatory the recording of elapsed-time readings and
- (e) include operating time on units not failing.

(4) The Military Services should establish as standard that military equipment incorporate elapsed-time indicators where feasible.

(5) The Military Services should standardize one elapsed-time indicator for use in electronic equipment to provide time-to-failure data for controlled investigations (see recommendation (1)) and for the Electronic Equipment Field Data Reporting System.

(6) A special bibliography of reports should be prepared and maintained in a state of constant revision to provide visibility of investigative efforts on electronic parts on a current basis. Such a bibliography must be published at intervals and with significantly greater timeliness than the listings in the foregoing sections 4.3, 4.4 and 4.5. This bibliography should be published in the form of a Department of Defense handbook in the MIL-HDBK series. Visibility regarding the existence of such a handbook would therefore be obtained by its listing in the military indexes of specifications and related documents.

(7) Wide publicity should be given to the Advisory Group on Electronic Parts and its "program" of dissemination of information (in particular, in the area of electronic parts and materials) that does not originate in a government-sponsored contract.

(8) The Military Services should establish a more comprehensive program to evaluate electronic parts to obtain failure-rate data as a function of circuit and environmental stress.

5. Technical-Data-Exchange Activities in Industry

5.1 ICBM (TITAN) Program.

(1) Objectives:

(a) To provide ready visibility of component test data generated by participating contractors;

(b) To set up a mechanism to facilitate the interchange of component test data between the participants.

(2) Method:

(a) Components and parts are classified under 62 categories to permit ready identification and listing.

(b) Environmental-test-level codes are established to identify the various environmental categories and associated severity levels.

(3) Operation:

(a) A TITAN Interchange Data List is compiled, listing the brief report title, classification numbers as appropriate and the originator's report number.

(b) The aforementioned list is circulated by a control office to the participating contractors. A contractor who requires a particular report requests it from the originator, sending a copy of the request to the control office.

(c) The function of the control office is to keep the Interchange Data List current and to monitor the exchange operation.

(4) Results: Since the inception of the program about a year ago, each contractor has offered about 100 reports for listing. Approximately 60 reports per month are requested by interested contractors from those listed.

5.2 Program of the Naval Ordnance Laboratory, Corona (NOLC).

(1) Objectives: To provide reliability guidance in the choice of components to be used in a missile by several contractors.

(2) Method: The various missile contractors furnish NOLC with comprehensive engineering test reports, which include qualification and receiving inspection tests. Environmental and functional requirements surrounding the usage of the part are included in the tests. These data are analyzed to determine the suitability of the part for the application. A further analysis indicates the best vendor, or vendors, from whom the part should be obtained.

(3) Operation: Based on the raw data received, NOLC prepares a summary report containing abstracts of each test and recommendations for future guidance of the missile manufacturers. The reports are made available to government agencies and appropriate missile manufacturers.

5.3 QA-1 Program of the Electronic Industries Association (EIA).

(1) Objective: To provide a mechanism whereby participating firms are notified that parts have successfully met qualification requirements.

(2) Method: Participants will submit data on standardized preprinted forms to the EIA Exchange Headquarters. The form will include the following information:

- (a) Name and address of testing company and division
- (b) Part name
- (c) Date of test
- (d) Part classes (This involves the use of a 6-digit classification code.)
- (e) Vendor drawing number or military nomenclature describing component under test
- (f) Vendor identification by name and address and division
- (g) Environmental test information described by a classification of 21 different categories of environment
- (h) The specification that is being used to test the component

Only parts that are approved for use by the reporting company are eligible to be reported in this program.

(3) Operation: The data filed under this program would be reduced to punched-card presentation and periodically distributed to participants.

(4) Current Status: The EIA has decided not to activate this program.

5.4 Battelle Memorial Institute - Electronic Component Reliability Center.

(1) Objective: To provide participating firms with reliability and performance data on electronic components.

(2) Method:

(a) A group of the largest users of electronic component parts would be formed.

(b) Battelle would serve as the center for this group.

(c) The members of this group would pool their component performance data at Battelle.

(d) Battelle representatives would visit the participating firms to assist in the collection of the data.

(e) The data would be cataloged and stored in an "as received" form.

(3) Operation: When sufficient data have been collected on a particular component type, a report would be prepared and released to each participating firm. A typical report would contain the following information:

(a) General data regarding the types of application in which the component type is useful;

(b) Catalog-type information giving names of manufacturers, styles, sizes and ratings available;

(c) Application information resulting from the analyses of the pooled data; and

(d) Procurement information in the form of a recommended procurement specification and the manufacturers producing the best components.

(4) Current Status: The specified minimum number of component-user firms have contracted with Battelle to enable the program to get under way.

5.5 Other Exchange Programs.

The programs defined here are considerably less formal than those identified in the foregoing paragraphs:

(1) The National Aircraft Standards Committee (NASC) of the Aerospace Industries Association (AIA) (formerly the Aircraft Industries Association). The objectives and scope of the NASC have been established as follows (in part):

... for the study of mutual standardization problems of aircraft and missile parts, components, materials, processes and related standards, specifications and other documents. The findings of such studies are implemented by adoption and promulgation of appropriate industry standards, ... 11

In the effort leading to the development of standards, committee members, as sponsors of standardization projects, conduct tests to assure themselves that the standards are realistic and that conforming articles exist. Subsequent to the approval of the standard, committee members have access to the test data on request to the project sponsor. No listings of projects are made for the purpose of data exchange. Committee working agenda and interim progress reports (sometimes oral) apparently suffice to provide visibility of work in process. Committee historical records, agenda and promulgated standards identify project sponsors.

(2) Data-exchange programs are known to exist between companies--for the most part, in pairs. Details of procedure are not known, but it is believed that experiences are discussed and reports are exchanged on a substantially equivalent basis.

11 Handbook on the Directive, Organization and Operation of the National Aircraft Standards Committee (of the Aircraft Industries Association), revised 8 March 1959.

5.6 Conclusions.

(1) It has not been possible to reach any conclusions regarding the worth of industrial data-exchange programs since no information can be obtained on their resulting influence on reduction of test effort. However, it is relatively clear that test effort could be reduced if recipients could have confidence in the tests performed by others.

(2) The cost of data exchange is not exclusively the cost of preparing reports for exchange purposes, the cost of distribution and the cost of receipt and record keeping. It is believed that the hidden costs can more than exceed the apparent costs. These hidden costs are those associated with the time that may be spent by the engineers in reviewing the data purporting to be related to the same part but which are different owing to the differences in statements of requirements, quantities of parts to be tested, environmental levels and test methods.

(3) If the data exchanged are used for comparison purposes (which is believed to be the principal purpose of data so exchanged), this comparison is useful and valid only if the test methods are similar enough to produce the same results and detailed enough to allow correlation between different test laboratories. Efficiency, expediency and tradition have caused a degree of standardization of test methods through the use of methods set forth in MIL-STD-202. It is believed that an expansion of MIL-STD-202 in scope and detail would serve to further standardize test methods.

(4) Whether the exchange of data is intended by the participants to (a) reduce test effort or (b) provide for comparison of experience, no industry data exchange along existing lines will effectively reduce test effort, since there is entirely too much fear of legal entanglements, uncertainty regarding responsibility and lack of confidence. It must be noted, however, as an exception that the NASC program mentioned in section 5.5(1) does not suffer from these ills.

5.7 Recommendations.

It is recommended that the Department of Defense establish a central organization for the collection and dissemination of technical information on electronic parts defined by existing military specifications. Such technical information should include:

- (1) Application data
(See prototype application data in Volume II, section 4.)
- (2) Basic failure rates
- (3) Predicted and application failure rates
(See section 3 for definitions of these terms.)

6. Contractual Data Requirements

In the examination of contractual data requirements, this part of the study was limited to requirements for the applicable data as contained in military

specifications and further exclusively to those known as "General Electronic Equipment Specifications" and to the recent specification governing the requirements for "Engineering Drawings."

6.1 Nonstandard Part Approvals.

The electronic-equipment-procuring activities of the Military Services generally required contractors to substantiate their need for nonstandard parts. This substantiation is intended to include an identification of the part characteristics needed for the application and a comparison of these needs to the characteristics of the most similar standard part. Further, under certain conditions, test data demonstrating conformance to the equipment needs are required.

The data requirements of some electronic-equipment-procuring activities differ slightly in detail, but the intent is clearly the same; the data are designed to serve as a basis for determining that a standard part cannot be used and that the quality of the nonstandard part chosen by the contractor is satisfactory for military equipment.

Some activities require copies of the company drawing or specification used to procure the part, and two activities require that the part characteristics be prepared in the same form as the military specification sheets--or the military specification for the most similar item. Generally, the electronic-equipment contractors have established the practice of defining the characteristics of nonstandard parts by means of company drawings, or specifications or a combination of both. This primarily results from a desire to define and control the characteristics of the part for procurement and receiving inspection, partly to assist in the preparation of item descriptions for stock numbering and partly to meet the requirements for data on nonstandard parts.

Company drawings and/or specifications to define nonstandard parts appear to fall into several identifiable categories:

- (1) Documents that restrict certain dimensional or performance (other than environmental) characteristics to more stringent requirements than those of the most similar military specification.
- (2) Documents that establish performance under more stringent environmental requirements than those of the most similar military specification.
- (3) Documents that restrict sources of supply to a narrower list than those contained in the QPL associated with the most similar military specification.
- (4) Documents that contain requirements of the most similar military specification when no military QPL exists.
- (5) Documents that define the characteristics of a part when no military specification exists (for a similar item).

Examination of some military electronic-parts specifications reveals (in comparing the environmental requirements with the test methods of MIL-STD-202 and MIL-STD-446, "Environmental Requirements for Electronic Parts") that many existing nonstandard parts are nonstandard only because the military electronic-parts

specifications have not been kept current with the equipment designers' needs. Many specifications can be immediately updated on the basis of contractor test data on file in the military electronic-equipment-procuring activity.

6.2 Engineering Drawings.

The most recent specification (MIL-D-70327) governing the requirements for engineering drawings treats only generally the technical content of documents prepared (by contractors) for purchased parts. The major concern seems to be the identification of sources of supply for spare-parts reprourement and for designation of the basic part-number identification.

In the preparation of documents to serve the purposes of section 6.1(1) or (2), the contractor must determine whether the supplier is obtaining such parts by selection inspection, and if so he must identify the characteristics associated with the selection and must identify the supplier's part number for the unselected item. Further, if the supplier chooses not to reidentify (assign new part number to) the selected item, the contractor's document number must be treated as the basic part identification.

6.3 Recommendations.

(1) It is urgently recommended that a vigorous military specification program be established to bring all military electronic-parts specifications up to current design demand with respect to the environmental requirements, and that existing data in military activity files serve as the basis for substantiating the parts' capabilities. (See report of Subgroup ST-4, which follows.)

(2) It is recommended that, for those items not completely described by military specifications, military contractors and subcontractors be required contractually to submit copies of their procurement documents for electronic component parts (drawings or specifications) to a central organization in the Department of Defense, along with test data substantiating the conformance of these parts to such documentation.

(3) It is recommended that military contractors and subcontractors be required contractually to use the test methods of MIL-STD-202 in their procurement documents for electronic component parts.

(4) It is recommended that the contractor and subcontractor data identified in recommendation (2) serve as the basis for the establishment of failure rates and the preparation of revised and new military specifications for component parts.

(5) It is recommended that the failure-rate data be analyzed and published in a suitable form, such as Department of Defense handbooks, for contractor and subcontractor use in the prediction of electronic systems reliability.

(6) It is recommended that MIL-STD-202 be expanded to cover the current and anticipated environmental levels established in MIL-STD-446, "Environmental Requirements for Electronic Parts."

(7) It is recommended that consideration be given to the use of EAM (electronic accounting machine) methods for the storage and retrieval of parts information.

7. Typical Publications and Projects Containing
Applications and Reliability Data

7.1 Publications.

Cooling Techniques and Components for Ground Electronic Equipment.
Cornell Aeronautical Laboratory, Inc.

Design Manual of Methods of Forced Air Cooling Electronic Equipment.
NAVSHIPS 900-194, June 1958.

Electron Tube Derating Data. New York: McGraw-Hill Book Company, Inc.

Electron Tubes, Techniques for Application of in Military Equipment.
Military Handbook, MIL-HDBK-211.

