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Materials and Process Specifications and Standards

Report of

The Committee on Materials Specifications, Testing Methods, and Standards

NATIONAL MATERIALS ADVISORY BOARD
Commission on Sociotechnical Systems
National Research Council

NATIONAL ACADEMY OF SCIENCES
Washington, D.C. 1977

NOTICE

The project that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the Councils of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The members of the committee responsible for the report were chosen for their special competences and with regard for appropriate balance.

This report has been reviewed by a group other than the authors according to procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

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ABSTRACT

The committee examined the present status of specifications and standards work in the Department of Defense and elsewhere as appropriate. As a major item the committee recommends that the U.S. voluntary standards system be extensively called upon to rectify a growing deficiency in the DoD system. The impact of the present situation, as related to engineering education, industrial engineering, current domestic and international trade, and Department of Defense problems of cost, design, reliability, and procurement is assessed. Appropriate recommendations for a plan of action are made, aimed at producing a more efficient, effective and nationally unified system.

ACKNOWLEDGMENTS

This report was prepared by the committee on Materials Specifications, Testing Methods, and Standards based on its own deliberations and numerous presentations made to it. For the latter, grateful acknowledgment is given to the American National Standards Institute; the American Society for Testing and Materials; the American Welding Society; the Society of Automotive Engineers (AMS); the American Society of Mechanical Engineers; the American Society for Nondestructive Testing; the Aerospace Industries Association; the General Electric Co.; Mr. W. A. McAdams; and to the liaison representatives listed in the following pages. Among the liaison representatives, special mention is made of the contributions of the late Mr. Linus MacDonald in the early stages of this study.

PREFACE

The subject of standards and specifications is clearly a wide-ranging and complex one, even when restricted, as in the present case, to materials and processes. Although some previous studies have dealt with some aspects of the broad subject - albeit none in the context of the specific interests and problems of the Department of Defense, as encompassed and specifically addressed herein - there has not been a comprehensive, all-embracing study to provide a basis for national policy at least insofar as the total government is concerned, and including government relations to non-government standards activities. Indeed, it is not clear that an intelligent all-embracing study is feasible; a step-by-step approach may be necessary and preferable.

The present committee early recognized that the conditions of its assignment, including timing, necessitated restricting its scope and activities. It has addressed itself, therefore, to what it considered the basic DoD problems, freely granting that other problems also required study and urging that this be done. For example, the subjects of certification or accreditation of laboratories for government purposes and the use and maintenance of "Qualified Products Lists" are certainly important and demand attention; this committee did in fact discuss these, but too superficially, because of limited time, to permit commenting on them in this report.

Likewise, the committee is not in a position to discuss certain bills relating to standards introduced in Congress in 1976, partly because the committee had essentially completed its deliberations by that time and partly because it was questionable if they truly were within its scope and authorization. Senate Bill S.3555, "Voluntary Standards and Certification Act of 1976", is an example. Similarly, it has come to the attention of some of the members of the committee only very recently that a newly proposed circular from the Office of Management and Budget deals with federal interaction with commercial standards-setting bodies. The circular, if actually issued in its present form or equivalent, would support one of the major recommendations of this report but, again, the committee as a whole has not had an opportunity to study the circular and therefore makes no comment on it. This is not to say, of course, that individual members of the committee do not have strong feelings on these documents. (See Appendix K for a copy of referenced circular).

This report also does not cover requirements of regulatory agencies and such requirements as safety and environment control, except as they might relate in a technical sense to certain material and process

specifications. For example, a problem posed to the committee from an outside source, and considered outside the scope of the committee, was the claim that regulations are issued in different formats and variations, sometimes contradictory, and are vague as to test methods, sampling, acceptance and rejection criteria, packaging, etc.

Although this report attempts to remain within the limited and specific scope assigned to the committee, in some respects it may serve as a pilot study. Some of the discussion herein undoubtedly applies to specifications and standards beyond materials and processes and national needs beyond those of the Department of Defense -- the national issues of proliferation, simplification, and unification of systems; possible development of a national specification and standard system for many commodities; the role of the voluntary specification and standard writing groups (that already cover a major segment of national needs). These and other similar topics, in the broad context of national interest (rather than being limited to the Department of Defense as in the current assignment) require study by a variety of appropriate groups. The committee hopes that, at least progressively, these studies will be initiated.

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[1] Since October 1975

MATERIALS AND PROCESS SPECIFICATIONS AND STANDARDS

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CHAPTER 1

SCOPE AND OBJECTIVES

1.1 INTRODUCTION

1.1.1 HISTORY

For a number of years, the National Materials Advisory Board (NMAB) has been informally discussing, in terms of national needs, the status and posture of materials and process specifications and standards in the United States, with respect to (a) those generated within the government and (b) those generated elsewhere. Clearly, specifications and standards have paramount importance for an economic design, and in the case of the Department of Defense (DoD), they are critical. This is true also for industry. The importance of a specification as a definitive tool for communication was also recognized.

In these preliminary contemplations and deliberations, there was not discerned the existence of a comprehensive, unified national policy or program that could lead to an efficient, cost-effective, practical, national system (or systems) for the preparation and utilization of timely and technically up-to-date specifications and standards. What was readily discernible was the need for an in-depth study of at least the major facets of the current situation, the needs, gaps, opportunities, and possible remedial action. Obviously, the full scope of this topic is vast, with many far-reaching implications. As indicated above, the narrower scope of specifications and standards for materials and processes used by and for the DoD comprises an issue of major importance, and it is to that kind of an issue that this study is addressed. Although the major thrust of this study and report relate to the DoD in both its national and international concerns, it has been necessary to consider also non-DoD relevant activities, because of their inevitable impingement on and interaction with current DoD practices and any future DoD system of operation. It should be further noted that DoD practices constitute a strong precedent and example for non-DoD-related practices in the development and usage of specifications and standards.

On June 6, 1973, the DoD issued Directive 4120.3 which established policies and assigned responsibilities for the Defense Standardization Program. Inter alia the Defense Materiel Specifications and Standards Board (DMSSB) was established. On 19 November 1974, the Materials Panel of the DMSSB was chartered; it was charged with assuring the adequacy of the Defense Standardization Program in the

specific area of materials[1] and processes used in the design and procurement of DoD materiel. Its efforts were to include formulation of standardization policies, plans and procedures. Within the above scope, the DMSSB Materials Panel was given the following responsibilities, which are itemized in detail here because they relate so intimately to the DoD charge to this committee:

1. Ascertain the adequacy of existing DoD standardization efforts, specifications and standards to meet DoD needs. Relate the DoD standardization efforts with other federal/industrial efforts. Recommend improvements and actions for improvement to the DMSSB.

2. Recommend policies relating to the DoD standardization of materials and processes and their application in DoD materiel.

3. Monitor DoD activities related to the development and coordination of (a) DoD originated specifications and standards, (b) Federal specifications and standards and (c) Technical society published specifications and standards. Make recommendations for improvement of the process/procedures.

4. Identify specific areas where increased use of industry specifications and standards would be advantageous to the DoD. Recommend policies and actions that can be adopted to expedite this increased use.

5. Identify specific problems related to materials and processes availability especially with respect to system production and design and effects of using substitute materials and processes.

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[1] Primarily classifed under FSG 93, Non Metallic Fabricated Materials; FSG 95, Metal Bars, Sheets and Shapes; FSG 96, Ores, Minerals and Their Primary Products, and secondarily classified under FSG 68, Chamicals and Chemical Products; FSG 80, Paints, Sealers, and Adhesives; FSG 81, Containers, Packaging Supplies; FSG 91, Fuels, Lubricants, Oils and Waxes.

6. Recommend plans and programs for improving standardization of materials and processes; as well as improving the use and applications of existing specifications and standards.

7. Recommend specific specification consolidation efforts as well as specific areas in need of standards development (identifying existing specifications that will form the basis for new standards).

8. Identify specifications and standards that need to be updated. Similarly identify those that should be cancelled.

9. Coordinate the panel efforts with non-DoD federal, industry associations, and industry standards groups; e.g., National Materials Advisory Board (NMAB) of the National Academy of Sciences - National Research Council, National Bureau of Standards (NBS), American National Standards Institute (ANSI), American Defense Preparedness Association, Aerospace Industries Association (AIA), American Society for Testing and Materials (ASTM), et al.

1.1.2 REQUEST TO NMAB

The Materials Panel of the DMSSB, recognizing the ubiquitous nature of materials in DoD materiel, considered it imperative to make a fundamental study of the basic documents of procurement and design, i.e., specifications and standards, not including engineering drawings. Accordingly on February 19, 1975, the National Materials Advisory Board was requested to undertake a study with the generalized task statement as follows: "Delineate an optimum plan for the generation, implementation, and improvement of DoD materials and process specifications and standards which would utilize, if possible, the resources and organizations in existence and with due consideration of other aspects of national standardization programs".

1.1.3 NMAB COMMITTEE ORGANIZATION, SCOPE, AND OBJECTIVES

As a result of this request, an NMAB Committee on Materials Specifications, Testing Methods and Standards was constituted. Its first meeting was held on June 19, 1975. The committee was structured to insure a variety of inputs, from a number of viewpoints, covering the several aspects of the subject that could be envisioned in the planning stage. Special guests, as appropriate, were invited to meetings to address critical issues that arose.

The committee adopted as its study scope the following:

1.1.3.1 SCOPE

Specification and standard systems applied to materials and associated finishes and processes.

The overall Department of Defense Management Program for specifications and standards as it related to the committee charge.

The impact of criteria for structural integrity on the foregoing specifications and standards.

The data base for specifications (with consideration of the Office of Technology Assessment (OTA) study on Materials Information Systems).

The cost elements of specifications and standards.

The educational aspects of specifications and standards.

Other areas that may be required to achieve the objectives of the committee.

After consideration of its charge, scope, and early presentations by liaison representatives, the following committee objectives were established:

1.1.3.2 OBJECTIVES

Develop recommendations that would improve the implementation of the Department of Defense Specifications and Standards System/Program.

Establish the interrelationship and impact of various specifications and standards in terms of the Department of Defense posture.

Determine and describe the importance of specifications and standards through the use of real-life examples and impact on procurement costs.

Examine the Department of Defense Standardization Program and the procedures used therein, including how specific specifications are selected for use, how selection is contractually controlled, how modifications, feed back, revisions and cancellations are introduced and effected, how DoD personnel perform in non-government groups that publish specifications and standards.

Examine the impact of a national system for standards, if one existed, on Department of Defense standardization programs.

Examine the interrelationship of the Department of Defense with (1) other government groups (refer to February 10, 1975 Department of Commerce memorandum and attachments, Appendix J); and (2) non-governmental groups.

Define current road blocks, problems and deterrents to cost-effectiveness and efficiency and make appropriate implementable recommendations.

Consider the education and training of specifications/standards engineers and of the document users in order to identify gaps and desirable actions.

Consider how to alert managers to the importance of specifications.

Examine opportunities to reduce the unnecessary proliferation and overlap of specifications and standards.

Examine present resources for development and maintenance of specifications and standards in terms of budgets and personnel (government and non-government).

Examine ways by which new technology becomes incorporated into specifications and standards and consider the interaction between research and development and the publishing of specifications and standards.

Examine the international aspects of U. S. materials and process specifications and standards in terms of what currently exists and what desirable features are missing.

Examine methods for improving the technical content of specifications and standards to eliminate or accomodate repetitive waivers.

Examine what happens in cases of deliberate or accidental noncompliance with specifications and standards when discovered after the fact.

1.1.4 MODUS OPERANDI

The modus operandi of the committee comprised an appraisal of the current situation, identification of problems and related omissions in necessary activity, identification of current efforts to improve the status quo, development of remedial recommendations, and assessment of costs and benefits of pursuing recommended courses of action where such an assessment could be made.

Because of the complexity, number of issues, and magnitude of the activity in this overall area, it was necessary to receive extensive and detailed presentations from many sources. Each liaison representative made a presentation to the committee from the point of view of his service or agency. Presentations were also made by the premier non-governmental standards development organizations: American National Standards Institute, Society of Automotive Engineers, American Society for Testing and Materials, American Society of Mechanical Engineers, the American Society for Nondestructive Testing, and American Welding Society. Resource material was made available to the committee by the liaison representatives. Presentations by individuals were valuable supplements in obtaining a comprehensive perspective of the subject.