Electronic Designers Shock and Vibration Guide for Airborne Applications.
Wright Air Development Center, Technical Report 58363, December 1958.

NEL Reliability Design Handbook. U. S. Navy Electronics Laboratory,
Reliability and Standards Branch. Periodically revised.

Reliability Status Report. Published by the Secretariat, Advisory Group on
Electron Tubes, 346 Broadway, New York 13, New York.

Techniques for Application of Electronic Component Parts in Military Equip-
ment. WADC TR 57-1, New York: McGraw-Hill Book Company, Inc.
Volume I - ASTIA AD 110672; Volume II - ASTIA AD 142275, April 1958;
Volume III - ASTIA AD 208661, June 1959.

Transistor Application Manual, Techniques for Application of Transistors in
Military Equipment. ARINC 101-15-143, 29 May 1959, Arinc Research
Corporation.

7.2 Projects.

"Electron Tube Research for Reliability," Cornell University.

"Tube Surveillance Program," Arinc Research Corporation.

SUBTASK 4

1. Summary

In this report, Subgroup ST-4 submits detailed recommendations and supporting data on (1) an outline of form and instructions for preparing design and procurement documentation for military parts and (2) procedures for coordinating specifications.

2. Statement of Mission

The assignment of Subgroup ST-4 was to review (1) present specification writing and (2) coordination procedures to achieve unification and to ensure that specifications are consistent with the full capabilities of the parts.

3. Current Procedures for Writing Specifications

3.1 Format.

The physical and organizational format in which the physical and performance requirements of items are presented in present military documentation is not optimum for either industry or the Military Services.

- 3.1.1 References:
- M202, Manual for Specifications (Procedures)
 - M203, Manual for Standards, Standardization Studies and Handbooks (Procedures)
 - M204, Manual for Qualified Products Lists
 - M205, Outline of Form and Instructions for the Preparation of Specifications
 - M206, Outline of Form and Instructions for the Preparation of Standards, Standardization Studies, and Handbooks

3.1.2 Remarks: The format described by the references is inadequate and incorrect with regard to the following:

(1) It does not--

(a) define the relationship between the various documents used, i. e., military standard, specification sheet, specification, qualified products list, etc.;

(b) assure that descriptive information required for design and procurement is placed on specific documents as completely as is needed by the users (military or industrial);

(c) provide a ready means of identifying other related documents when only one is available.

(2) It does--

(a) result in a tremendous duplication of effort throughout a sizable percentage of contractors to the government. This duplication of effort occurs in companies which maintain standards departments and which are forced to "revise" military documents to make them usable. This situation continues year after year to the extent of \$40 to \$50 million per year.

(b) result in unnecessary confusion in the minds of not only contractors to the government but also military personnel. The cost of such confusion can only be measured in millions of dollars.

3.1.3 Recommendations: In order to eliminate the duplication and confusion regarding format, document content and document relationship, it is recommended that:

(1) A project be established immediately within the Department of Defense to prepare and issue a policy manual, using as a guide the information contained in Volume II, section 3, "Outline of Form and Instructions for Design and Procurement Documentation for Military Components."

(2) All other existing manuals (M201, M202, M203, M204, M205 and M206) be revised as recommended in this report.

(3) All individual problems defined herein (or in reports of other subgroups), together with specific recommendations thereon, be carefully considered in the revision of existing manuals.

(4) An advisory group from industry be appointed to assist the Department of Defense in this project.

3.2 Item Numbering.

Item (part) numbering practices are inadequate and confusing in present military specifications and military standards.

3.2.1 References: M203, 4.1.2; M206, 3.6 and 3.6.1; DOD Directive No. 4120.3; MIL-STD-130; MIL-STD-208.

3.2.2 Remarks: In specifications prepared by the Armed Services Electro-Standards Agency (ASESA), the marking paragraph in section 3 details what is to be marked on the item. It may vary, depending upon whether the complementary document used with the specification is a military standard, specification sheet, detail specification or drawing, et al.

3.2.3 Recommendations: In order to eliminate inadequate and confusing item (part) numbering practices, it is recommended that this subject be made a part of the scope of the project to revise existing Department of Defense policy manuals, as follows:

(1) To establish a number to identify the item for callout on an assembly drawing;

(2) To establish a number which will provide an "address" to other associated documents;

(3) To establish a number which will remain unchanged even when military standardization takes place;

(4) To establish definitive ground rules for determining a change in part number owing to a change in technical requirements for the item.

(5) To establish instructions regarding when the number will be marked on the item.

3.3 Intended Use of Items.

The "intended use of items" is neither uniformly (from one specification to another) nor clearly defined in present military specifications.

3.3.1 References: M205, 3.9, 3.10, 3.30.

3.3.2 Recommendations: It is recommended that the referenced paragraphs of M205 be revised to more clearly distinguish between the "intended uses" for inclusion in the "Scope" section or the "Notes" section of the specification.

3.4 Language Ambiguity.

Present military specifications are being written in language which presupposes that the government is the only "buyer" in spite of the fact that there would be little or no need for government procurement if industry had not first created a need by design and had carried out the production procurement.

3.4.1 References: M201A, 2.2(6), 2.3, 2.6, 2.7; M202, especially section 3; M203A; M205, 1.1, 1.2; DOD Directive No. 4120.3, especially section VIII.

3.4.2 Remarks: The foregoing references state that the required orientation of military specifications is in the direction of procurement for government end use; e.g., DOD Directive No. 4120.3. Also, paragraph 2.3 of Standardization Manual M201 states that "The standardization program outlined in this manual covers only those items used by the military departments and maintained by them in their supply system."

3.4.3 Recommendations: It is recommended that a study be made to determine whether, within the framework of existing DOD directives, it is possible to eliminate such ambiguous words as "government inspector" and "government procurement" in favor of "procuring activity inspector" and "using activity procurement."

3.5 Footnotes to Tables.

Too many "footnotes" appear in present military specification under tables showing groupings of tests. Many times, this causes the tables to become part of the test procedures.

3.5.1 Reference: M205, 2.12.

3.5.2 Recommendations: It is recommended that the referenced paragraph of M205 be revised to caution strongly against the use of footnotes within a table that would cause the tables to become a part of succeeding test procedures.

3.6 Performance Requirements.

Some specifications state requirements in terms of "design" without including suitable performance requirements, even when they are available.

3.6.1 References: M202, 1.2, 1.4; M205, 2.4 through 2.4.2.

3.6.2 Remarks: Paragraph 1.2 of M202 states that the specification shall state requirements to the extent necessary to obtain items of requisite quality, consistent with military needs and current industrial technical and potential capabilities. Paragraph 1.4 of M202 states that specifications usually include both performance and design requirements but that, in some cases, design requirements are in order where it is desirable to control design in all or in certain respects. Paragraphs 2.4 through 2.4.2 of M205 state essentially the same philosophy.

3.6.3 Recommendations: The referenced paragraphs of M202 and M205 should be revised to emphasize the very important need to express requirements for items in terms of performance. The revisions should make it clear that, although there are specific cases in which it is permissible to specify requirements in terms of design (dimensions, for example, to establish interchangeability of the items), the specification of requirements in terms of design should ordinarily be permitted only when it is clear that the know-how to express the requirements in terms of performance does not exist. It should be emphasized also that, whenever requirements for a particular characteristic of an item have been specified for both performance and design and a failure occurs, it is sometimes very difficult to determine the real cause of the failure.

3.7 Environmental Requirements.

Specification requirements are not related to equipment environmental requirements.

3.7.1 References: (No policy exists on this problem.)

3.7.2 Recommendations: It is recommended that this problem be specifically recognized by suitable references in revisions to either M202 or M205. This revision should emphasize the fact that any equipments must be built from smaller "blocks"--the individual parts. Accordingly, "realistic" performance of the equipment depends upon, and cannot be divorced from, the performance of the parts. As a result, "realistic" and "reliable" equipment performance requirements should seldom be as severe as--and never more severe than--those of the parts to be used therein.

3.8 Reference Specifications.

A consistent procedure for selecting reference specifications for section 2 of the specification is not followed in present military specifications.

3.8.1 References: M205, 2.5, 2.6, 2.6.1, 3.12 through 3.13.

3.8.2 Remarks: In all ASE3A-prepared specifications, the documents listed in section 2 include all those referenced in sections 1 through 5.

3.8.3 Recommendations: No revisions to M205 regarding policy on this problem are considered necessary. It is recommended, however, that implementation of the policy be strengthened among all groups writing specifications.

3.9 Need for New or Revised Specification.

A consistent procedure is not followed when it is decided whether to revise an existing specification or to write a new one.

3.9.1 Reference: M205, 5.1.

3.9.2 Recommendations: It is recommended that a policy be established which defines (1) the conditions under which multiple specifications on similar items shall exist and (2) the conditions under which revisions to a basic specification shall be made as new but similar items become available. For example, should requirements of specifications MIL-C-14157 and MIL-C-26244 have been included as revisions to MIL-C-25 rather than being issued as separate specifications? During early efforts toward the coordination of MIL-C-14157, much time was wasted because there were no ground rules or policy for this question. Again, should MIL-T-27 be broken into several specifications since its coverage has now become so large?

Specific conditions of such a policy can best be established as a part of the project recommended in section 3.1.

3.10 Test Procedure Grouping.

There is no consistent organization of test procedure grouping (i.e., groups A, B and C) among the various military specifications.

3.10.1 References: M205, 3.24.1 through 3.26.

3.10.2 Recommendations: It is recommended that:

(1) Paragraphs 3.24 through 3.26.3 of M205 be revised to establish an agreement with the terminology of MIL-STD-109 (referenced as a requirement in paragraph 3.24 of M205).

(2) The revision of paragraphs 3.24 through 3.26.3 include definitions governing the quality-assurance provisions included in Volume II, section 3, Part III, paragraphs 11.1 through 11.8.1.

(3) Examples A, B and C, quality-assurance provisions contained in M205, should be replaced with an example taken from the sample capacitor specification MIL-C-0000 (see Volume II, section 4), which represents an outstanding example of a desirable arrangement.

3.11 Order of Detail Requirements.

The sequential order in which requirement and test paragraphs appear is not consistent among the various military specifications.

3.11.1 References: M206, 3.20, 3.24.1.

3.11.2 Recommendations: It is recommended that:

(1) Paragraph 3.23 of M206 be revised to indicate the specific order in which the detail requirements shall be listed.

(2) A new paragraph requirement for "Detail Requirement for Individual (Material) Types" be added before paragraph 3.23.1, "Qualification," of M206 where applicable. The paragraph should read as follows:

Detail requirements or exceptions applicable to particular types of (material) shall be as specified in the applicable Item Requirements Sheet. In the event of any conflict between requirements of this specification and the Item Requirements Sheet, the latter shall govern.

3.12 Reliability Requirements.

Present military specifications contain neither reliability requirements nor reliability test requirements.

3.12.1 References: M206, 3.23.5.1.

3.12.2 Remarks: A goal of the Ad Hoc Study Group, of course, is to provide assistance on this problem.

3.12.3 Recommendations: It is recommended that M206 be revised as required to define the policy recommendations of the Ad Hoc Study Group on Parts Specification Management.

3.13 Acceptance Inspection.

Specifications should contain a requirement that "parts supplied will have been subjected to and have passed specified acceptance inspection."

3.13.1 References: (No policy exists on this problem. However, see M206, 3.23.1, "Qualification.")

3.13.2 Recommendations: It is recommended that a new paragraph requirement, "Acceptance Inspection," be added after paragraph 3.23.1, "Qualification," of M206. The new paragraph should read:

3.2 Acceptance Inspection. The (material) furnished under this specification shall be a product that has been tested and has passed all the requirements of acceptance inspection specified herein.

3.14 Qualification and Acceptance Inspection and QPL Requirement

Present military specification requirements for qualification inspection and acceptance inspection are not properly integrated with Qualified Products List requirements.

3.14.1 References: M206, 3.23.1, 3.24, 3.24.3, 3.24.4; M204, 1.2 and 10.
(There is no policy assuring any specific relationship between Qualified Products Lists.)

3.14.2 Recommendations: It is recommended that the interrelationship of qualification inspection, acceptance inspection and Qualified Products Lists, as contained in the report of Subgroup ST-2, be established as policy. (See section 4.2, "Subtask 2.")

3.15 Policy Manuals

Requirements and definitions contained in the various policy manuals are not suitably integrated. Standardization manuals lack sufficient guidance in certain areas, for example, referencing single-Service drawings on military standards. Provisions in manuals permitting (a) addenda, (b) "in-lieu-of" specifications and (c) interim amendments have resulted in a multiplicity of requirements for the same item (e.g., MIL-C-003965).

3.15.1 References: (a) See statement on page V of M206: "Other standardization manuals related to this document which should be consulted for details of procedure."

(b) M6, 6.2.1; M206, 3.3.1.1, 3.6.1, 3.7.1; M203A, 3.3, 8.1; M202, 7.1, 7.2, 7.3.1.

3.15.2 Recommendations: It is recommended that:

(1) A very detailed cross-check of all policy manuals be made to locate contradictions or inconsistencies and to integrate all policies.

(2) Consideration be given to revisions, where required, to control the issuance of: (a) "in-lieu-of" specifications and (b) interim amendments.

(3) Provide additional guidance in areas where experience has shown there is a need.

3.16 Standard Groups of Environmental Requirements

Environmental requirements are not established in "standard groups" which in turn refer to suitable standard test procedures.

3.16.1 References: Standard MIL-STD-446, April 1959. (This defines "standard groups" which refer to standard test procedures, per MIL-STD-202.)

3.16.2 Recommendations: It is recommended that the preparation of all future military specifications be monitored to assure their preparation in accordance with the requirements of Standard MIL-STD-446.

Table 1. GUIDE FOR NORMAL SCHEDULING OF SPECIFICATIONS AND STANDARDS

(All time periods are given in weeks.)

	Project initiated; assigned agent	Establish DOD requirements	Initial draft stage	Reconciliation of comments	Final draft	Printing time	Total time: initiation to availability
New specification	3	23	23	15	5	8-16	81
Amendments	3	13	12	14	2	8-16	56
Detail specification	3	22	13	14	3	8-16	67
Military standards	3	22	13	15	3	8-12	68

4. Procedures for Coordinating Specifications

4.1 Time Scale.

As a result of the following problems (and others), the time scale for the preparation, coordination and printing of military specifications and standards is completely unrealistic:

- (1) The normal scheduling time (see Table I).
- (2) The actual time required (see Table II, examples representative of average time required).
- (3) The coordination flow chart requirements contained in M202.
- (4) The Military Services do not provide equivalent backing to personnel allowed to participate in coordination actions. One Service may always officially endorse its representatives' decisions, while another Service may have not the slightest hesitance in disapproving decisions of its representatives.
- (5) Too much time is wasted in haggling over detail requirements. The reasons for this are:
 - (a) Lack of experience of personnel available for coordination action;
 - (b) Nonstandardization of environmental requirements for electronic parts;
 - (c) The absence of "cross pollination" among the various coordinating groups;
 - (d) Lack of authority by the coordinating activity to resolve differences of opinion and thus terminate actions.
- (6) The coordinating agency lacks authority to "crack the whip" and speed up the coordination action. This situation must continue as long as the existence of the coordinating activity depends upon a charter created by the three Military Services. It is obvious that no Military Service will allow itself to be subject to criticism by an activity it helps to create and maintain.
- (7) The coordinating activity "does not exist" in the eyes of the Department of Defense.
- (8) Failure of the Department of Defense to provide an organization or procedure which is able to assure the necessary expeditious action.
- (9) Failure of the Services to bring "essential" comments to notice.
- (10) Submission of comments as "essential" which, in truth, should have been "suggested" or even "editorial."

Table II. ACTUAL TIME REQUIRED TO PROCESS SEVERAL SPECIFICATIONS, DETAIL SPECIFICATIONS AND MILITARY STANDARDS

(All time periods are given in weeks.)

	Project initiated; assigned agent	Establish DOD requirements	Initial draft stage	Reconciliation of comments	Final draft	Printing time	Total time: initiation to availability
<u>New specifications:</u>							
MIL-P-55034, Powdered Mag.	4	NA*	10	42	12	12	80
MIL-P-21346, Fuseholders	20	NA	40	62	12	9	143
<u>Amendments:</u>							
MIL-T-27, Transformers	6	NA	12	16	8	4**	46
MIL-T-713A, Twine	21	26	15	16	3	5	86
<u>Detail specifications:</u>							
MIL-R-11/8, Resistors	3	--	8	12 [§]	13	12	48
MIL-R-11804B, Resistors	--	NA	32	32	14	8	86
<u>Military standards:</u>							
MIL-T-27, Transformers	4	NA	20	12	4	6	46
MIL-K-3936, Knobs	6	NA	16	Coord. completed in initial draft.	13	16	54

NOTES: *Not applicable

**A revised final draft was forwarded for approval 10 November 1958 incorporating changes requested by the Office, Chief Signal Officer. These changes were coordinated by that office.

§Final draft was held up from 12 June 1958 to 21 August 1958 waiting for the withdrawal of Ordnance comments.

4.1.1 References: M202, 5.11.2 (quoted below), flow charts.

b.11.2 Action to resolve essential comments.--The draft, custodian comments, the record of reconciliation efforts, and a departmental recommendation for disposition of unresolved essential comments shall be submitted to the Standardization Division for action through the assignee activity and its DepSO, with copies of the transmittal letter to the other custodians and DepSO's. This procedure for submission of a draft to the Standardization Division provides successive opportunities for reconciliation. The Standardization Division will take appropriate action to resolve the essential comments and forward the specification to the preparing activity for printing, with copies of the letter to the assignee activity, custodians, and the DepSO's.

4.1.2 Recommendations: In order that the coordination procedure may be completed in a reasonable time, it is recommended that an Advisory Group on Management of Electronic Parts Specifications be established as an activity of the Office of the Assistant Secretary of Defense (Supply and Logistics), to have the functions detailed in Volume I, section 2, recommendation (1).

4.2 Limited Coordination.

Because of lack of control over the issuance of Limited Coordination Military Specification (other than by the Military Services involved), it is much easier for the interested Service to continue issuing this type of specification than it is to wait for the official coordination action. Accordingly, the individual Services handle their specification problems in exactly the same manner as their customers handle theirs--by writing their own. As a matter of fact, this feeling is so commonplace among the military personnel that it is reported that a responsible representative of one of the Services has publicly stated that, as a result of the difficulty in establishing full coordination, his Service in the future intends to continue writing its own specifications and to take little or no action with regard to their coordination.

4.2.1 References: M202, 7.2 (quoted below), revised 5 May 1958.

7.2 Limited coordination military specification "Used in Lieu of" a military coordination specification--When the procurement of an item with changed requirements does not allow time to coordinate a revision to a coordinated military specification, any DepSO may approve the justified request of the requiring activity, submitted through the departmental custodian to issue a specification "Used in Lieu of" the existing specification. The specification will then be issued, as approved, by the requiring activity. The need for a "Used in Lieu of" specification will be carefully reviewed by the DepSO in order that a minimum number of these documents will be issued. The preparing activity, assignee activity and Standardization Division will be informed of all such approvals by the DepSO's.

4.2.2 Recommendations: It is recommended that:

(1) A continuing program be established, to result in a "normal" scheduled time of 26 weeks (from inception to completion of printing) for full military and industrial coordination of electronic-parts specifications.

(2) Approval of the preparation and issuance of Limited Coordination Military Specifications be made a responsibility of an office at the Office of the Secretary of Defense level instead of the individual Military Service.

(3) Approval of the preparation and issuance of Limited Coordination Military Specifications be based upon a satisfactory justification, to be prepared by the Military Service concerned.

(4) A suitable record of activities relating to electronic-parts specifications throughout the Military Services be maintained by an office at the Office of the Secretary of Defense level, for reference purposes and to prevent duplicating activities in this field.

(5) Existing definitions, regulations and, perhaps, the name "Limited Coordination Military Specifications" be revised to ensure that they will be binding upon all other Military Services immediately upon issuance, except that a period of 60 days will be allowed any Service to show why the specification is not satisfactory for its use.

5. Instructions for a Documentation System

Section 3 of Volume II of the Ad Hoc Study Group's report is an "Outline of Form and Instructions for Design and Procurement Documentation for Military Parts."

TABLE III(A). COMPARISON OF ENVIRONMENTAL REQUIREMENTS

Environment	Group IV MIL-STD-446	MIL-C-0000
Temperature:		
Operating	-65°C +125°C	*-55°C +125°C
Storage	-65°C +85°C	**
Thermal shock	-65°C +125°C	**
Pressure:		
Operating	.326 in. Hg	*3.44 in. Hg
Altitude (ft)	100,000 ft	*50,000 ft
Nonoperating	NA	
Moisture (100% RH)	10C	10C
Vibration:		
Cycles per second	10-2000	10-2000
Acceleration (g)	10	10
Shock:		
Acceleration	50	50
Time (ms)	11 ± 1	11 ± 1
Air-induced vibration:		
Cycles per second	150-9600	**
Dd $\geq 2 \times 10^{-4}$		
dynes/sq cm	165	**
Acceleration (constant):		
Gravity units	No requirement	50
Time (sec)	No requirement	5
Explosive atmosphere	Proc I - MIL-E-5272	**
Nuclear radiation (pulse):		
Neutron flux level (fast):		
Neutron/cm ² -sec	10 ¹⁷	**
Time (microsec)	80	**
Gamma flux level:		
Roentgens/sec	10 ⁸	**
Time (microsec)	80	**
Sand and dust	Moving parts only	NA
Salt atmosphere	96	**48
Flammability	Para 5.2.13	**
Fungus resistance	Nonnutrient	Nonnutrient
Life (hr):		
Operating	2K	2K
Storage	30K	**

NOTES: *Deviation from MIL-STD-446 level owing to the state of the art in the item under specification. Level of operation may be obtained by derating.

**At this time, test data are not available to permit inclusion of requirement in specification.

NA - This environment not applicable to the use of this item.

TABLE XIB. COMPARISON OF ENVIRONMENTAL REQUIREMENTS

ITEM	ENVIRONMENTAL GROUP I											
	TEMPERATURE	HUMIDITY	CONDENSATION	WATER	SALT	ACID	ALKALI	SOIL	MOISTURE	UV RADIATION	MICROBIAL	OTHER
STANDARD MIL-STD-445	10-35	95	100	100	100	100	100	100	100	100	100	100
ENVIRONMENTAL GROUP I	10-35	95	100	100	100	100	100	100	100	100	100	100
ENVIRONMENTAL GROUP II	10-35	95	100	100	100	100	100	100	100	100	100	100
ENVIRONMENTAL GROUP III	10-35	95	100	100	100	100	100	100	100	100	100	100
ENVIRONMENTAL GROUP IV	10-35	95	100	100	100	100	100	100	100	100	100	100
ENVIRONMENTAL GROUP V	10-35	95	100	100	100	100	100	100	100	100	100	100
MIL-STD-445	10-35	95	100	100	100	100	100	100	100	100	100	100
MIL-8-1000C Film, Resistor	10-35	95	100	100	100	100	100	100	100	100	100	100
MIL-8-15C Composition, "	10-35	95	100	100	100	100	100	100	100	100	100	100
MIL-8-03B Wirewound, "	10-35	95	100	100	100	100	100	100	100	100	100	100
MIL-8-1000C Film, "	10-35	95	100	100	100	100	100	100	100	100	100	100
MIL-8-1000C Transistors	10-35	95	100	100	100	100	100	100	100	100	100	100
MIL-8-1000C Transistors	10-35	95	100	100	100	100	100	100	100	100	100	100
MIL-8-1000C Rectifiers	10-35	95	100	100	100	100	100	100	100	100	100	100
MIL-8-15A Paper, Capacitor	10-35	95	100	100	100	100	100	100	100	100	100	100
MIL-8-1127A Glass, "	10-35	95	100	100	100	100	100	100	100	100	100	100
MIL-8-3 Glass, "	10-35	95	100	100	100	100	100	100	100	100	100	100
MIL-8-3043B Thetalam, "	10-35	95	100	100	100	100	100	100	100	100	100	100
MIL-8-11015A Ceramic, "	10-35	95	100	100	100	100	100	100	100	100	100	100
MIL-8-14137A Paper, "	10-35	95	100	100	100	100	100	100	100	100	100	100
MIL-8-14400A Trimmer, "	10-35	95	100	100	100	100	100	100	100	100	100	100
MIL-8-71A Oxide	10-35	95	100	100	100	100	100	100	100	100	100	100
MIL-8-5615C Capacitor	10-35	95	100	100	100	100	100	100	100	100	100	100
MIL-8-4304A Connector	10-35	95	100	100	100	100	100	100	100	100	100	100

NOTE: This table indicates needed revisions to certain selected military specifications and to MIL-STD-445 to bring them into step with various environmental groups of MIL-STD-445. The shaded areas indicate requirements for the environmental condition shown at the head of the column.