In preparing this report, an attempt has been made to address several audiences. Since one of the major deficiencies in the present situation is lack of understanding and appreciation of the importance of specifications and standards by many in top management, a chapter has been devoted to "Role and Significance". Another chapter is on the economic implications of a proposed course of action and is addressed to responsible persons inquiring into the cost of implementing a proposal. Necessarily, much of the report is addressed to those responsible for meeting the charge to the Materials Panel of DMSSB. Other audiences, for reasons that should become clear in the report, include academe, industry, societies and groups concerned with developing voluntary standards, and certainly a number of government agencies, at technical, planning, and executive levels.

Except peripherally, the committee was not in a position, nor was it within its province, to assess the effect of proposals made in this report on the civilian sector or on government bodies outside DoD. Even with respect to DoD, recommendations necessarily are in the form of principles and guidelines; details of implementation and organization were neither within the scope of the charge to the committee nor was time available during the study to develop such details. On the other hand, care was exercised to reflect views from many sources and avoid an approach that would be indicative only of a single discipline or

industry. The committee aimed to utilize to the maximum degree practicable existing practices and organizations as opposed to creating new organizations.

The Table of Contents has been constructed in sufficient detail to avoid the need for an Index. Various appendices have been added for the benefit of those who want to pursue detailed data in support of the report.

CHAPTER 2

EXECUTIVE SUMMARY

2.1 INTRODUCTION

Specifications[1] have immediate major impact on the durability and satisfactory usage of an item or material and on minimizing the cost of DoD materiel to the taxpayer. By definition, a specification is a document intended primarily for use in procurement, that clearly and precisely describes the essential requirements for items, materials or services. It includes the procedures by which it will be determined that the requirements have been met. Specifications for items and materials also contain preservation, packing and marking requirements and provisions to comply with OSHA and other pertinent regulations. Standards[1] are definitive communication tools for design, procurement, delivery and acceptance. As such they have important impact on costs.

This study addresses the general subject of specifications and standards from the point of view of the needs of the Department of Defense in the area of materials, processes, and tests. It will be apparent to the reader that one or more studies in at least equal depth, should be undertaken for the civilian departments of government and, in the national interest, for American industry.

2.2 GENERAL CONCLUSIONS AND RECOMMENDATIONS

The major findings and recommendations of the committee are summarized below. The reader is encouraged to review the supporting rationale in the subsequent chapters; these chapters also list some minor recommendations not included in this summary.

- Exploit the Cost-Effectiveness Potential of Standardization

Upward spiralling cost and complexity of modern military weapons, vehicles, and equipments necessitate that every available management technique be employed for increasing the life-cycle cost-effectiveness of weapons systems (v. Chapters 3 and 6).

RECOMMENDATION

Concentrate on the effective use of the very important technique of standardization and impose it early during the

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[1] See Appendix A for definitions.

design development phase of weapons systems, particularly with respect to materials and processes.

- Increase DoD Emphasis on Specifications and Standards

For a variety of reasons, the Defense Department has historically maintained an independent specification and standards system. This system has been fragmented among the Services although an effort has been and is being made to draw the system together through use of a Department of Defense Index of Specifications and Standards. In spite of continuing efforts by the Services, however, the Defense standardization system with respect to materials and processes and very probably other areas as well has become increasingly obsolete, redundant, ad hoc, expensive in terms of results, and underfunded in terms of needs (v. Chapter 5).

RECOMMENDATION

Seek supplementary specification and standards resources (see 2.4 below) which, through judicious use of specifically allocated and protected Defense financial and manpower, inputs and adaptation to Defense needs, may provide a better, more adequate, and more cost-effective satisfaction of Defense requirements.

- Take Advantage of the Voluntary Standards System

There is available within the voluntary standards system an enormous body of specifications and standards. This has largely evolved from American Industry in response to its own needs, but at no direct cost to the government. The extent and costs of this voluntary system heavily outweigh the Defense Department resources allocated to specifications and standards work (v. Chapters 3, 4, 5).

RECOMMENDATION

The Department of Defense should implement in appropriate and identified technical areas, the required use of available specifications and standards of maximum general acceptance rather than (a) develop specifications case by case, (b) attempt to maintain a parallel total specifications and standards system for Defense use, or (c) allow specifications and standards to be a matter of special treaty for each procurement (v. Chapters 3, 5, 6). It follows from this that (a) DoD should strengthen its participation in those groups developing the above specifications and standards, and (b) the accepted documents should be listed in DoDISS in lieu of the government specifications in order to minimize the need for special preparation of the latter.

- Work Toward a Unified System of Specifications and Standards

It is necessary to evolve a rational plan for taking advantage of the available supplementary resources. This may require legislation or it may be done by voluntary cooperation. Responsible spokesmen for the American National Standards Institute, the Society of Automotive Engineers, the American Society for Testing and Materials, and others involved in voluntary standards development have indicated to this committee a complete commitment to satisfying the needs of the Department of Defense in the national interest (v. Chapters 4 and 6).

RECOMMENDATIONS

A. Create a unified system of specifications and standards in line with the suggestions of Chapter 6, preferably for the total government but, in any case, for DoD's needs, through coordinated efforts among government and non-government groups. A major objective should be to maximize the total methodological effectiveness of all groups involved in material and process specification preparations.

B. Assign and fund competent Department of Defense personnel to participate actively in standards development work, as appropriate, to assure that Department of Defense needs are addressed and that Defense requirements are satisfied.

C. Impose DoD Directive No.4120.3 and DoD Instruction 4120.20 and expand their applications. (See Appendix F-1 for discussion of this Directive and Section 5.2 for its place in DoD activities.)

D. Develop and implement a computer program to yield up-to-date information on availability of acceptable specifications, currency and review status, differences among similar specifications, etc.

E. Take appropriate steps to develop more reliable and uniform data and to conserve, collect, and make available the technical data generated by Defense contractors to serve as a data base for up-dating or developing materials and processes standards. (DoD Directive No.4120.3 now excludes data development from specifications and standards development funding.)

F. Take appropriate steps to assure a legal voice for U. S. interests in international standards activities and particularly as NATO and other off-shore Defense commitments are involved.

- Use Specifications and Standards as a Mechanism to Cope with Shortages, Substitution and Conservation

Materials, energy and the environment are an interacting triad and, when combined with the supply/demand ratio for materials, pose some complicated availability problems. Specifications and standards are one mechanism for ameliorating critical situations by providing requirements for substitutes, by minimizing requirements for critical materials in various products, by defining requirements for materials to be stock-piled, by minimizing material factors that militate against recovery of critical materials and products, by providing processes that reduce energy consumption, by improving procurement, stocking and storage practices, etc. (v. Chapter 5).

RECOMMENDATION

Establish a task force to provide stimulus and guidance with respect to the above opportunities and to provide a deliberate means for reviewing specifications with the objective of conserving critical materials and energy. Simultaneously, environmental impact should be examined (v. Chapter 5). If authority to implement this recommendation already exists, then the authority should be exercised forthwith by the appropriate organization.

2.3 SPECIFICS OF THIS STUDY

For closer examination of the details of this study and recommendations to implement the broad conclusions and recommendations of this chapter, it is suggested that the detailed Table of Contents be used as a guide to related topics and it is urged that the specific conclusions, recommendations, and opportunities in each chapter be considered. Particular attention should be given to Chapters 5 and 6 which, based on first-hand experience contributed by members of the committee, offer an opportunity to make early specific improvements.

RECOMMENDATIONS

Undertake a phased implementation of appropriate action items at this time.

As described in the detailed recommendations, undertake the suggested studies with particular attention to keeping specifications and standards current and consistent with the state of the art as well as with emerging technologies.

CHAPTER 3

THE ROLE AND SIGNIFICANCE OF SPECIFICATIONS AND STANDARDS

3.1 INTRODUCTION

The increasing complexity and upward-spiralling cost of modern military weapons, vehicles and equipments, coupled with the drastic reduction in dollar purchasing power available in recent defense budgets, necessitate that every available management technique be employed toward increasing the life-cycle cost-effectiveness of weapons systems. It is widely recognized, both in government and industry, that one such management technique is the effective use of standards imposed during the design and development phases of weapons systems. This is particularly true with respect to materials and processes that, in themselves, represent a standardization effort in the tens of millions of dollars annually (v. Chapter 6) and involving thousands of specifications (as detailed below).

It is important to understand how and why materials specifications and standards are used and what economic impact such documents have on our society. It is certain that the use of published specifications and standards represents a great savings; for example, if published documents were not available, specifications for each item would have to be developed case by case.

This chapter concentrates on the role and significance of specifications and standards for materials, finishes and processes[1] primarily as they apply to the Department of Defense. In addressing standardization relative to DoD needs, the committee has also found it necessary to consider specifications and standards issued by government agencies other than DoD, as well as the voluminous contributions of the numerous private sector technical societies and trade organizations in this country.

3.2 HISTORIC PERSPECTIVE

Specifications and standards represent one of the keystones in our economic system. They have become so commonplace that they are taken for granted to the extent that the attitude of some people is, "What have specifications done for me lately?"

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[1] For convenience, the word "materials" may be understood by the reader of this report to include finishes and processes unless otherwise specified.

Specifications are a part of almost every buy-sell operation. The specification must define the material. Specifications are directly referenced in most significant government and industrial procurements and inferred in most consumer transactions. The buyer can refer to specifications to establish what he expects to receive and the basis on which he will accept the product. The seller can refer to specifications with each order, negating the need to write new and elaborate descriptive supporting documents each time he makes a delivery. The "specification" thus defines the responsibilities of both buyer and seller. In addition it can provide valuable technical information to both sides.

The time saved by the buyer and the seller, through contract language documented in the form of a specification, decreases the cost of doing business for both parties.

Probably a more important result of the use of specifications is a capability of manufacturers to economically mass produce uniform products that comply with specifications. The results of this systematized use of standard parts and materials are well known. The entire economic and military strength of this country is built on an economic system which could not exist without the approximately 63,000 standards[1] essential to our technical society. The role of standardization in containing costs and increasing production makes the standardization process one of the most powerful of anti-inflationary tools. A realistic estimate of the total benefits which have been achieved as a result of standards work is impossible. They would represent a major part of our economy integrated over the period since 1798 when Eli Whitney standardized on parts for the mass production of guns for the United States Army.

In the interest of national defense, it is imperative that the American system of standardization not only be maintained, but also that it be improved and strengthened. DoD has played a prominent role in the management, control and implementation of government specifications and standards throughout the years; currently it does so in cooperation with the General Services Administration (GSA).

The Defense Standardization Manual (DSM) 4120.3-M, January 1972 (now in revision), covers Standardization Policies, Procedures and Instructions. This is DoD's implementation of the law embodied in U.S. Code 10, Secs. 2451-2456, which superseded Public Law 436 - 82nd Congress.

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[1] See Table 3.

The law requires the achievement of the greatest practicable degree of standardization of items and practices applicable thereto used throughout the Department of Defense. The background upon which 4120.3-M was originally developed extends back for fity years or more. During World War II the system, which was essentially the same as covered in 4120.3, worked very well.

In the background report for the Commission on Government Procurement in 1971, A. L. Pilson, then Director of the Contract Management Division, Defense Communications Agency, observed:

> "In the early 1950's the Congress was significantly interested in the defense supply management area. Out of this interest was enacted a law which strengthened the ongoing efforts of the Office of the Secretary of Defense to achieve DoD-wide standardization[1]. The Act directed DoD to standardize supplies to the highest degree possible "by developing and using single specification, eliminating overlapping and duplicate specifications, and reducing the number of sizes and kinds of items that are generally similar," and further to "standardize the methods of packing, packaging, and preserving such items." To carry out this program, DoD was to "maintain liaison with industry advisory groups to coordinate the development of... the standardization program with the best practices of industry."

The Federal Property and Administration Act[2] directed the General Services Administration (GSA) to achieve similar standardization for the civilian agencies. Both Acts called for cooperation between GSA and DoD.

The committee recognizes on the basis of presentations made to it, that a common quandary within our government is conflicting laws and directives; e.g., the Federal Trade Commission has interpreted the Anti-Trust Laws in a manner that militates against the implementation of the two acts cited above. DoD legal counsel has issued policy instructions that often make it difficult for DoD to work with industry advisory groups as required by law.