EXHIBIT A

PARTS SPECIFICATION QUESTIONNAIRE

Studies have indicated that although many company specifications have been written for procurement of parts of the same generic types covered by existing military specifications, many of these company specifications would probably not have been written if the military specification had been "up-to-date." Inquiry has indicated that "up-to-date" means having, for example, higher temperature or higher vibration or higher shock or more effective Quality Assurance requirements, etc.---that is, as high as required to bring the specification requirements up to the level of readily available parts of the type the military specification describes.

The purpose of this questionnaire is to determine the consensus of parts users regarding requirements which should be added to existing military specifications to bring them "up-to-date" and in order that they may be used to buy parts which are presently being procured from one or more manufacturers by means of company specifications. This questionnaire differs from others which have been prepared in that it defines specific standard levels of requirements as related to specific parts specifications. It is believed such definition will be of inestimable value in a much needed "modernization" phase of a mandatory military program to improve military specifications.

1. Does your company use parts of the generic types described by the specifications listed on Table II? Example: If your company uses capacitors of the general types described by MIL-C-3965, place check in square immediately following "MIL-C-3965" to indicate "yes."
2. When your company orders parts of these generic types, are they identified on the purchase order by the exact part (or type) number specified in the specification (or MS sheet) with absolutely no additional "requirements" or "conditions" specified? Indicate "yes" by checks in the column headed "exact part (or type) number."
3. If your company identifies the parts on the purchase order in any other manner than by the exact military part (or type) number, does your company--
 - a. Write a company specification and identify the items by means of a company part number? ☐
 - b. Take some other action? Define _____ ☐

4. If your answer to the above is "a" does your company write the specification---

a. To cover procurement of a value, tolerance, or physical configuration not listed in the military specification? ☐

b. To bring the specification "up-to-date?" ☐

c. For some other reason? Define ☐

5. If your answer to the above is "b" please indicate, in the "needed requirements" column of Table II, by means of the code numbers selected from Table I, those requirements which, if added to the specific military specification, would in your opinion, bring it "up-to-date."

TABLE I

(Environmental condition limits have been extracted from Standard MIL-STD-446 Environmental Requirements for Electronic Component Parts)

Requirement	Code	Requirement	Code
<u>Temperature</u>		<u>Pressure</u>	
<u>Operating</u>		<u>Operating</u>	
Low		(In.Hg.) (Altitude)	
-55°C	T-1	20.58 10,000 ft.	P-1
-65°C	T-2	1.32 70,000 ft.	P-2
*Other	T-3	.326 100,000 ft.	P-3
High		.043 150,000 ft.	P-4
+55°C	T-4	*Other	P-5
+85°C	T-5	<u>Non-operating</u>	
+125°C	T-6	(In.Hg.) (Altitude)	
+200°C	T-7	3.4 50,000 ft.	P-6
+350°C	T-8	*Other	P-7
+500°C	T-9	<u>Moisture</u>	
*Other	T-10	Method 106-MIL-STD-	
<u>Storage</u>		202A-10 cycles	M-1
Low		*Other	M-2
-65°C	T-11	<u>Vibration</u>	
High		<u>Mechanical</u>	
+71°C	T-12	10-55 at .03" Ampl.	V-1
+85°C	T-13	10-2000 at 100	V-2
*Other	T-14	10-2000 at 150	V-3
<u>Shock</u>		10-2000 at 200	V-4
Low		10-2000 at 400	V-5
-65°C	T-15	*Other	V-6
High		<u>Air-induced</u>	
+85°C	T-16	150-9,600 cps at 165db	V-7
+125°C	T-17	*Other	V-8
+200°C	T-18		
+350°C	T-19		
+500°C	T-20		
*Other	T-21		

Requirement	Code	Requirement	Code
<u>Shock (impulse)</u>		<u>Miscellaneous</u>	
500 for 6 millisecs	S-1	Add Qualification Inspection	Q-1
500 for 1111 millisecs	S-2	Increase test sample size	Q-2
*Other	S-3	Specify lower AQL values	Q-3
<u>Explosive atmosphere</u>		*Other	Q-4
MIL-E-5272-Procedure I	E-1	Add Acceptance Inspection	
*Other	E-2	Provide Groups A, B & C	Q-5
<u>Nuclear radiation (reactor)</u>		Increase test sample size	Q-7
10^{10} neutron/cm ² sec for 1000 hrs.	N-1	Specify lower AQL values	Q-8
*Other	N-2	*Other	Q-9
10^7 photon/cm ² sec for 1000 hrs.	N-3	Add date or lot coding	D-1
*Other	N-4	Revise test methods	TM-1
<u>Nuclear radiation (pulse)</u>		Add test methods	TM-2
10^{17} neutron/cm ² sec for 80 microsecs	N-5	Add other values, tolerances or physical configurations	OV-1
*Other	N-6		
10^8 roentgens/sec for 20 microsecs	N-7		
*Other	N-8		
<u>Salt atmosphere</u>			
Method 101A-MIL-STD-202A for 96 hrs.	SA-1		
*Other	SA-2		
<u>Sand and Dust</u>			
MIL-E-5272-Procedure I	SD-1		
*Other	SD-2		
<u>Fungus resistance</u>			
MIL-E-5272-Procedure I	F-1		
*Other	F-2		
<u>Acceleration (constant)**</u>			
500 for 5 sec	A-1		
5000 for 1 sec	A-2		
*Other	A-3		

* Define "other" on Table II in "needed requirements" column.

** Not in MIL-STD-446.

TABLE II

LIST OF REQUIREMENTS NEEDED TO BRING CERTAIN MILITARY
SPECIFICATIONS "UP-TO-DATE"

Prepared by

Ad Hoc Study Group on Parts Specifications
Management for Reliability

Specification	Generic Types Used	Exact Part Number Used	Needed Requirements
1. Capacitors			
MIL-C-5 (mica)	☐	☐	
MIL-C-25 (paper)	☐	☐	
MIL-C-3965 (tantalum)	☐	☐	
MIL-C-10950 (button mica)	☐	☐	
MIL-C-11015 (ceramic)	☐	☐	
MIL-C-11272 (glass)	☐	☐	
MIL-C-14157 (paper)	☐	☐	
MIL-C-14409 (trimmer)	☐	☐	
*Other _____	☐	☐	
_____	☐	☐	
_____	☐	☐	
_____	☐	☐	
_____	☐	☐	
_____	☐	☐	
2. Connectors			
MIL-C-5015	☐	☐	
MIL-C-3989	☐	☐	
MIL-C-71A	☐	☐	
MIL-C-3608	☐	☐	

2. Connectors (Continued)				
*Other				
3. Electron tubes				
MIL-E-1				
*Other				
4. Relays				
MIL-R-5757				
*Other				
5. Resistors				
MIL-R-11 (composition)				
MIL-R-93 (wir/wound)				
MIL-R-10509 (carbon film)				
MIL-R-94 (var composition)				
*Other				

6. <u>Semi-conductor diodes</u>			
MIL-E-1	☐	☐	
*Other	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
7. <u>Transistors</u>			
MIL-T-19500	☐	☐	
*Other	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	

* Coordinated or uncoordinated military specifications only.

EXHIBIT B

Summary Report on Results of Parts Specification Questionnaire

20 July 1959

1. BACKGROUND

A questionnaire, included as a part of the report of Subgroup 3T-4, was prepared and circulated to a wide segment of parts users on 20 July 1959. The questionnaire was sent to 100 different companies that are producers of electronic equipment for the Military Services. The mailing list was prepared by consultation with Military Service representatives and with members of the Aerospace Industries Association's Electronic Parts Committee (EPC) and the Electronic Industries Association's Military Engineering Components Coordinating Committee (M-1). Replies were received from a total of 31 different companies.

The questionnaire was prepared especially to attempt to identify the requirements in specific military specifications that could be revised to result in specifications which would describe items which represent the latest industry know-how. It was expected that the results of the questionnaire could be the basis for the initiation of a Department of Defense "crash" program to update certain specifications.

2. CONTENTS

Table I (of this summary report) summarizes all the indicated requirements on the basis of categories (temperature, acceleration, etc.). Table I shows the following:

(1) Under the column headed "Total Usage Generic Types": the number of companies indicating they used items of the type covered by the indicated specification. For example, 25 companies indicated they used capacitors of the generic type covered by MIL-C-5.

(2) Under the column headed "Total Usage Exact Number": the number of companies indicating they identified items on their purchase orders solely by the use of the military specification identifying number, with no additional requirements whatsoever placed on the items. For example, 20 companies indicated they used the exact military specification identifying number when ordering capacitors to MIL-C-5.

(3) Under columns headed "Requirements": the total number of indications of need for revision in one of the categories. For example, there are 6 indications of need for revision of the quality assurance category. (Some categories contain several subcategories and any one company may have indicated more than one subcategory.)

(4) A review of the numbers in the category columns quickly identifies those categories of the greatest concern.

Table II (of this summary report) summarizes all the indicated requirements on the basis of subcategories (e. g., "-55°C Operating Temperature" is a subcategory of "Temperature"). Table II shows the following:

(1) Columns headed "Total Usage Generic Types" and "Total Usage Exact Number" are explained in connection with Table I, paragraphs (1) and (2).

(2) Under column headed "Requirements": the number of companies indicating the need for revision in the specific subcategory. For example, 11 companies indicated the need to revise MIL-C-5 to include 125°C operating temperature.

(3) It is recognized that certain revisions may be indicated as needed when the requirements already exist in the specification. No attempt has been made to edit the indicated requirements.

3. CONCLUSIONS

From the results of the questionnaire, the following conclusions can be drawn:

(1) The listed military specifications could be revised to bring them up to date.

(2) There is sufficient agreement of parts users with regard to requirements that the availability of up-to-date military specifications would greatly reduce the number of company specifications being written.

(3) The availability of up-to-date military specifications would greatly reduce the cost of present nonstandard-part approval procedures by reducing the number of nonstandard parts.

(4) Parts representing the requirements indicated by the reporting companies and technical data thereon exist as a result of procurement of the parts by the companies. These same technical data can also be found in the record files of the individual Services as a result of existing nonstandard-part approval procedures.

(5) Results tabulated in Tables I and II will be very useful in establishing the requirements and procedures of a program to revise certain specifications to bring them up to date.

(6) Such a revision program is needed. It is feasible. It is justifiable. Technical data are available. This summary presents starting points for such a program.

Table 1. Combined Requirements by Categories

Specification Number	Requirements											
	Total Usage	Generic Types	Total Usage	Exact Number	Temperature	Pressure	Moisture	Vibration	Shock	Explosive	Nuclear	Salt Atmos.
MIL-C-5	25	20	25	5	1	8	5			1		1
MIL-C-25	25	17	15	4		9	4					1
MIL-C-3065	23	13	12	1		4	5					1
MIL-C-10850	18	13	12	3	1	4	5					1
MIL-C-11015	19	13	19	4	1	7	3			1		1
MIL-C-11772	21	14	17	4	1	7	3					1
MIL-C-14187	9	6	5	2		1						1
MIL-C-34344	7	4	5	1		4	1					1
MIL-C-14409	14	8	11	3	1	5	2					1
MIL-C-42	7	3	3									
MIL-C-30	5	4	4	1		1						
MIL-C-5015	24	17	14	3	3	4	1			1	1	1
MIL-C-3080	17	13	11	3	3	3	2			1	1	1
MIL-C-71	17	13	14	4	3	5	3			1	1	1
MIL-C-3508	18	15	11	3	3	4	3					1
MIL-C-8384	10	3	6	4	2	4	2			1	1	1
MIL-R-5757	22	6	16	4	1	11	3	1		1		1
MIL-R-25618	12	3	8	2	1	5	2			1		
MIL-R-11	9	4	9	5	4		1				1	1
MIL-R-93	26	16	10	3		3	1				1	1
MIL-R-10500	27	17	6	4	3	2					1	1
MIL-R-94	21	14	11	4		5	2			1	1	1
MIL-R-26	8	5	2	1	1							
MIL-R-11804	5	4										
MIL-R-19	5	4	3	1								
MIL-R-9444	7	5	3	1	1	1		1				
MIL-R-22	4	3										
MIL-T-19500	19	14	10	2	1	8	5				1	1
MIL-R-1	21	15	2	2	1	7	4				1	1
(diodes)												
MIL-R-1	24	21	19	2		9	4		2			1
(traps)												

Table E. Combined Requirements by Subcategories

Specifi- cation Number	Total Usage Generic Types	Total Usage Exact Number	Requirements				
MIL-C-5	26	20	(T-1)1 (T-2)2 (T-6)11 (T-7)1 (T-11)3 (T-13)1	(T-15)3 (T-16)3 (T-18)1 (P-2)5 (P-3)1 (M-1)1	(V-2)1 (V-3)2 (V-4)3 (V-6)1 (V-7)1 (S-2)3	(3-3)2 (SA-1)1 (F-1)1 (A-1)1 (A-3)1 (Q-2)1	(Q-3)1 (Q-4)1 (Q-8)1 (Q-9)2 (D-1)2 (OV-1)7
MIL-C-25	25	17	(T-1)1 (T-6)4 (T-11)4 (T-13)2 (T-15)2 (T-17)2	(P-1)1 (P-2)2 (P-3)1 (V-2)4 (V-3)1 (V-4)1	(V-6)2 (V-7)1 (S-1)1 (S-2)2 (S-3)1 (F-1)1	(A-1)2 (Q-2)3 (Q-3)1 (Q-4)1 (Q-6)2 (Q-7)1	(Q-8)2 (Q-9)3 (D-1)3 (OV-1)6
MIL-C-3965	23	13	(T-2)1 (T-6)2 (T-11)4 (T-13)1 (T-15)2	(T-17)2 (P-3)1 (V-2)1 (V-6)2 (V-7)1	(S-2)5 (F-1)1 (A-1)2 (Q-2)2 (Q-3)2	(Q-4)1 (Q-6)1 (Q-7)1 (Q-8)1 (Q-9)1	(D-1)2 (OV-1)7
MIL-C-10950	18	13	(T-1)1 (T-2)1 (T-6)3 (T-7)1 (T-11)1	(T-15)2 (T-17)2 (T-18)1 (P-2)2 (P-3)1	(M-1)1 (V-2)1 (V-4)1 (V-6)1 (V-7)1	(A-1)1 (Q-2)1 (Q-3)1 (Q-4)1 (Q-6)2	(Q-7)2 (Q-8)2 (Q-9)1 (D-1)1 (OV-1)2
MIL-C-11015	17	13	(T-1)1 (T-2)2 (T-6)2 (T-7)1 (T-11)1 (T-15)2	(T-17)3 (T-18)1 (P-2)3 (P-3)1 (M-1)1 (V-2)2	(V-3)1 (V-4)3 (V-6)1 (V-7)1 (S-2)1 (S-3)2	(SA-1)1 (A-1)1 (A-3)1 (Q-2)1 (Q-3)2 (Q-4)1	(Q-8)1 (Q-9)1 (D-1)2 (OV-1)6
MIL-C-11272	21	14	(T-1)1 (T-2)1 (T-6)3 (T-7)1 (T-11)3 (T-13)1	(T-15)3 (T-17)3 (T-18)1 (P-2)4 (M-1)1 (V-2)2	(V-3)1 (V-4)1 (V-6)2 (V-7)1 (S-2)2 (S-3)1	(F-1)1 (A-1)1 (Q-2)1 (Q-3)1 (Q-4)1 (Q-8)1	(Q-9)1 (D-1)2
MIL-C-14187	9	6	(T-11)2 (T-13)1	(T-15)1 (P-2)2	(V-3)1 (F-1)1	(A-1)1 (OV-1)3	
MIL-C-26244	7	4	(T-11)2 (T-15)2	(T-17)1 (V-4)1	(V-6)2 (V-7)1	(P-3)1 (S-2)1	(F-1)1

MIL-C-14409	14	3	(T-6)1 (T-7)1 (T-11)1 (T-13)1 (T-15)2	(T-17)2 (T-18)1 (T-2)2 (P-3)1 (M-1)1 (V-2)2	(V-4)1 (V-6)1 (V-7)2 (S-1)1 (S-2)1 (A-1)2	(Q-2)2 (Q-3)2 (Q-4)1 (Q-6)1 (Q-7)1 (Q-8)1	(Q-9)1 (D-1)2 (OV-1)3
MIL-C-62	7	3	(T-6)1	(T-11)1	(TM-1)1	(OV-1)2	
MIL-C-20	5	4	(T-1)1 (T-8)1	(T-11)1 (T-13)1	(V-2)1	(A-1)1	(P-2)1
MIL-C-5015	24	17	(T-1)1 (T-6)4 (T-7)1 (T-11)2 (T-13)1 (T-15)2	(T-17)2 (T-18)1 (P-2)2 (P-3)1 (M-1)3 (V-2)2	(V-3)1 (V-4)1 (S-2)1 (SA-1)1 (SD-1)1 (A-1)1	(Q-2)1 (Q-3)1 (Q-4)1 (Q-6)1 (Q-7)1 (Q-8)1	(Q-9)1 (D-1)2 (TM-1)1 (TM-2)1 (OV-1)3
MIL-C-3989	17	13	(T-1)1 (T-2)2 (T-6)1 (T-7)1 (T-9)1 (T-11)2	(T-13)1 (T-15)1 (T-18)1 (P-2)1 (P-3)2 (M-1)2	(V-4)1 (V-6)1 (S-2)2 (SD-1)1 (A-1)1 (Q-1)1	(Q-2)1 (Q-3)1 (Q-4)1 (Q-8)1 (Q-9)1 (D-1)2	(TM-1)1 (TM-2)1 (OV-1)2
MIL-C-71	17	13	(T-1)1 (T-2)2 (T-6)2 (T-7)1 (T-9)1 (T-11)2 (T-13)1	(T-15)2 (T-16)1 (T-18)1 (P-2)2 (P-3)2 (M-1)3 (V-2)3	(V-4)1 (V-6)1 (S-2)2 (SA-2)1 (SD-1)1 (A-1)2 (Q-1)1	(Q-2)1 (Q-3)1 (Q-4)1 (Q-6)1 (Q-8)1 (Q-8)1 (D-1)3	(TM-1)1 (TM-2)2 (OV-1)2
MIL-C-3608	18	15	(T-2)2 (T-6)1 (T-7)1 (T-9)1 (T-11)2 (T-13)1	(T-15)1 (T-18)1 (P-2)1 (P-3)2 (M-1)3 (V-2)1	(V-4)1 (V-6)2 (S-2)3 (SD-1)1 (A-1)1 (Q-1)1	(Q-2)1 (Q-3)1 (Q-4)1 (Q-8)1 (Q-9)1 (D-1)2	(TM-1)1 (TM-2)1
MIL-C-8384	10	3	(T-1)1 (T-2)1 (T-6)1 (T-11)2 (T-13)1	(P-2)2 (P-3)2 (M-1)2 (V-2)1 (V-3)1	(V-4)1 (V-6)1 (S-2)2 (SD-1)1 (A-1)1	(Q-2)1 (Q-3)1 (Q-4)1 (Q-8)1 (Q-9)1	(D-1)2 (TM-1)1 (TM-2)2 (OV-1)4
MIL-R-5757	22	6	(T-2)1 (T-6)2 (T-11)4 (T-13)2 (T-14)1 (T-15)2 (T-1)1	(T-17)2 (T-18)1 (P-2)2 (P-3)1 (P-6)1 (M-1)1 (V-2)1	(V-3)3 (V-4)5 (V-6)2 (S-2)2 (S-3)1 (SA-1)1 (F-1)1	(A-1)2 (A-3)4 (E-1)1 (Q-2)1 (Q-3)1 (Q-4)1 (Q-8)1	(Q-9)1 (D-1)3 (TM-1)2 (TM-2)2 (OV-1)7
MIL-R-25018	12	3	(T-2)1 (T-6)1 (T-11)2 (T-13)1 (T-14)1	(T-15)1 (T-17)1 (P-2)1 (P-6)1 (M-1)1	(V-2)1 (V-4)3 (V-6)1 (S-2)2 (SA-1)1	(Q-2)1 (Q-3)1 (Q-4)1 (Q-8)1 (Q-9)1	(D-1)2 (TM-1)1 (TM-2)2 (OV-1)4

MIL-R-6106	8	4	(T-2)1 (T-3)1 (T-11)2 (T-15)2	(T-17)2 (M-1)1 (V-4)3 (S-2)4	(S-3)1 (Q-2)1 (Q-3)1 (Q-4)1	(Q-8)1 (Q-9)1 (D-1)2 (TM-1)2	(TM-2)2 (OV-1)3
MIL-R-11	23	19	(T-1)1 (T-2)1 (T-5)1 (T-6)1 (T-10)1 (T-11)1	(T-13)1 (T-15)1 (T-17)1 (P-2)4 (P-3)1 (V-2)1	(V-3)1 (V-4)2 (S-2)1 (SD-1)1 (F-1)1 (A-1)1	(Q-2)1 (Q-3)1 (Q-4)1 (Q-8)1 (Q-9)1 (D-1)1	(TM-1)1 (TM-2)1 (OV-1)2
MIL-R-93	25	16	(T-1)1 (T-6)3 (T-11)2 (T-13)1 (T-15)2	(T-17)1 (P-2)2 (P-3)1 (V-3)1 (V-4)1	(V-6)1 (S-2)1 (F-1)1 (Q-2)1 (Q-3)2	(Q-4)1 (Q-8)1 (Q-9)1 (D-1)2 (TM-1)2	(TM-2)2 (OV-1)6
MIL-R-10509	27	17	(T-6)1 (T-10)1 (T-11)2 (T-13)1 (T-17)1	(M-2)3 (V-2)1 (V-4)1 (V-6)1 (P-2)3	(P-3)1 (F-1)1 (A-1)1 (Q-2)1 (Q-3)2	(Q-4)1 (Q-8)1 (Q-9)1 (D-1)2 (TM-1)1	(TM-2)1 (D-1)2 (OV-1)4
MIL-R-94	21	14	(T-6)4 (T-11)2 (T-13)1 (T-15)1 (T-17)3	(P-2)3 (P-3)1 (V-2)1 (V-3)1 (V-4)2	(V-6)1 (S-2)2 (SD-1)1 (F-1)1 (Q-2)1	(Q-3)1 (Q-4)1 (Q-8)1 (Q-9)1 (D-1)2	(TM-1)1 (TM-2)1 (D-1)2 (OV-1)6
MIL-R-26	5	5	(T-10)1	(T-15)1	(P-2)1	(V-4)1	(OV-1)2
MIL-R-11804	5	4	(OV-1)1				
MIL-R-19	5	4	(T-1)1	(T-11)1	(T-13)1	(P-2)1	(OV-1)1
MIL-R-22	4	3	(T-11)1 (T-13)1	(P-2) (M-1)1	(V-2)1	(A-1)1	(OV-1)2
MIL-R-9444	7	5	(T-2)1 (T-10)1	(T-31)1 (P-3)1	(M-1)1 (V-6)1	(S-2)1 (Q-3)1	(Q-7)1 (Q-8)1
MIL-R-1 (diodes)	21	18	(T-1)1 (T-2)1 (T-6)1 (T-7)1 (T-11)1 (T-15)1	(T-17)2 (P-2)1 (P-3)1 (M-1)1 (V-3)2 (V-4)1	(V-5)1 (V-6)1 (V-7)2 (S-2)3 (S-3)1 (F-1)1	(Q-1)2 (Q-2)2 (Q-3)2 (Q-4)1 (Q-6)1 (Q-8)2	(Q-9)1 (D-1)1 (TM-1)2 (TM-2)3 (OV-1)7
MIL-R-1 (tubes)	26	21	(T-1)11 (T-6)1 (T-7)2 (T-11)1 (T-13)1 (T-15)1	(T-16)1 (T-17)1 (P-3)3 (V-2)1 (V-3)4 (V-4)3	(V-5)1 (S-2)3 (S-3)1 (M-5)2 (A-2)1 (Q-1)1	(Q-2)3 (Q-3)4 (Q-4)1 (Q-6)1 (Q-7)1 (Q-8)2	(Q-9)1 (D-1)2 (TM-1)4 (TM-2)4 (OV-1)2
MIL-T-19500 (transistors)	19	14	(T-1)2 (T-2)1 (T-6)2 (T-7)1 (T-11)1 (T-15)1	(T-17)2 (P-3)1 (P-3)1 (M-1)1 (V-3)3 (V-4)1	(V-5)1 (V-6)2 (V-7)1 (S-2)4 (S-3)1 (F-1)1	(Q-1)2 (Q-2)2 (Q-3)2 (Q-4)1 (Q-6)3 (Q-8)2	(Q-9)2 (D-1)2 (TM-1)2 (TM-2)4 (OV-1)6

SUBTASK 5

1. Summary

Subgroup ST-5 distributed two questionnaires, one to industry and one to the Military Services, in order to determine actual procurement practices relating to electronic parts. Summaries of the survey results and the subgroup's conclusions and recommendations are presented.