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[1] U. S. Code 10, Section 145, et seq.

[2] U. S. Code 40, Section 487, et seq.

It is becoming clear that DoD's legal directives are solely based upon FTC's interpretation of the Anti-Trust Laws; but, FTC has no responsibility for implementing or assisting in the interpretation of other laws such as the Defense Standardization and Cataloging Act of 1952 and the related U. S. Codes that followed. Thus, conflict and possible nullification of the intent of Congress may ensue. Although one might claim that DoD is oversensitive to the Anti-Trust Laws, it is a fact that DMSSB activities have already been delayed because of this restriction. Unfortunately, there is no referee to determine Congressional intent except Congress itself. Such regulatory conflict is seldom classified as a "crisis" and so it escapes Congressional notice or interest.

Mr. Jacques S. Gansler, Deputy Assistant Secretary of Defense for Materiel Acquisition and Chairman of DMSSB emphasized that the objective of the DMSSB is not to push standardization for its own sake, but rather as a means of cost reduction. He stated[1] that DoD's objectives are: (1) cut costs of Defense equipment by designing to unit production cost rather than exclusively to performance, (2) better use of standards, including commercial standards, wherever possible, and (3) make contractors more responsible for field maintainability and reliability of equipment, including having them warrant equipment just as is done in the commercial world."

As a further indication of the significance and magnitude of the standardization effort, it should be noted that numerous private sector groups publish tens of thousands of materials standards, many of which address DoD needs. This aspect is discussed in detail in Chapters 4 and 5.

All materials and processes specifications have specific objectives as shown in Table 1.

3.3 ROLE OF SPECIFICATIONS IN ACTUAL USE

Materials and products must meet standards of efficiency, safety, and satisfactory performance. This approach to standards and standardization has nothing to do with uniformity. Because we insist on products conforming to standards does not mean that they must have identical appearance (unless the appearance is standardized).

Within the defense area, specifications are considered procurement documents in terms of performance requirements.

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[1] ASTM STANDARDIZATION NEWS, February 1975, Page 26.

TABLE 1

OBJECTIVES IN WRITING SPECIFICATIONS FOR MATERIALS, FINISHES AND PROCESSES

Definition	Precisely define items and provide uniform definitions of specific items.
Improvement	Target improvements to items or practices.
Cost-effectiveness	Make systems more cost-effective by standardizing items and practices for multi-usage by deleting superfluous requirements.
Requirement	Comply with contract requirements for design, manufacturing, and quality assurance at lowest cost.
Guides	Provide guidelines and instructions to engineers, shop personnel, inspectors, purchasing agents and others.
Inspection	Provide inspection criteria for precise acceptance or rejection of items and practices.
Reliability	Insure consistent quality products that are neither over-specified nor under-specified.
Records	Provide uniform technical records of items that have been purchased or manufactured.
Forum	Provide a forum for a unified and cost-effective consensus of opinion during the development of documents for multi-usage items.
Safety	Promote safety and focus on product liability which have an economic impact on the product.
	See also 3-2.

Military standards[1] generally provide direction and guidance. In the private sector, specifications and standards respond to public need and to private industry requirements.

Table 2 lists some detailed uses for specifications and standards. In each category it is obvious that there are savings in time and money to be gained by judicious use of specifications and standards.

3.4 SIGNIFICANT MAGNITUDE OF SPECIFICATIONS AND STANDARDS

The total output of the standards-producing bodies is large and complex. In this study the committee largely focused its attention on the impact of materials and process documents on the Department of Defense.

Even with this limited scope it should be noted that there are approximately 5,000 materials and process specifications immediately applicable to DoD with an additional 7 to 8 thousand possibly applicable to DoD as indicated in Table 3. The further significance of these large numbers in terms of possible adverse effects on cost, effectiveness, and product performance may be deduced from the fact that many existing DoD standards are obsolete and have not been cancelled or even reviewed for updating.

It is appropriate to note at this time that the private sector produces some excellent specifications, many of which are more up-to-date, timely, and appropriate for DoD use than the DoD-approved standards. Yet, a major fraction of these appropriate private sector material and process documents have not been accepted by DoD as shown in Table 3.

Not included in this survey are the unknown thousands of company-originated specifications and standards, prepared by companies at their own expense or under a government contract. Many of these documents are generated because of the rapidly expanding use of electronics. In general, company-originated specifications are for items which are neither included in DoDISS nor in published technical society documents. Whereas, in some cases use of the item may be unique to one company, in other cases the item may have multi-usage throughout other user industries with consequent replication of specifications. There is no estimate of the development cost throughout industry of company specifications. The cost of developing a company specification is estimated to vary from $600 per

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[1] See Appendix A - Definitions.

TABLE 2

USAGE OF SPECIFICATIONS AND STANDARDS RELATED TO MATERIALS, FINISHES, AND PROCESSES

USAGE WITH RESPECT TO:	SPECIFICATIONS SERVE TO:
Contract	Provide a basis for contract negotiations.
Procurement	Procure items and locate vendors.
Bidding	Facilitate bidding by providing uniform requirements.
Logistics	Reduce variety of unique products and improve logistics.
Order and Priority	Establish the order and priority with which specifications and standards shall be selected for use in given contracts: such as MIL-STD-143.
Traceability	Trace the application and use of an item within a system or equipment and provide consumer reference.
Critical Materials	Identify and evaluate scarce, critical or potentially problematic materials and promote conservation.
Communication	Provide state-of-the-art knowledge to a wide range of potential users, by opening mutual channels of communication.
Education	Provide understanding of our R&D, inform and provide alternatives to engineers in the new and upcoming materials, finishes, and processes.
Research and Development	Translate research into practice.

TABLE 2

USAGE OF SPECIFICATIONS AND STANDARDS RELATED TO MATERIALS, FINISHES, AND PROCESSES

(Continued)

USAGE WITH RESPECT TO:	SPECIFICATIONS SERVE TO:
Structural Integrity, Health and Safety	Insure structural integrity of equipment and thereby safety of human lives by developing criteria for fatigue and fracture and by defining human engineering concepts. Conform to OSHA regulations such as toxicity, noise levels etc.
Qualification	Develop requirements and procedures for items to become qualified for given applications. Avoid repetition of long, complex, or expensive tests, some of which would otherwise be required after each contract award.
Producibility and Interchangeability	Insure producibility and provide for interchangeability of parts.
Substitutions	Determine and make available substitute materials, finishes, and processes.
Environmental Protection	Prevent corrosion of metals and deterioration of plastics throughout the life-cycle of equipments and systems during use and storage for predetermined environments.
Electrical Characteristics	Provide materials and customized surfaces that respond to electrical and electronic characterization and charges during operational test, short term usage, continuous operation, and storage; and that prove reliable and maintainable throughout the environmental life-cycle of the system.

TABLE 2

USAGE OF SPECIFICATIONS AND STANDARDS RELATED TO MATERIALS, FINISHES, AND PROCESSES

(Continued)

USAGE WITH RESPECT TO:	SPECIFICATIONS SERVE TO:
Engineering Drawings and Systems Specs.	Formulate accurate and uniform drawing notes on engineering drawing and in systems specifications to precisely define the materials, finishes, and processes.
Operating Procedures	Identify repetitive finishes and processes to establish uniform operating procedures.
Manpower and Equipment	Determine materials, manpower, workloads, instruments, equipments and facilities needed to produce items.
Test and Inspection	Define test procedures (destructive and nondestructive) and inspection requirements for items and equipment.
Certification	Certify critical processes, operators, and equipment; e.g., certification of welders, welding equipments, and weldments.
Time/Cost	Reduce time periods and costs involved to design, produce, and inspect items and equipments by using uniform criteria and established practices.
Repairs	Assist repair of items and maintenance of equipments by utilizing approved and reliable materials and procedures.

TABLE 3

ESTIMATED NUMBER OF SPECIFICATIONS AND STANDARDS IN DoD AND PRIVATE (VOLUNTARY) SECTOR SYSTEMS

Specs./Stds. Indexes[1]	Materials and Processes Specs. Government	Materials and Processes Specs. Private Sector	All Categories of Specs.
DoDISS Index	4,000	(1,000)[2]	40,000
SAE/AMS Index	-	1,680	1,680
ASTM Index[3]	-	2,200	6,680
Other Technical Society[3] Indexes		3,800	14,600
TOTALS:	4,000	7,680	62,960

Footnotes

[1] Indexes list items other than materials, processes, and test methods.

[2] Included also in indexes for other technical societies in this table.

[3] Indexes also list items believed to be of no interest to DoD.

specification to $2,500 per specification, exclusive of the research, testing, characterization, and other tasks necessary to complete the data base for the specification.

Industrial technology moves so rapidly that published specifications often lag behind the current technology, so that a company specification has long since been generated and invoked before a coordinated specification can be published. This is particularly true in the newer, more sophisticated disciplines in vogue for electronics. Although technology is generally ahead of specifications, when the time lag extends to several years it becomes a serious matter.

3.5 "NOTES" IN SPECIFICATIONS

The most underused section of a military or federal specification is Section 6, "Notes". In the past this has usually covered only general ordering information. In the light of increasing national concerns of which specifications must take cognizance for the foreseeable future, Section 6, "Notes", is the only place in a specification where such concerns as energy conservation, materials conservation, environmental problems, and manufacturing technology can be addressed. Specifications and standards are multi-faceted documents that can satisfy the needs for direction and communication of, inter alia, the preparing agency, the procurement officer, the proposal preparer, the designer, and the manufacturing engineer.

It is therefore recommended that developers of specifications and standards expand the use of Section 6, as a matter of policy, to include relevant helpful information, suggestions, and the function of the materials or product covered for the normal users of these documents.

CHAPTER 4

THE PRESENT DOMESTIC STANDARDS SYSTEM

4.1 INTRODUCTION

The word "standard" has a range of meanings depending on the context within which it is used; even so, there are analogies and evolutionary procedures worth considering. Individuals have standards of conduct which vary widely and which sometimes can come into conflict. A company may have internal manufacturing standards and procedures that are arbitrary within the company, but which are usually developed on the basis of achieving a particular result at a given cost largely using existing facilities. Users and producers can get together to set standards for materials and products which fit their particular industry. In contrast, the ultimate consumers become involved when it becomes necessary to make sure that products are being produced to a standard in the public interest. (From this point on "specifications" will also be understood when "standards" is used.)

The laws under which we live and operate are essentially a set of standards of conduct and performance. These laws are standards made by representatives of the people and they should be in the interest of the people. If they are not, the law makers may be judged at the next election and the laws may be changed. The courts interpret the laws or standards and the executive department enforces them. Our standards system is neither more nor less perfect than our legal system. It has some of the same advantages and disadvantages. It is as good or as bad in a particular area as the people who operate it, and it can be changed when it is at fault.

4.1.1 TYPES OF STANDARDS EMPLOYED BY SOCIETY

4.1.1.1 VALUE STANDARDS

This is the highest level of standards in terms of the basic impact on society. Public interest is the dominating consideration in the development of these standards, and they are usually the result of action by Congress. The major factors involved in setting standards of this type are social (which usually predominates), legal, political, and then, to a lesser extent, economic, and technical.

Typical examples of value standards are the various pieces of legislation that deal with the "quality of life," such as the need for limiting exposure to radioactivity, the need for clean air and water, and the requirement that consumer products be safe. This legislation usually

provides the fundamental framework, leaving the enforcement agency to set the specifics.

Because the process by which these standards come into being is frequently political and sometimes highly emotional, the predictability of requirements for standards of this sort is very low. Moreover, once introduced, they are difficult to change. During the development of the standard, the opportunity for public comment is quite limited, and the voluntary standards system has played practically no role in the process.

4.1.1.2 REGULATORY STANDARDS

Frequently derived from the more basic value standards, regulatory standards are usually created by the legislative authority accorded to a branch of the federal or state government by the act which sets the value standards. While there are a number of regulatory standards that are produced on a voluntary basis, the issuing agency is usually the federal or state bureaucracy. (In this connection, it should be noted that the term "regulatory" is not exclusively associated with federal agencies. Some of the more basic codes developed by industry initiatives fall into the category of regulatory standards.)

Major considerations involved in producing such standards are technical and economic, with legal and political overtones. During the development of a standard by federal agencies, public participation may be limited to the required period for public comment on a draft regulation in the Federal Register. In other cases, the agency may convene groups of outside "experts" to comment on the problem. The view of the private sector may be solicited, such as in inter-laboratory evaluation of test procedures. Once such standards have been set, the process by which they become modified is not easy, since it usually involves a change of stance by a regulatory agency. However, the process, though difficult, is not impossible.

The predictability of requirements for standards of this sort is fairly high since these standards are the logical output of value standards established by Congress or a legislature. Frequently, political pressure or legislative requirements may require that such standards be set in a short period of time.

We consider here three types of regulatory standards. These are:

a. Industry regulations or codes that are produced (and hence paid for) by industry;

b. Consensus-type regulatory standards paid for by members of standards-writing bodies and/or the federal government, such as standards produced by the voluntary organizations in response to government needs, e.g., for the Nuclear Regulatory Commission or the Occupational Safety and Health Administration, inter alia. The voluntary standards system has been active in types of regulatory standards where the dominating factors involve well-defined engineering practices and other basic technical considerations;

c. Mandatory regulatory standards that are entirely the product of the federal, state, or local government agencies, in accordance with established procedures. Examples of mandated regulatory standards are those for the permitted level of Strontium-90, or oxides of nitrogen in the atmosphere. The latter case provides an example of a regulatory standard that may undergo modification as a result of interaction between the Environmental Protection Agency and state, local, and industrial interests. Sometimes a regulatory standard cannot be set until a standardized test method (v. 4.1.3) is available. An example is the flammability standard for children's sleepwear.

4.1.1.3 MATERIALS AND METHODS (M&M) STANDARDS

Regulatory standards stem from value standards. However, regulatory standards require the development of M&M type standards to provide the means for developing (a) performance and design specifications, or (b) a test method to demonstrate compliance. Thus, the rationale for such M&M standards, particularly as they relate to the interaction between the federal agencies and the voluntary standards organizations, is usually found in the implementation of regulatory standards. The issuing agencies are either the federal government, which may reference voluntary standards or adapt them for their own needs, or the voluntary system itself. The major factors involved are predominantly technical, with economic and legal considerations assuming a secondary role.

Federal agencies also need M&M standards for procurement from private sources (v. also 4.2). These standards are sometimes complicated by the fact that the General Services Administration is often the purchaser of products offered to the general public in similar or identical form; each class of user may have differing needs. The voluntary system plays a dominant role in the development of such M&M standards.

In the three types of regulatory standards, M&M standards are most amenable to public comment through consensus procedures; they may be routinely reviewed for change. Predictability of the need for such M&M voluntary standards is high; however, because of the need to resolve numerous diverse opinions it may take longer to resolve an M&M standard than other regulatory standards.

4.1.2 STANDARDS PROCEDURES

There are several procedures by which standards are written. The term "consensus" may be applied to several procedures in different ways.

"Full consensus" may be defined as the process in which all interested parties are involved in the generation of the standard, including producers, users, and general interest participants.

"Consensus" may be achieved if a standard is prepared by one group, for example, by either a producer or technical society, and then sent out for public review to all interested parties. Comments received are considered though not necessarily incorporated by the preparing body.

Consensus does not mean unanimity, but it does mean that minority opinion has been considered and is available in the record. Openness and the ordinary rules of conduct of meetings are considered essential. One person can write a good standard, but the document cannot be said to have consensus unless it has either had all other concerned parties involved in its preparation or until it has been reviewed and agreed upon by a representative group of various interests.

4.2 THE U.S. GOVERNMENT AND STANDARDS

4.2.1 INTRODUCTION

The U.S. Government is involved with standards in many of its operations. Methods used for development and application of standards vary widely and, in general, the specific method is based on the particular needs and practices of the preparing agency.

With increasing regulation, particularly in the fields of human interaction with the environment and the workplace, the need for all types of standards is becoming more apparent. In many cases, the measurement of compliance requires new standards for the measurement of the item under consideration such as dust particles, air pollution, and flammable fabrics. The Department of Defense is concerned on three grounds: its own facilities, its contractors'

facilities, and the potential of the United States industrial machine.

Various governmental agencies have quite different views of their in-house capabilities to generate satisfactory standards. For example, some parts of Environmental Protection Agency (EPA) regard themselves as having strong in-house technical expertise; others, such as the Nuclear Regulatory Commission (NRC), know that their in-house capabilities are largely scientific in nature and their standards development capabilities are inadequate to the task; hence they tend to utilize outside, primarily nongovernment, sources to prepare their documents.

Some agencies have recognized that they have a kind of "life cycle" of standards needs, depending on how recently they were called upon to develop or regulate under a value standard. The Nuclear Regulatory Commission, which for many years, as a part of the Atomic Energy Commission, was concerned primarily with value and regulatory standards, is beginning to work on materials and methods standards, whereas the Consumer Product Safety Commission is just beginning operations in the regulatory standards arena.

Most agencies believe that they have an effective system for developing standards which provides for external input during the drafting process--that is, before public review and comment. Thus, unless an agency is required to use voluntary standards organizations, it will generally prefer to use its own system. In part, this may be the result of ignorance of the voluntary system.

In dealing with the total public interest, the federal government sees itself as the only possible mechanism. Executive agencies and regulatory bodies stress that they have the mandate from Congress to set standards, that they cannot (by law) pass that responsibility to any one else, and that they must, therefore, make a considered, well tempered judgment between polarized positions such as industry vs the consumer. In this connection, it should be noted that agencies do not necessarily want stricter standards; they are sometimes embarrassed by standards which are virtually unenforceable.

Finally, unlike voluntary standards organizations that work within the state-of-the-art, federal agencies are aware that they can set standards that will anticipate advances in the state-of-the-art. This concept was tested in court by Department of Transportation and was supported.

4.2.2 FEDERAL AGENCY STANDARDS - GENERAL NEEDS

The following comments relate to agencies that use, or would like to use, the voluntary system. The two needs most frequently cited relate to speed and language.

Agencies often find themselves in the position of having to respond within a short time frame, either because of the requirements of the law, political pressures, or previous lack of available manpower. A fast response capability by outside resources is obviously of interest.

One prime need in federal standards is a tightness of language which permits unambiguous interpretation by those responsible for compliance. There is also a need for sophisticated non-technical inputs, risk-benefit analyses, socio-economic, and legal considerations, etc.

Agencies want to preserve their options since the agency is ultimately responsible for whatever emerges. Thus, there may be circumstances in which an agency will prefer criteria documents that they can use as the basis for writing standards rather than a draft standard itself.

Some needs can be appropriately handled without turning standards into regulations; voluntary standards can be cited, or given the status of an "approved method," or published as a guideline.

4.2.3 FEDERAL TRADE COMMISSION (FTC)

The FTC's interest in standardization procedures and activities relates to possible anti-competitive or anti-consumer effects of standards and certification activities. It issued an advisory opinion on March 8, 1971 (File No. 713 7002) to the American National Standards Institute. This opinion was not intended to be firm, definitive or comprehensive statements of FTC policy, and it may be changed in the future. Because of their interest to both the government and voluntary systems, they are paraphrased here.

1. Standardization and certification programs must not be used as devices for fixing prices or otherwise lessening competition.

2. Standardization and certification programs must not have the effect of boycotting or excluding competitors.

3. Standardization and certification programs must not have the effect of withholding or controlling products.

4. Construction or specification standards should not be used when performance standards can be developed.

5. Any organization sponsoring standards must insure that its standards reflect existing technology and are kept current.

6. No applicant for certification may be denied certification for any of the following reasons: (i) that he is not a member of any association or organization; (ii) that he is a foreign competitor; or (iii) that he is unable to pay the fee or cost charged for certification.

7. Fees charged must be reasonable.

8. Membership in groups or organizations sponsoring standardization programs must be open to all competitors, domestic or foreign.

9. Due process must be accorded all parties interested.

10. Standards and certification programs, unless otherwise clearly required by considerations of safety, may not be used to reduce, restrict, or limit the kinds, quantities, sizes, styles, or qualities of products.

11. The exercise of the responsibility of validating any proposed standard should include a determination by a laboratory independent of those immediately affected that criteria are meaningful and relevant.

12. The function of determining whether any product is to be certified should be performed by an organization independent of those immediately affected by such programs.

13. Representations must be truthful.

14. In cases involving a challenge to standards, the burden of proof is upon those who develop and enforce the standards.

15. All standards must be voluntary.

16. Certification programs should avoid the use of single standards, "pass/fail" systems and employ graded systems which preserve consumer and user options.

However, in 1952 Congress instructed the Department of Defense to standardize by doing what item 10 above states should not be done. This subject is discussed in depth in Chapter 3, Section 3.2 to which the reader is referred.

4.2.4 THE CONGRESS

On June 11, 1976, Senator Abourezk introduced S.3555, titled, "The Voluntary Standards and Certification Act of 1976". The purpose of this legislation was to place certification of voluntary standardization under federal government control.

The primary thrust of this bill was to establish a system whereby no private organization is authorized to conduct activity in standards development or certification until it has obtained a certificate from the Department of Commerce that it meets the requirements in the bill and complies with the pertinent Federal Trade Commission rules.

The procedures which standards organizations must follow to achieve certification under this bill would include:

1. Adequate notice of standards development;
2. Opportunity for interested persons to present views during standards development;
3. Balanced standards development committees;
4. Right of appeal of any action, preliminary or final;
5. An appeals body which is
   a. competent, technically and administratively;
   b. independent and impartial;
   c. able to cause revisions;
   d. fair and expeditious.

The procedures which certifying organizations must follow to receive certification under this bill would encompass:

1. Uniform provisions to ensure fair, objective testing, inspection, and certification;
2. Consideration of equivalent factors in certifying items;

3. An appeals body similar to that required for standards development;

4. Publication (once certified) of the existence and procedures of the organizations.

As noted above, requirements for standards should, follow rules to be set by the FTC, as well as operational rules for enforcement relief and remedies.

This bill would have a profound effect on the voluntary standards system, most important of which could be its influence on the extent of the voluntary effort which goes into the present system. This would be very difficult to assess before the fact. It is, in fact, the basis for a study of its own.

The major part of the present voluntary system meets the requirements proposed in this law, particularly the part of the system that would be involved in the relations between DoD and the voluntary system. There is therefore no reason to reconsider the recommendations of this report in light of this recent development.

Legislative activity in this area is still pending; no definitive action has been taken at the time of publication of this report.

4.3 FEDERAL STANDARDS ACTIVITIES

Following is a brief description of the important standards activities of the federal government, leaving the DoD until last for detailed discussion because of its particular relationship to this report. Detailed presentations of the other agencies are given in Appendix J. Also, there exists a Federal Interagency Committee on Standards Policy, established in 1968 and described in Appendix I. It is for the purpose of wider and sharper government focus on standardization matters and for the purpose of providing more effective participation by agencies of the federal government in domestic and international standards programs. It should be noted that the influence of the federal government, when it elects to participate, on the voluntary standards system is very significant. It has an effect many times larger than its proportional participation and it is welcomed in the voluntary system.

Of the many nonmilitary government agencies involved in standards activities, as more fully described in Appendix J, the National Bureau of Standards plays the broadest role. It is the repository of and maintains the fundamental physical standards in the United States. It is engaged in supportive standards research and provides technical support

to other parts of the federal government as well as to the states. In general, it is a very active participant in the government and voluntary standards systems.

The Department of Labor, the Consumer Product Safety Commission, the Department of Health, Education and Welfare (HEW), the Nuclear Regulatory Commission (NRC), the General Services Administration (GSA), the Department of Transportation (DoT), the Environmental Protection Agency (EPA), the Department of Commerce, and the Veterans Administration (VA) have important standards activities both for development and for use in regulation. These are covered in some detail in Appendix J. See Appendix K for a recent OMB circular that proposes implementation of some of the recommendations of this report.

4.4 INTERNATIONAL

A review of the international situation on standards is provided in Chapter 7 and in detail in Appendix H. The following is a brief summary:

4.4.1 NATO STANDARDS

The Congress is considering legislation as an amendment to the Military Appropriations Bill requiring that equipment procured by the DoD for NATO "be standardized and interoperable with equipment of NATO allies." A State Department study report estimates that $20-40 billion a year is being wasted because of duplication and lack of standardization of military equipment in the NATO stockpile. It also affects the quality and versatility of the NATO forces.