2. Statement of Mission

The subgroup's assignment was a study of the procurement and engineering practices of contractors, supply groups and other agencies to ensure the use of qualified and reliable parts.

3. Summary of Replies from Industry

(1) Qualified Products List parts are used in moderate amounts in research and development equipments and in larger amounts in production equipment.

(2) Where QPL parts are used, only 14 of 36 companies call out such parts by their military specification part numbers.

(3) A significant number of parts is purchased from an engineering-department-approved source of supply. However, only a small number of companies (4 of 25) base the listing on complete qualification tests. An additional 5 companies use partial qualification tests, and 10 use evaluation tests different from QPL tests.

(4) In general, company specifications are not prepared by equipment manufacturers to cover QPL parts, and although engineering departments indicate medium to light control over the purchasing department with respect to using approved sources, purchasing departments usually have buyers' choice among the listed sources.

(5) Of 33 companies, 30 indicated that functional organizations other than engineering departments could cause the purchasing department to use other than approved sources, but this happened infrequently.

(6) Very few parts purchases for research and development (R&D) equipments include the requirements that the supplier conduct acceptance tests. The purchase of only a moderate number of parts for production equipments requires acceptance tests by suppliers.

(7) Very little acceptance testing is performed in contractors' plants for parts used in R&D equipment. There is a moderate amount of acceptance testing in contractors' plants on parts used in production equipment, but most of them are not complete acceptance tests. After the first production order, only a few parts are tested to determine complete conformance to specifications.

(8) Only 2 of 29 companies report to the Armed Services Electro-Standards Agency on parts not conforming to military specifications. Eleven of the 29 companies indicate they report noncompliance to the procuring activity, but such reports are made in only limited numbers.

4. Conclusions Based on Replies from Industry

A review of the industry survey leads to the following observations relative to making any "reliable parts specification" meaningful.

(1) The existence of a good military specification will not be meaningful unless administrative control over the use of standard parts is effectively exercised to ensure that prime contractors use standard parts.

(2) Complete acceptance and qualification tests are essential to the reliable parts program. No formal machinery exists to ensure that these tests are made for parts purchased by prime contractors or to ensure feedback of test information to a central military group for the purpose of specification and QPL maintenance.

(3) Other subgroups have made recommendations that will fulfill the needs stated in paragraphs (1) and (2) above.

5. Summary of Replies of Military Services

(1) The age of parts in stock bins in the field is considered to range from one to 8 years, with the exception of specific items that have an expected short shelf life (e.g., batteries and electrolytic capacitors). The high-use items are considered to average 2 to 3 years. One Military Service indicates that inactive items are specially packaged and periodically examined.

All three Military Services have different approaches to the determination of stock levels. One stocks to meet 3 to 14 months requisitioning, plus procurement lead time (up to 9 months), depending on the item's value. Another considers a 1-month safety, plus 9 months' average procurement, plus an economically determined level which varies up to 5 years for low-use items; note, however, in the preceding paragraph that average age for parts is 3 years. The third stocks for one and one-half months to 20 months, plus a "war readiness" level.

(2) All the Military Services reported a procedure to purge obsolete parts. One indicates control through automatic data processing. The second indicates only limited control currently, but it is building up EDP (electronic data-processing) equipment to improve the situation. The third indicates a rather complete control through the issuance of (a) bulletins directing the disposal of specific obsolete items, (b) "do not replace" instructions and (c) listing of "stock number actions" (alternate replacements).

(3) Although all the Military Services indicate a control of aged (not obsolete) parts, a careful reading of the answers indicates that this is effective only for dated items (such as batteries, etc.), but that, once other parts are broken out of packages and put into bins, their age usually cannot be determined. (See section 5, paragraph (1), for Service opinions on age.) All tubes, including the subminiature variety, are date-coded.

(4) Two Military Services indicate that 80 percent of orders for parts and tubes are for purchases totaling less than \$1,000. A third Service indicates 45 percent for purchases totaling less than \$1,000. One states that only about 34 percent of the dollar value of purchases fall into JAN/MIL items. (Converted into numbers of parts, this should be well in excess of 50 percent.)

(5) Two Military Services indicate that qualified parts are inspected in accordance with military specifications. The third reported that inspection of qualified parts is by surveillance to ensure that contractors are maintaining the required standard of quality during production. One specifically stated that, where a QPL exists, procurement is only from a qualified source.

(6) Technical review of purchase orders varies among the Military Services. One has a technical group at its stock control activity to screen orders for replacement parts of commercial variety, with a view to supplying equivalent parts to a military specification and for consolidation into larger orders. Note that, even with this consolidation, 80 percent of orders are for less than \$1,000. This group also passes on the acceptability of substitutions or exception in bids. One Military Service refers technical questions to "maintenance engineering" and the third Service refers technical questions through a liaison engineer to its standardization group.

(7) One Military Service indicated positively that specifications are never changed to accept the lowest bidder. Answers from the others imply the same situation. However, answers from all three indicate that information from bidders may result in re-advertising for alternate items, presumably based on equivalence as determined by the technical review. Note that one Military Service (in paragraph (5) above) states that only qualified parts are purchased where a QPL exists.

6. Conclusions Based on the Military Services' Replies

A review of the Military Services' replies leads to the following observations relative to the effectiveness of any "reliable parts specification."

(1) Any decision to modify a specification must consider stocking levels in the Military Services and must be based on the knowledge that such modification will affect replacement stock levels averaging two to three years of Service demand.

(2) A further consideration is the volume of paper work behind stock control (see paragraph (2), section 5), reflecting not only the cost of replacing parts in all depots but also the cost of issuing stock control bulletins and changes to instruction books resulting from any specification change.

(3) Consideration should be given to adding age identification in specifications for all "reliable" parts.

(4) The purchase and use of reliable parts by the Military Services must be effectively controlled to prevent the substitution (by "consolidation" or "equivalence") of a part with lower or no specified life expectancy.

(5) The levels of stock replenishment have been established as resulting in the bulk of purchases covering orders less than \$1,000. This points strongly toward the following:

(a) Consolidated purchases of identical items for the three Military Services;

(b) Much greater consolidation of styles and sizes of permissible "standards" to eliminate numerous purchases of many varieties of parts in small quantities;

(c) A need for continuous inspection of production in the parts manufacturers' plants.

(6) Other subgroups have considered the conclusion stated in paragraph (5)(c) above.

7. Recommendations

The following actions are recommended by Subgroup ST-5, based on the foregoing considerations:

(1) Establish effective administrative control machinery to ensure that prime contractors make maximum use of an abbreviated listing of standard reliable parts (see recommendation (2) below) in equipment design.

(2) Restrict the styles and types of standard reliable parts to a considerably greater degree than is currently done for military standard parts in order to minimize the test load inherent in establishing failure rates.

(3) Institute a study of the details of stock binning down through all levels of the supply system, from stock control point to field repair activities, directed specifically toward ensuring first-in/first-out stock control and the maintenance of information on identity and age of parts.

(4) Modify standardization manuals to include procurement policies that are of concern to specification writers and essential to the adequate preparation of specifications.

(5) Establish consolidated procurement of standard reliable parts for replacement. The procurement of such parts by a single Military Service is a possible solution.

EXHIBIT A

QUESTIONNAIRE DISTRIBUTED TO THE MILITARY SERVICES

Supply (Distribution)

1. What is your impression regarding the age of parts in your supply bins in the field?
2. Have you an established procedure for continually purging obsolete stock?
3. Have you a means of identifying the age and the manufacturer of parts in the stock bins at major depots and at repair bases (after removal from shipping containers)?
4. Have you any regular orders to remove aged (not obsolete) stocks in the field? What are they?

Supply (Procurement)

Note: All questions concern the procurement of electronic parts only.

1. What percent of your parts orders are for less than \$1000? more than \$1000?
2. Of those that are not for qualified parts, what kind of information do you use to determine what to buy?

Engineers specifications
Drawings
Others

3. What acceptance testing do you require for
 - a. Qualified parts?
 - b. Nonqualified parts?
4. Do you maintain a technical group which may decide on equivalence of parts between orders for purposes of more advantageous procurement?
5. Are their findings in any way reviewed by order originator?
Or a technical arm of your Service?
6. Does the requirement for the low-bidder purchase result in any operations that may tend to change purchase orders specification after receipt of bid?
Comment:
7. In determining the level of stocks, approximately what period of time do you stock for?

1 year? 2 years? Other?

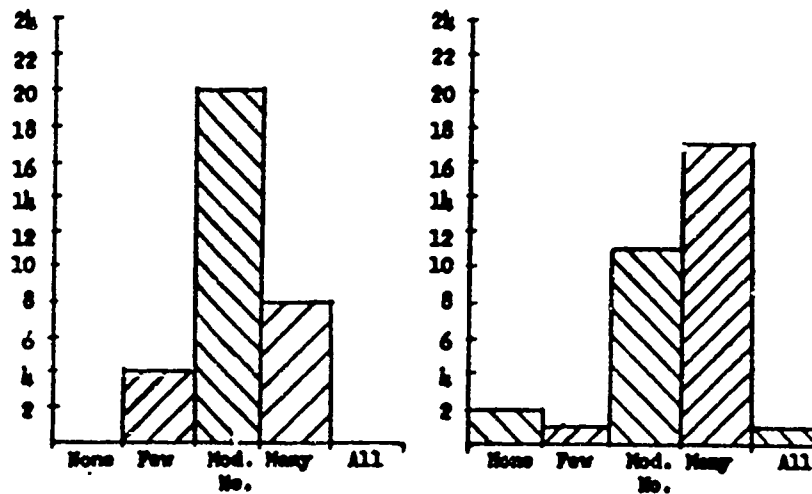
EXHIBIT B

Compilation of Replies to Questionnaire

Inspection Practices in Contractors'

Engineering and Procurement of Electrical and Electronic Parts

1. Use the appropriate block below to indicate usage of qualified (QPL) Military specification electrical and electronic parts in your Military equipment.

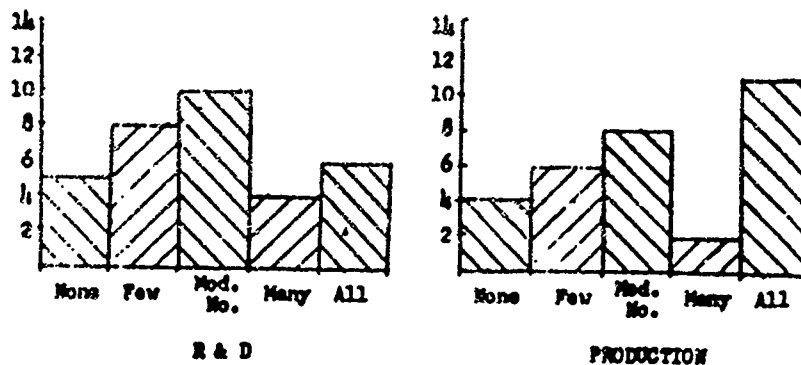


R & D

PRODUCTION

2. Do your production drawing bills of materials (or materials list) identify Military specification electrical and electronic parts?
- (a) ☐ 22 directly by Military part number or type designation callout.
 - (b) ☐ 8 indirectly by use of company internal numbers.
 - (c) ☐ 6 either or both of above.
3. If 2b or 2c above is checked, are Military specification parts procured,
- (a) ☐ 3 by purchase order callout of Military part number or type designation, or
 - (b) ☐ 12 by purchase order callout of company internal number?