To the extent that standardization is increased in NATO equipment, the availability of material and process specifications, internationally recognized by NATO, becomes increasingly important. This problem has already surfaced. Metrication, important in itself, simply adds to the problem.

For years, there has been, in fact, a NATO activity on standardization of material specification. This has been described with other pertinent activities in Appendix H.

4.4.2 STANDARDS AS NON-TARIFF TRADE BARRIERS (NTTB)

An international "Code of Conduct" for the formulation of standards and acceptance of material has been proposed by a GATT[1] Working Group in an attempt to deal with this type of Non-Tariff Trade Barrier. Product standards can often be

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[1] See 7.5.

very effective NTTB's and constitute an appreciable part of the official complaints. The Common Market and its associated groups have set up a separate European coordinating committee for electrical standards which is working through the ISO and the IEC to unify the European position. In addition to the unification of standards, there must be the harmonization of testing, inspection, and other procedures to eliminate this type of non-tariff trade barriers (NTTB). How this will affect the United States is unclear. Difficult and onerous procedures are still present for U.S. producers to follow before selling in the Common Market. The GATT "Code of Conduct" should ameliorate some of the difficulties, but the outcome is not clear.

Progress in solving these problems will be slow until the United States makes its own intentions clear. U.S. international activities are carried out primarily through ANSI, but neither government nor industry has given ANSI the support it needs to do an effective job.

4.4.3 THE USE OF INTERNATIONAL STANDARDS IN THE U. S.

The use of international standards in the United States is beginning, principally by multinational corporations, but needs considerable support, particularly in the development of these standards. Many U.S. standards are, in effect, international standards by reference, but new international standards are being developed with only minimal input from the United States. As is mentioned elsewhere in this report, there is need for government financial and manpower support of this essentially voluntary effort in the United States, similar to existing government support of standards activity in the rest of the industrialized world.

4.5 DEPARTMENT OF DEFENSE (DoD)

The DoD is one of the largest procurement agencies in the U.S. Government. DoD policies have an important influence on the economy as a whole and, in particular, on those companies and industries which adapt to serve it.

DoD goods are covered by a broad spectrum of material and process specifications. The requirements for critical military applications are unique, and DoD has and must have complete responsibility and authority to get what it needs. On the other hand, a significant part of DoD procurement is not of a critical nature and these items could be bought at considerable savings by using voluntary standards. This has been recognized in the Department and several directives, boards, and panels have been established to deal with the situation. The most important of these groups, the Defense Materiel Specifications and Standards Board (DMSSB), has the responsibility to interface between the DoD military specifications and standards system and other government

departments as well as with the private sector. An additional incentive to utilize the voluntary system comes from the decrease in constant dollar funds available for specifications and standards work in the various parts of the DoD. However, since the number of available goverment man-years for standardization work has decreased, it seems that the importance of standardization work has a lower priority for resource allocation than other areas, and a fortiori DoD must turn to the voluntary standards system to meet its needs.

Since a very large proportion of government procurements must be based upon specifications, it is quite natural that the system for the generation and maintenance of specifications and standards, as well as the procedures for their use, is well developed within the government. Procedures have been developed for coordination within the DoD, as well as to encourage and carry out the shift from DoD documents to those of the voluntary system where this is possible. Considerable progress has already been made in steel and aluminum under Department of Defense Instruction "Development and Use of Non-Government Standards," (Federal Register, Vol. 41, No. 148, pages 317, 318, July 30, 1976).

To review the system briefly (see Appendices F-1 and F-2 for details).

MIL-STD-962, 22 Sept. 75, provides the outline of forms and instructions for the preparation of military standards and military handbooks.

MIL STD-961, 22 Sept. 75, provides the outline of forms and instructions for the preparation of specifications and associated documents.

Specifications and Standards: Generation and Publication AMMRC, Watertown. In Appendix F-1 are discussed policies and procedures involved in the system for specifications and standards. Of particular note is the chart of the Defense Standardization Program (DSP) shown in the block diagram (Figure 1) which indicates the coordination functions as well as the lines of responsibility. A second block diagram (Figure 2) shows the flow chart for Fully Coordinated Standardization Documents.

DoD Single Stock Point (DoD/SSP) has been set up to list the requirements of the interested parties in specifications and standards so that anyone concerned will be notified of changes and cancellations. It should be noted that literally thousands of documents are involved in this communication system when changes are made.

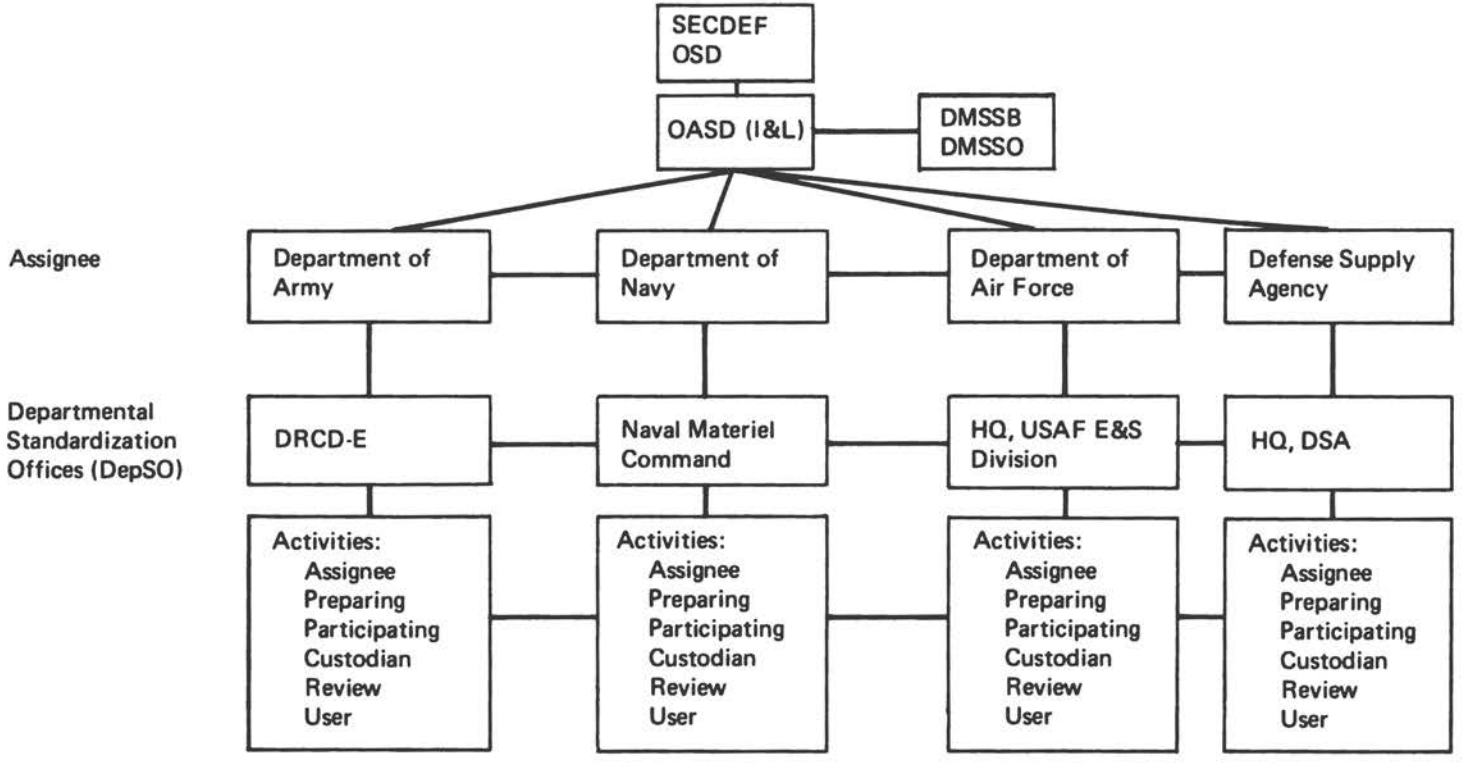

Figure 1 DEFENSE STANDARDIZATION PROGRAM

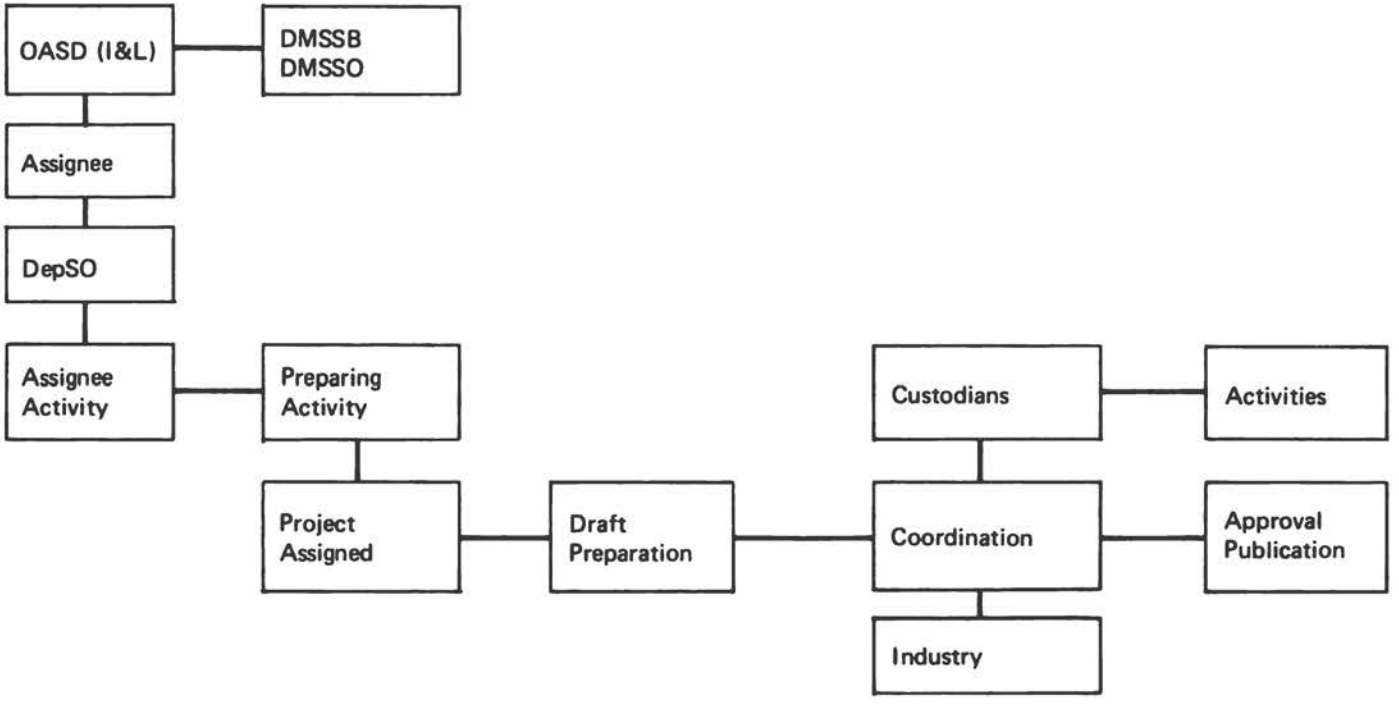

Figure 2 FLOW CHART: FULLY COORDINATED STANDARDIZATION DOCUMENTS

Note: When problems occur, all of the various groups interact with DMSSB as final resolving body.

SD-1 Standardization Directory lists standards together with the responsible agencies and participating activities.

The Qualified Products Lists (QPL) for certain types of specifications have been set up to simplify procurement of those items which qualify. Once on the list, the specifications are determined and purchasing documents are simplified. DSP-SD6 describes the Provisions Governing Qualification. While the qualification tests are intended to be paid for by the supplier, in general, this is not the case, and the DoD defrays the cost. There has been criticism of the difficulty of getting products on the list and the extensive testing required.

This listing has been brief and non-critical. The DoD has a system for handling specifications and standards which is operable and which is operating. Some of the details are peculiar to the military and change could be disastrous or very expensive. Other details can be subjected to scrutiny to make sure that not only in the systems but also in the procurements there is not over-designing. The DMSSB is in a particularly good position to cause the details of the system to be reviewed and to provide for further acceptance of the standards from the voluntary system.

4.6 THE PRESENT VOLUNTARY STANDARDS SYSTEM

4.6.1 INTRODUCTION

As noted earlier, in the United States most national standards are generated through a loosely knit voluntary system comprising government and industry, producers and consumers, institutions, and individuals. The system is called "voluntary" for two reasons. First, participation in the system by the many interested parties is voluntary. Second, the standards produced by the system usually are intended for voluntary use. However, many standards prepared for voluntary use have been made mandatory by governmental bodies, and some parts of the voluntary standards system now provide special procedures to develop standards for purposes of government.

4.6.2 SOURCES OF STANDARDS

There are several hundred organizations in the United States engaged in voluntary standards-making activities. They include branches of government, professional and technical societies, manufacturing and non-manufacturing trade associations, public service and consumer groups, and testing and inspection bodies.

This is a heterogeneous array of standards development organizations, and it comprises a system that operates with a highly complicated, and sometimes overlapping machinery. The standards produced by some elements of the machinery attain national and, often, international acceptance as a result of the broad-based consensus procedures used to develop and approve them. Standards produced by different parts of the system assure varying kinds of consensus, and most of them satisfy quite well the needs of the sectors for which they were developed. Many of these standards are quite parochial in both development and use, but despite this, they can be (and often are) fed into another part of the system for accreditation on their own, or for blending with other inputs, to become nationally accepted standards.

Each organization in the U.S. voluntary standards-making system has developed its own standards-making machinery through experience and has tailored the machinery to fit its own scope and objectives.

These organizations may be classified into several groups.

4.6.2.1 BODIES CONCERNED EXCLUSIVELY WITH STANDARDS

Two organizations in the United States are concerned exclusively, or nearly so, with the preparation, approval, and publication of voluntary consensus standards. These are American National Standards Institute (ANSI) and American Society for Testing and Materials (ASTM). The Standards Development Services Section (SDSS) of the National Bureau of Standards (NBS), U.S. Department of Commerce, has a similar function and so do major parts of other organizations, a typical one being the Codes and Standards Division of the American Society for Mechanical Engineers (ASME).

ANSI is also concerned with the well-being of the total system. It seeks to accomplish this through procedures for:

Certification of standards-making processes of other organizations;

Initiation of new standards-making projects;

Examination of standards prepared by others to determine if they meet the requirements for a consensus of interested parties to an extent suitable for approval as American National Standard;

Representation for the United States on International Standards Committees (ISO, IEC).

ANSI also organizes and supervises committees that prepare standards for approval under the ANSI procedures. Usually ANSI does this only at the request of several of the affected parties or when it concludes that no other organization is suitable to carry out the work. Almost 25 percent of the American National Standards currently come from these committees.

ASTM was incorporated for "the promotion of knowledge of the materials of engineering, and the standardization of specifications and the methods of testing." In 1971 a modified scope was adopted, "the development of standards on characteristics and performance of materials, products, systems, and services; and the promotion of related knowledge." It is now concerned almost entirely with the preparation of standards and with the well-being of the voluntary standards system. It is the source of more than half the existing American National Standards approved by ANSI.

The Standards Development Services (SDSS) of the National Bureau of Standards manages the Voluntary Product Standards program established by Part 10, Title 15, of the Code of Federal Regulations. It develops standards under a prescribed consensus procedure. An important criterion for undertaking the development of a standard by SDSS is that the standard "cannot be processed according to the needs or the desires of the proponent group or by any other private national standardizing body."

4.6.2.2 TRADE ASSOCIATIONS

Trade organizations either produce or review and coordinate voluntary standards that usually are a consensus of only producers or suppliers. The standards may cover safety, interchangeability, test methods, and other product characteristics which the association members believe are technically desirable to standardize. They describe what the industry is prepared to supply, but often they may require a sophisticated purchaser to understand them. In some cases, users of the product are able to participate, at least to some extent, in the development of the standards. In other cases, the associations work with user organizations in specification development (e.g., Aerospace Industries Association reviews of NASA and DoD specifications). A number of trade association standards have gained national acceptance.

Some of the trade associations that have produced substantial numbers of standards include the American Petroleum Institute, Association of American Railroads, Electronic Industries Association, Manufacturing Chemists Association, the National Electrical Manufacturers Association, and the Institute of Printed Circuits.

4.6.2.3 PROFESSIONAL AND TECHNICAL ORGANIZATIONS

Professional societies in the scientific and engineering fields usually have been organized to advance their professions or the branch of science or engineering with which they are concerned. Many of the standards they develop are of the technical, nonproduct, noncommercial type (nomenclature, graphical symbols, test methods). Many others deal with processes, materials, and components of interest to the profession. Usually only members of the society can serve on the committees that develop these standards, but the society membership may be representative of producers, users, academia, government, and other interests. Some societies, e.g., the Society of Automotive Engineers (SAE), do not require membership. Some societies achieve an excellent balance of interests on their standards-development committees.

The professional and technical organizations contributing the most standards to the system are the Society of Automotive Engineers, American Concrete Institute, American Oil Chemists Society, American Society of Agricultural Engineers, American Society of Mechanical Engineers, Institute of Electrical and Electronics Engineers, and the Technical Association of the Pulp and Paper Industry.

With respect to the American Society of Mechanical Engineers, its Codes and Standards Division prepares the well-known Boiler and Pressure Vessel Code that is now referenced in the laws of most states, most large U.S. cities, and all the Canadian provinces. The ASME Codes and Standards Division is also responsible for 40 performance test codes for turbines, combustion engines, and other large mechanical equipment.

With respect to the Society of Automotive Engineers, the Aerospace Materials Division is the primary source of voluntary nongovernmental materials specifications (AMS) used in the aerospace industry and to a substantial degree by the DoD and extensively in foreign countries.

There are some smaller organizations concerned almost entirely with voluntary standards. Some typical examples are the Industrial Fasteners Institute, Insulated Power Cable Engineers Association, and Manufacturers Standardization Society of the Valves and Fittings Industry.

4.6.2.4 OTHER ORGANIZATIONS

There are a number of standards-making organizations that cannot be classified into any of the previous groups. Several are of major significance:

National Fire Protection Association (NFPA)

Underwriters Laboratories, Inc. (UL)

Factory Mutual Engineering Corporation (FMEC)

Building Code Organizations.

4.6.2.5 OTHER SOURCES OF STANDARDS

There are two other important sources of standards that should be recognized: (1) single company standards, and (2) purchase specifications.

4.6.3 CONSENSUS AND THE VOLUNTARY STANDARDS SYSTEM

4.6.3.1 INTRODUCTION

A basic principle of standards development, supported by both theory and experience, is that a standard will be used voluntarily only to the extent that it serves an identified need, and only if it has considered the views of all those who share that need. It follows that the degree of acceptance depends on the procedures used to develop and approve the standard. Consensus has become the keystone about which procedures designed to assure maximum voluntary acceptance of standards are assembled.

During the last few years the type of consensus used in approval of voluntary standards has been under scrutiny by several federal agencies. The examination is being directed at the organizations claiming a consensus of all interests, and also at those whose standards were not intended to represent a broad consensus but are actually used by or applied to groups having no part in their development. Some federal agencies question the claims of proper balance of interests in the standards development and also suggest that any consensus guarantees an inferior standard ("lowest common denominator").

4.6.3.2 DEFINITION OF A CONSENSUS STANDARD

A consensus standard is a standard produced by a body selected, organized, and conducted in accordance with the procedural standards of due process. In standards development practice a consensus is achieved when substantial agreement is reached by concerned interests according to the judgment of a duly appointed review

authority. Full consensus means that all parties concerned were involved in the development of the standard, not just a review of the final standards documents.

4.6.3.3 DUE PROCESS

The standards of due process are the general ones of equity and fair dealing and include:

1. Timely and adequate notice of a propcsed standard undertaking to all persons likely to be materially affected by it.

2. Opportunity of all affected interests to participate in the deliberations, discussions and decisions concerning both procedural and substantive matters.

3. Maintenance of adequate records of discussions and decisions.

4. Timely publication and distribution of minutes of meetings of main and subcommittees.

5. Adequate notice of proposed actions.

6. Meticulously maintained records of drafts of a proposed standard, proposed amendments, action on amendments, and final promulgation of the standard.

7. Timely and full reports on results of balloting.

8. Careful attention to minority opinions throughout the process.

4.6.3.4 REVIEW AUTHORITY

Consensus is important in the acceptance of voluntary standards by government bodies for mandatory use. If the consensus for the voluntary standard is sufficiently broad to cover all parties affected by a needed mandatory standard, there is no reason why the voluntary standard cannot be at least the major input in formulating the mandatory standard. A standard with limited consensus may be less acceptable, and may have recommendations, advisory parts, or options that are not suitable for a mandatory standard. On the other hand, the voluntary standards system is capable of producing standards especially for mandatory use if it is given proper guidance by the governmental authority that wants the standard. It should be remembered, however, that the voluntary standards system generally produces standards for voluntary use. Only a governmental body can make a standard mandatory in a legal sense.

4.6.4 EVALUATION

The Voluntary Standards System of the United States has some flaws. Most important are probably that in some cases it may be too slow; that there is some duplication of effort; and that it is fragmented.

On the other side of the coin, the Voluntary Standards System has responded quickly when the need has been recognized. Further strengthening of ANSI would give it the ability to discourage duplication of effort and to organize the large number of smaller contributors.

But most important, there is a large reservoir of work already done and talent available for further work and this talent would be willing and able to carry out new programs with appropriate DoD participation. Appendix E gives a more detailed appraisal.

4.7 INTERACTIONS BETWEEN THE GOVERNMENT AND THE VOLUNTARY SYSTEM

While there is a great deal of interaction between government agencies and the voluntary standards system, the quantity and quality vary widely even within a particular agency. Some segments of government must write their own standards and specifications, for example, special military applications; while others could do it either way, for example, EPA, NRC, CPSC. Others rely to the greatest extent possible on the voluntary system and support it fully, for example, NBS. It is not the purpose here to offer a critique. However, government agencies in general could utilize the voluntary system to greater advantage by supporting its activities in principle and by active participation in the work.

The effort to carry this out has already started in the DoD. As pointed out in Section 4.5, progress has been made in aluminum and steel. This is only a beginning and the results should encourage further activity. (Also see Appendix K, OMB Circular). Utilizing the voluntary standards system more widely will not be an easy task. It is not as simple as putting new numbers on present standards and specifications. It will require technical input from both sides to make sure that the essential DoD requirements are met. The magnitude of the voluntary standards effort and the problem of adequate DoD participation in it are covered in Chapters 5 and 6.

4.8 CONCLUSIONS AND RECOMMENDATIONS

It is apparent that the numerous voluntary standards writing groups, together with DoD and non-DoD government agencies, are all presently adding to the proliferation of

standards and specifications in our society. There is urgent need to address the cost, methods of operation, specification obsolescence, timely availability of specifications, duplication and overlap of the complex group activities of the many different standards-originating organizations; and to address the complexity, confusion, and cost imposed on the users of the documents. In particular, it is essential to incorporate advance planning to provide better organization and direction to these now widespread efforts.

Specific examples of materials and process specifications, standards and test methods are discussed in Appendix D to illustrate some of the problems and concerns of the industry-users of documents generated by (a) DoD, (b) organizations in the private sector, and (c) government agencies other than DoD. Appendix D is not intended to be critical of any agency, organization, or society; nor is it intended to present solutions to highlighted problems. Rather, Appendix D shows typical specification/standard problems that now exist.

RECOMMENDATIONS

DoD should accelerate and expand its acceptance and usage of applicable ASTM and AMS documents for materials, processes, and test methods and list them in DoDISS in lieu of the now listed MII and Federal specifications for materials, processes, and test methods.

DoD should strengthen its participation in voluntary standards development organizations (national and international) and urge its contractors to do the same.

A study should be performed to determine the need for, and how best to prepare process specifications; including philosophy, approach, format, and other guidelines.