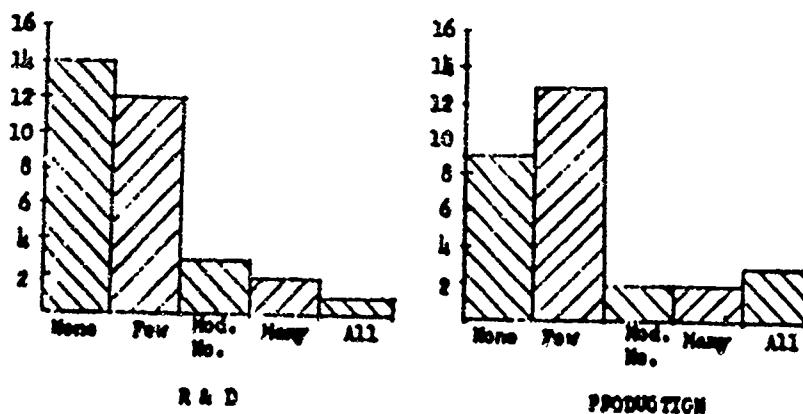
4. Does your engineering department establish approved sources of supply for use by your purchasing department (by engineering approval list or otherwise) of Military (OPL) parts for procurement?



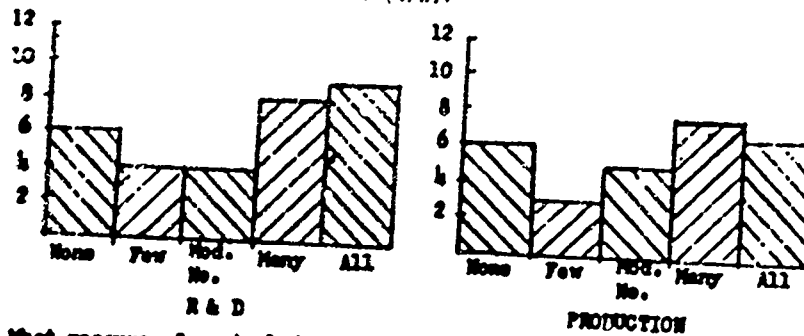
5. Are the above engineering approved sources based primarily on:

- (a) ☐ 6 Engineering judgment
 (b) ☐ 5 Partial qualification test
 (c) ☐ 10 Engineering evaluation test (different from Qualification Test)
 (d) ☐ 4 Complete Qualification test

6. Do you prepare complete specifications for Military (OPL) parts (electrical and electronic) in order to limit the source(s) of supply type used by your purchasing department?



7. May your purchasing department procure from any whatever source(s) (buyer's choice) listed on the (OPL)?



8. What measure of control does your engineering department exercise on your purchasing department with regard to use of approved engineering source(s)?

- (a) Tight
 (b) Medium
 (c) Loose

9. Can it happen accidentally or deliberately that your purchasing department procures from source(s) not approved by your engineering department?



10. Can any functional organization cause your purchasing department deliberately to procure from other than the engineering approved source(s)?

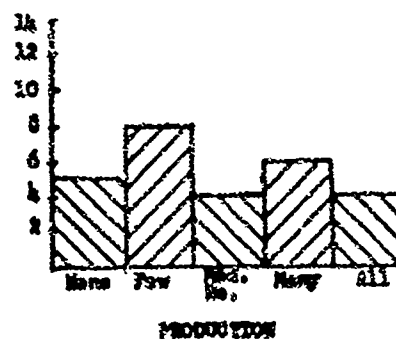
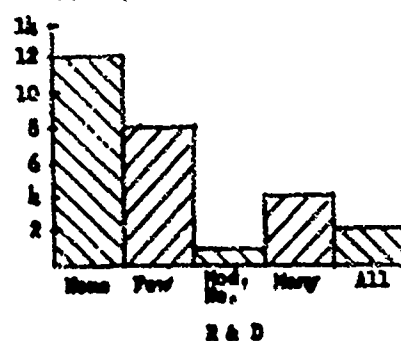
- (a) Production planning
- (b) Material control
- (c) Material ordering
- (d) Quality control
- (e) Other
- NO
- No answer

11. Does receiving, receiving inspection or quality control support the engineering approved source(s) by:

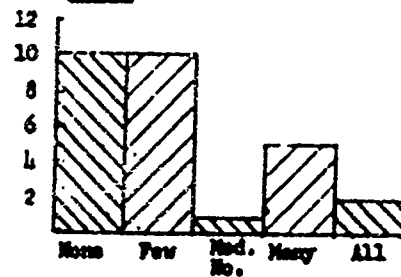
- (a) Returning shipment of parts
- (b) Accepting shipments and notifying engineering
- (c) Chastizing purchasing
- (d) Other
- (e) If combination, check here and identify each
- No answer

12. Does your engineering, purchasing, quality control,

☒ No answer, separately or in combination demand by specification purchase order requirement that suppliers conduct acceptance tests on (QPL) parts?



13. Does ☐ 13 engineering, ☐ 12 purchasing, ☐ 17 quality control,
☐ 16 answer, separately or in combination require evidence of No. 12,
above, by
- (a) ☐ 12 Certified statement
- (b) ☐ 18 Certified test data
- (c) ☐ 7 Test data (not certified)



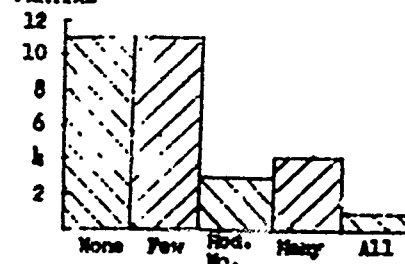
R & D



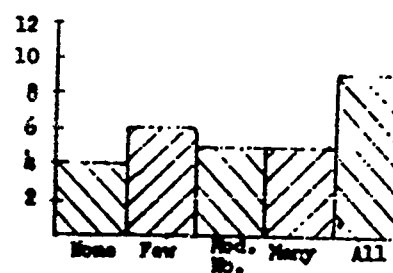
PRODUCTION

14. Does your quality control perform "Acceptance Tests" on (QPL) parts per Military specifications?

PARTIAL

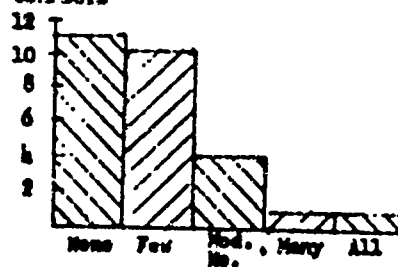


R & D

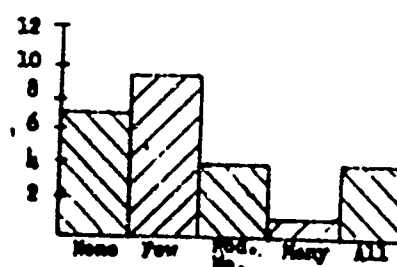


PRODUCTION

COMPLETE



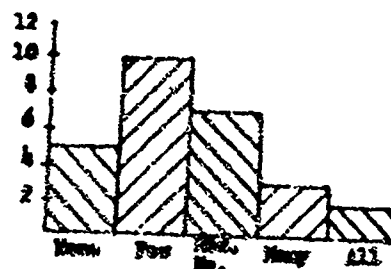
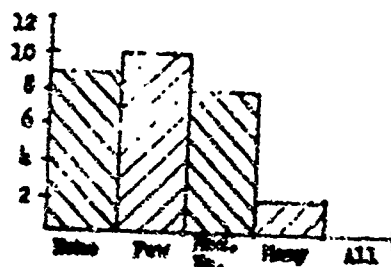
R & D



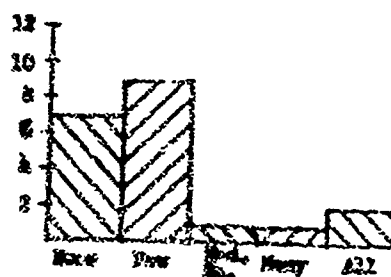
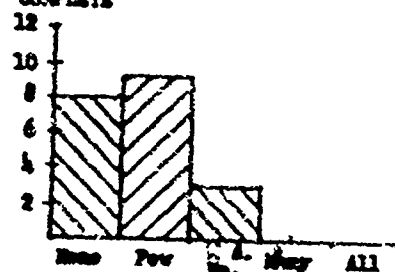
PRODUCTION

15. During or subsequent to first production order of parts per Military specification from (OPL) sources does ☐ engineering, or ☐ quality control, or ☐ both, conduct additional tests?

PARTIAL



COMPLETE



R & D

PRODUCTION

16. If parts do not conform to Military specification requirements as determined by tests conducted in No. 15, above, do you report the facts to:

- (a) ☐ 2 AECMA
 (b) ☐ 11 Procuring activity
 (c) ☐ 15 No activity outside our company
☐ 7 Answers dropped because of inconsistencies with answers to question 15.

17. How many times have you reported non-compliance with specifications based on tests conducted per Item No. 15, above?

No answer - 1 Company.
 Don't know - 2 Companies
 None - 1 Company
 Very Few - 1 Company
 Few - 1 Company
 Several - 1 Company
 Many - 2 Companies
 Numerous - 1 Company
 Ten - 1 Company

12 Answers dropped because of inconsistencies with answers to questions 14 and 15.

18. Paragraph 12, "distribution of test data," of "provisions governing qualification," (Department of Defense, Armed Services Supply Support Center, 17 June 1958) states in part "test reports or information therefrom will not be furnished to commercial activities without permission from the manufacturer."

(a) Would the qualification test report serve a useful purpose to you?

☒ 30 Yes ☐ 2 No

(b) Could you assure parts suppliers that you would hold test data in confidence and not disclose to his competitor(s)?

☒ 31 Yes ☐ 2 No

(c) Do you obtain such reports now directly from parts suppliers?

☒ 22 Yes ☐ 11 No

APPENDIX I



OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
WASHINGTON 25, D. C.

RESEARCH AND ENGINEERING

14 July 1958

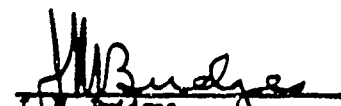
MEMORANDUM OF AGREEMENT

SUBJECT: Jointly Sponsored OSD (R&E/S&L) Ad Hoc Study on Electronic Parts

The rapidly changing state of the electronics art with increasingly more complex equipments demanding high reliability has created the need for (a) additional requirements in electronic parts and tubes specifications, (b) more rapid coordination of specifications, (c) establishment of technical characteristics data for dissemination to design and logistics personnel and (d) a complete review of the parts specifications program to insure compatibility with the reliability program.

In view of the above, it is felt that the solution to these problems should be undertaken in the manner delineated in Enclosure (1).


G. A. Tucker
Director for Production Policy
OASD (S&L)


J. A. Bridges
Director of Electronics
OASD (R&E)

Enclosure - 1
Task Assignment for Ad Hoc Study on
Parts Specifications Management for
Reliability

Enclosure 1

TASK ASSIGNMENT FOR
AD HOC STUDY ON PARTS SPECIFICATIONS
MANAGEMENT FOR RELIABILITY

1. This ad hoc study on Electronic Parts and Tubes is sponsored by the Office of the Assistant Secretaries of Defense (Research and Engineering) and (Supply and Logistics).
2. Control and administrative support of this study will be provided by OASD (R&E). Members of the study will be selected by the sponsors and will be either full time government employees or consultants to the Office of the Secretary of Defense.
3. The study shall be conducted by the following people:
 - (a) Chairman
 - (b) One member from OASD (R&E)
 - (c) One member from OASD (S&L)
 - (d) Two members from each of the Military Departments
 - (e) One member from ASESA (Armed Services Electro-Standards Agency)
 - (f) Six members selected from Consultants to the OSD -- two shall be experienced in the area of electronic parts, two experienced in the area of electron tubes and two experienced in electronic equipment and systems design.
4. The following is a statement of the problem which this study is being established to evaluate.