CHAPTER 5

PROBLEMS AND OPPORTUNITIES

5.1 INTRODUCTION

The preparation of duplicate standards by the many voluntary groups described in Chapter 4 and by the Department of Defense is time consuming, costly, contrary to good resource management and inefficient. According to Meiselman[1], more cooperation between the private sector and DoD is needed to conserve the resources now being expended. The problem is how to develop a method for achieving this greater cooperation to reduce and, where possible, eliminate overlap and conflict. This problem is especially acute in the field of materials and process specifications and standards. This NMAB committee, as previously indicated, is charged with the task: "to deliver an optimum plan for the generation, implementation and improvement of DoD materials and process specifications and standards which would utilize, if possible, the resources and organizations in existence and with due consideration of other aspects of National Standardization Programs."

In Chapter 3 the committee attempted to portray the role and significance of specifications and standards. It has presented in Chapter 4 the present situation pertaining to specifications and standards generation and publication, the procedures utilized, the coordination carried out, the organizations involved, in both government and industry, in this vital area of materials and processes. Chapter 6 will attempt to quantify the costs involved in these and related activities. This chapter will deal with the problems that exist in the current system and opportunities to relieve them.

It has long been a stated policy, as has been discussed in Chapter 3, that the DoD Standardization Program implements the following:

> "Specifications and standards of nationally recognized industrial organizations and technical societies shall be used in the development and design of material, and in the preparation of military or federal specifications and standards to maximum extent practicable. Duplication in the military services of industry standards is to be avoided." And, "it is the policy. . .to adopt industry standardization documents in lieu of preparing military or federal documents when

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[1] Meiselman, Harry - Proposed: A National Standards Program, Defense Management Journal, April 1975; p. 52.

> they fully satisfy the needs. . .with respect to content and have been coordinated in accordance with established procedures."[1]

The following section briefly describes the historical background and the salient relevant directives and studies.

5.2 HISTORY OF DoD STANDARDIZATION ACTIVITIES

The DoD history of directives, manuals, and other documents to implement the stated standardization programs reflects many changes in the past ten years.

In April 1965, DoD Directive 4120.3 established the Defense Standardization Program (DSP). In April 1966, Defense Standardization Manual (DSM) 4120.3-M was established to implement that directive.

DoD Directive 5500.2 was issued in May 1968 to "establish policies governing the participation of liaison representatives of the Department of Defense in the activities of private or nongovernment organizations or associations, including technical and professional societies."

DoD Directive 4120.3, dated June 1973, implemented the January 1972 DSM 4120.3-M that superseded the issue of April 1966.

The June 1973 DoD Directive 4120.3 established the Defense Materiel Specifications and Standards Office (DMSSO) and the Defense Materiel Specifications and Standards Board (DMSSB)*. One of the objectives of this directive states in part, "--preventing the preparation of duplicative and overlapping descriptions of materiels and services (e.g., specifications, purchase descriptions and drawings for materiel, test procedures and limits);--".

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[1] See Reference 1, Chapter 3, page 12.

* It is understood that DoD Directive 4120.3 is in process of reissue as of 1977.

A memorandum[1] addressed the application of specifications and standards. It stated in part, "The main cause of cost escalation was identified to be in the application, interpretation, demonstration of compliance and enforcement of specifications and standards in Requests for Proposals (RFPs) and contracts. This, therefore, is a fertile arena for effective cost reductions in the acquisition process." Certain documents were labled as "cost drivers."

In September 1975, portions of DSM 4120.3-M were cancelled and the following superseding items were issued.

MIL-STD-961, "Outline of Forms and Instructions for the Preparation of Specifications and Associated Documents", 22 Sept. 75 (supersedes Chapter V in DSM 4120.3-M).

MIL-STD-962, "Outline of Forms and Instructions for the Preparation of Military Standards and Military Handbooks", 22 Sept. 75 (supersedes Chapter VI in DSM 4120.3-M).

Recognizing that a specification is a complex document, DMSSO in December 1975 issued DMSSO-GB-1, "DoD Specifications Development Guide (History, Purpose, Disciplines and Techniques)."

DMSSO-GB-1 states in its Foreword: "In the acquisition of today's complex military weapon systems and hardware, an essential ingredient of the procurement process is a quality specification---. It is paramount that the specification be technically complete, free of vague and ambiguous terms and using the simplest words and phrases that will convey the intended meaning."

A DMSSO memorandum in December 1975 addressed the subject of "Development and Use of Non-Government Standards", stating that DoD "is placing increased emphasis on the use of commercial products and the use of common commercial items in the manufacture of military materiel. One method for achieving this objective is to facilitate the use of specifications and standards developed by nationally recognized standard bodies which mainly serve the private sector. Closer coordination and cooperation between the DoD and nongovernment groups will enhance the availability and

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[1] Clements, W. P., Memorandum for the Secretaries of the Military Departments, Subject: "Specifications/Standards Application," The Deputy Secretary of Defense, Washington, D.C. dated August 4, 1975.

applicability of nongovernment standards to DoD use. Also a major objective is to reduce overlapping, duplicative and conflicting documents generated separately by the DoD and industry groups. In the broad picture, the concept is a move toward a national voluntary standards program".

DoD Instruction 4120.20, dated 28 December 1976, officially sets forth the DoD policy on adoption of "non-government specifications and standards developed by nationally recognized standard-setting organizations."

Another study was conducted under the Defense Science Board (DSB) by a Task Force known as the "Shea Committee". That study addressed the impact that specifications and standards have on the costs of DoD procurements.

5.2.1 COMPLEXITY AND SIZE OF PROBLEM

The committee concludes that the preceding directives, although expressing desirable objectives, have not been adequately implemented, presumably because of shrinking budgets and insuffient manpower. A further impediment has been inadequate coordination both within the voluntary system and between DoD and that system.

It is in the context of this DoD activity that the committee reviewed the problems and now delineates the opportunities for enhancing the generation, preparation and implementation of specifications for materials and processes and test methods consistent with DoD and industry needs. The aerospace industry will be used to keep the discussion in focus because of its high level of engineering sophistication and urgent need for high quality standard specifications.

5.3 OVERALL VIEW OF THE PROBLEMS IN MATERIALS AND PROCESSES SPECIFICATIONS AND STANDARDS

5.3.1 DECLINE IN DoD ACTIVITY

The Department of Defense has been fortunate in having over 4,000 materials and process specifications available for the purpose of ensuring that the standardization effort in the DoD is consistent with the procurement of military hardware that meets the performance, reliability and life expectancy of the using Services. However, because of the declining manpower and financial resources allocated to the generation and maintenance of these specifications and standards, and with the increasing sophistication of the newer weapons systems, the ability of the Services to meet the needs of standardization in this area is declining. For these reasons a number of problems, some of which are detailed below, have arisen. This suggests, as one alternative, that the Services should lean more heavily on

the voluntary specification development organizations, as has been suggested by the studies and DoD Instruction 4120.20.

5.3.2 UTILIZATION OF VOLUNTARY ORGANIZATIONS

The thrust of these studies and the DoD directives would make it appear that a rapid changeover to the use of specifications and standards developed through the voluntary organizations would be easily implemented. However, there are a number of problems that must be solved before such a changeover can be fully implemented.

5.3.3 DEVELOPMENT OF DATA BASE

There exists a need for a data base of meaningful properties to include:

(1) A means of generating material property data.

(2) A proper format to display data generated in major DoD programs so that all meaningful data is available.

(3) A long term program of R&D to develop property data on new materials thereby expediting the introduction of new materials and process technology to the newer weapon systems.

5.3.4 ESTABLISHMENT OF TEST AND INSPECTION PROCEDURES (See 5.9)

There is a need to ensure that proper and meaningful test procedures and inspection techniques are validated prior to incorporation in specifications in order to ensure:

(1) That the specification requirements are being met.

(2) That processes delineated in the specification are properly carried out, and

(3) That proper nondestructive inspection techniques are prescribed.

5.3.5 NEED FOR IMPROVED COMBINATION OF PROPERTIES

Existing design allowables and other specifications do not always express the optimum obtainable for a particular material. Where there is a need for improved mechanical properties for design and enhanced structural integrity, it is sometimes possible to obtain them, for example, by such means as closer chemical control, different processing, and/or changes in heat treatment. Such improvements must be

reflected in the relevant handbooks and specifications and must not be later downgraded (see 5.6.2).

5.3.6 AVAILABILITY OF MATERIALS

The effect of materials and process specifications in inhibiting the availability of materials is being considered by the Navy[1]. This is part of an on-going analysis of materials requirements for military purposes in which the amount of the various materials are listed for different weapons systems.

Programs have been set in motion to eliminate non-essential contractual requirements of specifications and standards in RFP's and subsequent contracts. These are similar to a value analysis for each item in the specification.

5.3.7 ADDITIONAL CONCERNS AND PROBLEMS

In addition to the foregoing, the following aspects are discussed in detail below:

- Proliferation of specifications and standards and the reasons therefor.
- Manpower.
- Technical reliability of documents.
- Relevance of specifications to DoD needs.
- Shortages and Substitutions.
- Unification of Extant Multiple Systems.

5.4 PROLIFERATION OF SPECIFICATIONS AND STANDARDS AND THE REASONS THEREFOR

5.4.1 PRIORITY IN THE SELECTION OF SPECIFICATIONS

Proliferation of Department of Defense specifications results from several factors. A major reason is subtly differing requirements for differing military end-usage. Specification usage priority among available specification

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[1] E. J. Dyckman, Communication dated 16 July 1975.

systems is governed by MIL-STD-143, which assigns highest priority to Federal and Military Specifications. However, many years ago the aircraft powerplant manufacturers documented the need to have their military material and process specifications under their control. By what is now MIL-BULL-343, they were given greater freedom to use industry-generated and individual company specifications. In the aerospace industry a need to have closer industrial control of specifications resulted in the establishment of the coordinated industry-generated aerospace materials specifications under the aegis of SAE. It should be noted that MIL-BULL-343 is inconsistent with MIL-STD-143. Further, the literal implementation of MIL-STD-143 can result in a more costly or less reliable product. This major hierarchical document (MIL-STD-143) actually encourages through necessity the preparation of a large number of duplicate company documents. We recommend that MIL-STD-143 be rewritten to encourage the development by all specification writing activities of non-redundant specifications for a specific type of application; and discourage the generation of in-house private specifications by individual users of materials.

5.4.2 LACK OF COORDINATION

There is an increasing tendency toward release of MIL specifications which are not fully coordinated among the Services so that the separate Services are creating specifications of similar requirements but which differ slightly from Service to Service. This not only proliferates specifications but creates inventory and other problems and increases equipment costs for contractors supplying equipment to two or more Services. The specification-preparing activities of non-DoD agencies within the federal government are also contributing to this problem. An example of this is the military specification (MIL-H-81200) for heat treatment of titanium, and a similar specification released by NASA Marshall Space Flight Center requiring different time and temperature conditions for attaining the same end results. Sometimes economic considerations dictate minor differences among otherwise identical specifications.

5.4.3 OBSOLETE AND ALTERNATE DOCUMENTS

The U.S. Government, as a buyer, purchases large quantities of materiel to some sort of specification of requirements, and acceptance or rejection of the materiel is contingent upon inspection for compliance to the relevant specification. The burden of this inspection, within the Department of Defense, usually falls in the Defense Contract Administration Services Regional (DCASR) Office. There are many problems associated with an inspection function of this complexity and size; one of these contributes to

proliferation in the following sense. When changes have occurred in specifications during production runs or when obsolete specifications are the only ones available to the DCASR or when, for other reasons, a specification is incorrect for a particular usage, then the contractor calls out a company or other, e.g., SAE or ASTM, specification and cites it as "used in lieu of" the prescribed military or federal specification. DCASR has the burden of resolving the problem of the resulting deviation from the official documentation.

5.4.4 USE OF COMPANY SPECIFICATIONS AND STANDARDS

5.4.4.1 CUSTOMIZING COMPANY NEEDS

Government specifications are, generally speaking, more frequently attacked and circumvented than industry specifications because of the tremendous pressures which are brought to bear, on the one hand, by suppliers penalized by too tight a specification that will be used for many diverse and unintended applications, and, on the other hand, by users who want stringent controls for their critical applications. As a result of this, waivers are granted by the government to permit the use of company specifications. This further proliferates the number of specifications being used.