Increasingly more complex electronic equipments demanding high reliability have created the need for additional requirements in the parts and tubes specifications. The specifying of reliability in quantitative terms requires the introduction of reliability requirements into both equipment and component specifications as well as the development of practical and economical test procedures to verify compliance with the specifications. In addition, quality control procedures should include features to insure maintenance of reliability levels throughout production runs.

To enable designers to develop equipments which will meet quantitative specification of reliability for equipments and systems it is essential that guidance and application data such as component failure rates as a function of time and environment be made available to engineering groups. There is a great need to obtain and disseminate these technical characteristics of components as quickly as possible.

In the interests of economy, procedures must be designed and developed which will avoid duplication of acceptance tests.

5. The basic objective of this study is to analyze the recommendations established by the AGPZZ Task Group 5 in order to advise the Assistant Secretaries of Defense (R&E) and (S&L) regarding efficient implementation methods and procedures. The study shall include:

(a) Recommended criteria and methods for specifying the reliability of parts and tubes in terms of failure rate as a function of time, environment and circuit application severity.

(b) Survey the methods used in preparation of parts and tubes specifications as well as coordination procedures and practices. This survey shall be made to suggest changes which would accommodate the specification of reliability level and its allied reliability assurance requirements. Procedures proposed shall be to enhance rapid and full specification coordination within the Military Departments and with industry.

(c) Review of Qualified Products List (QPL) and Qualifications Testing Procedures to evaluate:

(1) If qualification is being properly implemented.

(2) Adequacy of tests with respect to the reliability requirements and quality control procedures included in the specification.

(3) Provisions for avoiding any duplication of Qualification Testing by various contractors.

(d) Recommend reliability assurance test procedures to verify compliance with the reliability level specified.

(e) Recommend a program and methodology for obtaining technical characteristics and test data of parts including failure rate data and the procedure for making this data available to designers and logistics personnel.

(f) Investigate the need for a document other than the specification to provide design guide information such as parts and tube application curves (including failure rate curves or data as a function of circuit application severity level and environment). Such a document would provide design guide information as opposed to the firm specification requirement data mentioned above.

6. A report of the conclusions reached as a result of this study will be prepared for consideration by the Assistant Secretaries of Defense (R&E) and (S&L). It is expected that the study will be completed within six months.

APPENDIX II

Membership of the Ad Hoc Study Group and Subgroups

Ad Hoc Study Group on Parts Specifications Management for Reliability

P. S. Darnell (Chairman)	Bell Telephone Laboratories, Inc. Whippany, New Jersey
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M. A. Ford	Armed Forces Supply Support Center Washington, D. C.
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J. Hanley	U. S. Army Signal R&D Laboratory Fort Monmouth, New Jersey
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C. G. Killen	Sprague Electric Company North Adams, Massachusetts
R. E. Kuehn	International Business Machines Corporation Owego, New York
R. E. Moe	General Electric Company Owensboro, Kentucky
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R. J. Nordlund	Wright Air Development Center Wright-Patterson Air Force Base, Ohio
G. T. Reeves	Armed Services Electro-Standards Agency Fort Monmouth, New Jersey
J. Riordan	Office of the Assistant Secretary of Defense (Supply and Logistics) Washington, D. C.
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Raymond Eoward

Convair/Pomona
Convair Div. of General Dynamics
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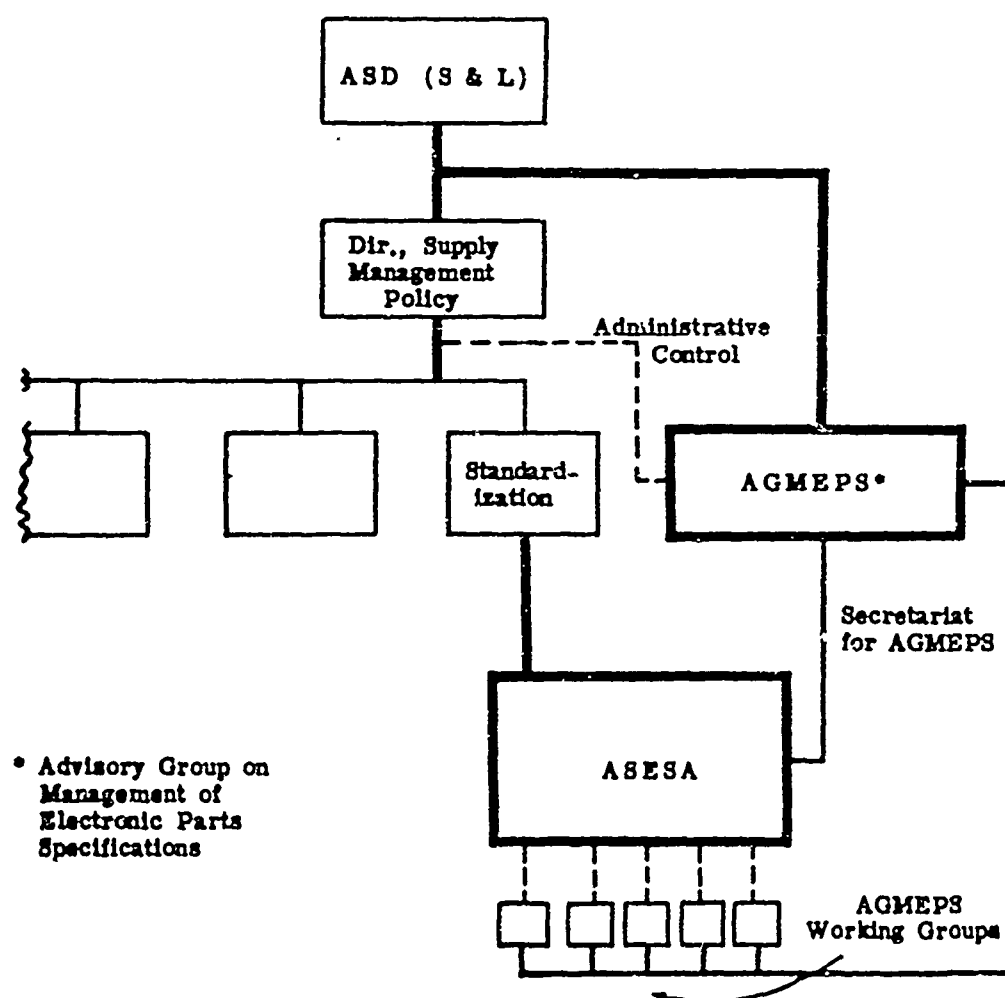
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ORGANIZATION CHART

(Appendix III)



* Advisory Group on Management of Electronic Parts Specifications

APPENDIX III

PROPOSED DEPARTMENT OF DEFENSE INSTRUCTION

SUBJECT: Advisory Group on Management of Electronic Parts Specifications

References: (a) DOD Directive No. 5128, 1 "Assistant Secretary of Defense (Supply and Logistics)," January 7, 1959.

I. PURPOSE

To aid the Assistant Secretary of Defense (Supply and Logistics) in carrying out the functions set forth in reference (a), the Advisory Group on Management of Electronic Parts Specifications is hereby established as an activity of the Office of the Assistant Secretary of Defense (Supply and Logistics) (OASD-S&L), Office of the Secretary of Defense (OSD), with membership, field of interest and method of operation as defined herein.

II. DEFINITIONS

A. The terms "electronic component parts" or "parts" mean all electronic parts, including electron tubes and semiconductor devices, integrated circuit components and functional components.

B. The term "parts specification program" refers to all electronic parts specifications, standards, handbooks and other required technical documentation.

III. MEMBERSHIP

The members selected for the Advisory Group shall represent a balanced team with management and technical experience in the areas of electronic parts, tubes and semiconductors; the electronic-systems design area; and the electronics engineering, procurement and logistics areas of the Department of Defense. The Group shall comprise the following members:

A. The Assistant Secretary of Defense (S&L), after collaborating with the Director of Defense Research and Engineering in the selection of members, shall appoint the members to the Advisory Group from OSD consultants who are expert in the fields indicated herein.

B. One member and one deputy may be designated by each of the three Military Departments.

C. One member and one deputy may be designated by both the OASD (S&L) and the ODDR&E.

D. In addition, agencies of the Department of Defense and other agencies of the government may formally nominate representatives to serve as associate members, subject to the approval of the Assistant Secretary of Defense (S&L).

E. The Assistant Secretary of Defense (S&L), after coordinating with the Director of Defense Research and Engineering, shall appoint a chairman of the Advisory Group from among the members, preferably from among the OSD consultant members.

IV. FIELD OF INTEREST

The field of interest of the Advisory Group on Management of Electronic Parts Specifications shall encompass all phases of DOD programs on the development of electronic-parts specifications and technical documentation and the management thereof. It shall include the preparation and coordination of specifications; the designation of standard preferred parts and the establishment of parts lists; the establishment of approved sources of supply for qualified electronic parts lists; the establishment of test methods and procedures (sampling plans) for reliability and quality assurance; and the development of engineering application data for electronic component parts.

V. FUNCTIONS

A. General. The function of the Advisory Group is to provide, on a continuing basis, technical advice that will aid the Assistant Secretary of Defense (S&L) in planning and directing an adequate, economical and effective program of specification development and technical documentation in the area of electronic component parts. In addition, the Advisory Group may provide similar advice to the Director of Defense Research and Engineering and the Military Departments relative to their interests in these areas.

B. Specific. In pursuit of its stated general function, the Advisory Group shall:

1. Review all proposed DOD programs relating to the development of electronic-parts specifications and technical documentation and the management thereof, and recommend to the Assistant Secretary of Defense (S&L) the most effective program and changes to proposed programs that will ensure the timely implementation of the programs.

2. Prepare and recommend DOD policy, program and implementation plans for the development of specifications, standards and handbooks for electronic parts regarding:

- a. Priorities and schedules for the specification-development program that will be consistent with the operational needs of the Military Departments.

- b. All specification programs and actions to ensure their adherence to established schedules.

- c. Techniques and guidelines, to be used in preparing military specifications, that will ensure the completeness and adequacy of specifications for procurement. This shall include the specification of performance and reliability in standard levels; test plans necessary to prove compliance with specification requirements; procedures for qualification approval; and the development and dissemination of parts application data, including failure rate as a function of time and levels of application severity.

d. The collection, analysis and use of parts characteristics data in the development of new specifications or the revision of existing ones.

3. Review the programs on specifications development and technical documentation in relation to the many other programs of the Military Departments, such as the Long Range Parts and Tubes Research and Development Program and the Industrial Mobilization Planning Program, to ensure that the programs are properly coordinated. This coordination shall be extended to ensure the programs' compatibility with industrial facilities and activities in the areas of electronic parts.

4. Assist in resolving areas of conflict in the over-all program and detailed problems arising in the preparation and coordination of parts specifications.

5. Develop and recommend criteria for the generation of preferred parts lists to be contained in military standards and approved sources of supply for qualified electronic parts lists to be included in military specifications or procurement documents, where applicable, to ensure that:

a. Preferred parts lists are developed or brought up to date and promptly issued.

b. Efficient methods and techniques are employed by the Military Departments to ensure maximum use of parts on the preferred parts lists. Where necessary, the Advisory Group shall recommend actions to improve the methods and techniques.

c. Application data, including failure rates, are developed and promulgated.

d. A Parts Qualification Activity for each specification category is established.

e. Qualified products lists are developed and promptly issued.

6. Review budget requirements for the programs relating to specification development, technical documentation and standardization and recommend adequate funding levels. Review the manpower and facilities in relation to the required funding levels and recommend action to ensure efficient management and implementation of the over-all program.

VI. OPERATIONS

In performing its functions, the Advisory Group shall operate under the supervision, administration and control of the Director of Supply Management, OASD (S&L).

Associate members of the Advisory Group are invited to participate in presentations and discussions. Any dissenting views of associate members may be presented, but the action of the Advisory Group shall be determined by the designated members.

The Advisory Group is authorized to establish such working groups or ad hoc groups as may be required, subject to the approval of the Director of Supply Management, OASD (S&L), coordinating with the Director of Electronics, ODDR&E.

VII. LIAISON

The Advisory Group shall maintain liaison with other groups and agencies, both within and outside the Department of Defense, that have related interests, such as the Advisory Group on Electronic Parts and the Advisory Group on Electron Tubes, ODDR&E. The Director of Supply Management, OASD (S&L), and the Director of Electronics, ODDR&E, shall collaborate in arranging effective liaison among the groups.

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