5.4.4.2 ABSENCE OF GOVERNMENT SPECIFICATIONS

Generally, in a development contract some materials and processes may be used that are not covered by DoD or industry specifications. Specifications are written in a company specification format which does not meet the military specification format. Eventually, this contract may go into a production phase, and, at this point, the government asks, and pays, to have company paperwork redrawn into a format suitable to the agency involved and to eliminate all reference to company numbers.

Since specification formats, identifying numbers, and interpretation of requirements differ among agencies (and sometimes among segments of an agency), several specifications for the same item can result. This proliferation occurs despite the efforts of each DoD agency to avoid duplication.

Multiplicity of formats and numbering systems is confusing and costly. The opportunity exists to standardize on a format and system of identifying numbers acceptable to all agencies. In addition the opportunity exists for government support to be provided to a contractor's personnel to work in the preparation of broadly useful specifications. Furthermore, since the above operation indirectly or directly involves government funds, the

opportunity exists for more cost-effective support to contractors personnel in voluntary standard development groups.

5.4.4.3 COMPANY CONVENIENCE

Another cause of proliferation results from the fact that in some cases it is easier to write a new specification than to identify a suitable specification from the plethora of possibilities. Soldering specifications are illustrative (see Appendix D). At one time, one contractor had more than thirty soldering specifications in his files. The situation is exacerbated when there are coexisting coordinated specifications, plus single service specifications, other government specifications, industry specifications and company specifications. To list all the soldering specifications used by the government would be a large task in itself.

5.4.4.4 DUPLICATION IN THE PRIVATE SECTOR

It should be noted that there is competition among technical organizations that issue specifications and standards. This results in the issuance of voluntary documents that replicate those issued by other nongovernment and government agencies.

5.4.5 STRUCTURING OF PROCESS SPECIFICATIONS

Nongovernment specifications are permitted for use on DoD programs when so specified in the contract or as approved by their inclusion in the DoDISS. These specifications are quite acceptable for materials, but are generally not acceptable for processes. Processes are also a problem for government specifications. In the area of heat treatment processing, for example, all aerospace firms supplement in-house processing, as called out in MIL-H-6088E and MIL-F-6875F, with their own heat treatment processing specifications. This is necessary to accomodate particular equipment, unique to the company or the plant processing the material, and latest changes or inclusions of newer materials in individual company process specifications. One acceptable way of overcoming the problem might be to issue performance specifictions in lieu of "how to" process specifications.

5.4.6 ADVANTAGES OF COORDINATED SPECIFICATIONS AND STANDARDS

Fully coordinated specifications, approved for use, form a basis for procurement of materials used industry-wide for production of DoD hardware. They also provide for mill production of material to accepted standards at the lowest competitive price. The concept of broad acceptance of

coordinated specifications should be continued by the DoD aiming at procurement of material made available by mill producers at the lowest cost. Economy moves within the DoD that result in reduction in efforts to maintain generally accepted coordinated specifications could well prove to be counter-productive in that procurement to company specifications and other industry specifications with special requirements could result in an overall increased cost for procurement of military hardware.

5.4.7 SPECIFICATIONS FOR DIFFERING QUALITY LEVELS

A present flexibility (not to be confused with proliferation) is the ability to select materials procured to a variety of government, industry, and company specifications and standards. This provides for the use of materials produced to the quality level required for each specific application, such that over-specification is avoided, and maximum economy can be attained.

In the 1940's and 1950's, both industry and government deemed it appropriate to write Materials Specifications for "Production Categories" (i.e., Ordnance, Aircraft, Naval, Civilian, etc.). A common material thus was covered by specifications developed for its application area. The various qualities and attributes necessary for a specific type of application were emphasized; the various qualities and attributes needed for other applications were de-emphasized in a given family of "duplicate" specifications. This led to the desirable industry position that one could buy a material to a specification for his application without over-specifying or under-specifying the material. This "duplication of specifications" was viable and in the best interest of the country from all aspects that our modern society holds vital (i.e., conservation of energy, ecology, conservation of resources, etc.). However, during the years, the reasons for and the attributes of "duplicate" specifications appear to have been lost sight of because of the desire for universal usage for all applications of material purchases to one specification. Such a specification is usually not usable except for the least demanding use and, therefore, may not be cost-effective in a real sense. The above use of specialized specifications should not be confused with the production of truly duplicate specifications with identical requirements or with minor or unnecessary variations.

It is recommended that the validity of actually unique specifications be recognized, albeit for the same generically named material. These different specifications are to be used in different specific applications so that material does not have over-specified or under-specified qualities for the application involved.

5.5 MANPOWER

By adopting a sizable number of technical society specifications and standards, DoDISS makes available over 4,000 documents for materials, finishes, processes and test methods. These documents are consistent with the requirements of DoD hardware, even though some are government documents and others are technical society specifications and standards.

Table 4 shows the man-years and dollars invested annually by DoD in specifications and standards. The number of DoD man-years devoted to materials and process standards is less than 50 percent of what it was 10 years ago.

Regardless of DoD directives that prescribe otherwise, it is well nigh impossible to maintain currency in government specifications for materials and processes with only 96 man-years per year available to carry out the task unless a high degree of coordination is maintained and perhaps not even then. Perhaps a substantial measure of mandatory cooperation must be instituted. The fact is that currency has not been maintained.

This situation has caused many contractors to turn elsewhere for more up-to-date specifications with resultant disadvantages such as increasing proliferation. For example, this has led to increased use of SAE-AMS documents which, in many cases, more adequately meet the current needs of the aerospace industry.

It should be noted that a chain of reaction is involved here.

Most DoD contractors are required by government contracts to use government specifications. Therefore, in the interest of standardization and lower costs, they prefer to use them on all contracts, resorting to company specifications only when actually necessary due to lack of, or some fault with, a government specification. In some cases a contractor will prefer to use a less appropriate government specification rather than get involved in problems of justifying and obtaining approval for using more suitable non-government specification.

TABLE 4

ESTIMATED ANNUAL COST TO DoD OF PREPARING GOVERNMENT SPECIFICATIONS AND STANDARDS [1]

DoD Dept.	Man Yrs./Yr. Devoted to Specs. & Stds.		Cost/Yr. of Specs. & Stds.	
	All Specs.&Stds.	Materials & Process Specs.&Stds.	All Specs.&Stds.	Materials & Process Specs.&Stds.
Army	490	61	$ 12,000,000	$ 1,300,000[2]
Navy	555	23	17,210,000	690,000
Air Force	[3]	12	[3]	360,000[4]
Defense Supply Agency[5]	145[6]		3,037,289[6]	
TOTALS	1190 (plus Air Force)	96	$ 32,247,289 (plus Air Force)	$ 2,350,000

Footnotes

1. In addition to DoD-originated documents DoD has purchased as an absolute minimum over 2.5 million copies of the more than 1000 private sector documents listed in DoDISS. Approximately 2500 copies of each document are needed for internal DoD distribution and shelf stock. Industry users must purchase private sector documents directly from the originating source, whereas government specifictions are furnished to contractors free of charge.
2. Represents 61 man-years per year.
3. Actual count unknown.
4. Represents 12 man-years per year.
5. DSA Centers, DPSC and DIPEC, prepare specifications and standards. DESC prepares specifictions for Army, Navy, Air Force and GSA as agent.
6. About 20 of the DSA man-years and $458,306 of costs cover management aspects and standard preparation.

5.6 TECHNICAL RELIABILITY OF DOCUMENTS

5.6.1 FAULTS

Faults in government specifications fall into two major categories -- technical and editorial, both of which could be eliminated by a review procedure if the government made use of appropriately competent reviewers.

5.6.1.1 TECHNICAL FAULTS

The technical adequacy of the specifications could be maximized if all new and revised government specifications were reviewed by technical experts in user-industries prior to issuance, thus avoiding many costly situations that currently occur in contractors' plants. To some degree, such reviews occur now, but not on a properly organized or sufficiently extensive basis. Comments via industry coordination can normally be readily resolved, e.g., as illustrated by the procedures used by the SAE/AMS. For those few cases where an industry coordinated comment is unacceptable to the preparing activity, resolution should first be attempted with industry and, if unsuccessful, the impasse would then be resolved by the government reviewing activities listed on the final page of the pertinent specification. This procedure would still provide final control of the specification by the government but would tend to eliminate most technically questionable decisions which often prevent use of the specification as released.

5.6.1.2 EDITORIAL FAULTS

Editorial faults, such as, reversing type designations, failure to assign proper identifiers to options, undesirable changes, could be eliminated if the preparing activities would insist on compliance with the requirements of Defense Standardization Manual 4120.3-M, Standardization Policies, Procedures and Instructions. The obvious solution would be to have all specifications checked and approved for format and editorial content, including uniformity of expressions, by a DoD-established review board prior to release. This would not be necessary if MIL-STD-961 and MIL-STD-962 were closely followed. The review board used by SAE for its aerospace documents has been used successfully for over 20 years and has entailed only minor delays in issuance of specifications. ASTM and other groups use similar techniques.

5.6.2 MECHANICAL PROPERTY DOWNGRADING

Another factor in technical reliability is the downgrading of mechanical property values of materials in existing specifications after design allowable values have been established, for example, in MIL-HDBK-5. It is true

that downgrading can occasionally be justified, particularly when original specification values have been based on incomplete data. However, downgrading should not be tolerated for the producers' economic reasons (e.g., to increase mill product yields), particularly where design allowables have been in existence without change for several years.

An example of problems created by downgrading occurred in the changes from QQ-A-367F to QQ-A-367G, Mechanical Properties of Aluminum Alloy 7075 Hard Forgings. In abandoning identification classification numbers based on cross sectional area, the classification changed to a thickness basis, reducing guaranteed tensile properties by 1,000 to 3,000 psi after the parts were designed and in production. This was a situation that would jeopardize the strength of the parts. This change, when duly noted, forced the use of company specifications to retain the classifications and values of QQ-A-367F, in order to avoid expensive reanalysis and redesign.

When changes that downgrade specifications are unavoidable, the identification number of the downgraded specification should be changed, to avoid inadvertent misuse and to insure proper interchangeability.

5.6.3 INTERCHANGEABILITY

5.6.3.1 FORM, FIT, AND FUNCTION

Even though there are rules on interchangeability of a part, these rules have been occasionally violated by changes to its specifications that result in non-interchangeability. Some such changes have involved "form, fit and function." Revising the specification language may also force a contractor to change all drawings and associated documents currently in use. These contractor document changes are expensive.

5.6.3.2 ELIMINATION OF MATERIALS

Some specification revisions have deleted materials as in the case of the current revision of MIL-S-7720, wherein the requirements for 303 stainless steel were eliminated. In turn, this forced the ordering of the material to an obsolete specification.

5.7 REQUESTS FOR SPECIFICATION REVISIONS AND DELAYS IN CURRENT SYSTEMS

In all probability, inadequate manpower (v. Section 5.5) and funding are the prime causes of the Services inability to meet promptly the need for specifications for new or improved materials and processes, or revisions of

older specifications. Other major factors militating against the timely availability of suitable specifications are the confusion resulting from excessive proliferation (see 5.4) and questions of reliability (see 5.6).

Technical societies sometimes have scheduling and delay problems. Requests for changes to technical society (voluntary) specifications and standards are made directly to the originating organization. Each society has its own rules for handling direct requests and the rules vary among the societies. Revised or new documents may be issued at intervals of from a few months to a few years, depending on society policy, extent of change, sophistication of subject matter, degree of commitment of the committee workers (all volunteers), and availability of data base to substantiate the requested revision.

The opportunity exists for DoD to work with the voluntary writing groups to improve their response time. One solution is to help fund the technical writing specialists in their committee work, possibly through their employers as DoD contractors. It is recommended that DoD investigate possible mechanisms for financial assistance to expedite the preparation and issuance of needed specifications and standards by voluntary writing groups, and estimate the indirect potential dollar savings resulting therefrom.

DoD Form 1426 attached to the back of each Military Specification, provides an opportunity for users of the document to request the issuing agency to incorporate specific revisions. Whereas, this is one way to identify errors after publication of the document, many users report that DoD response to Form 1426 is either slow or inconclusive. The DoD reply often is: "When the document is next revised or amended, due consideration will be given... etc." This type of generality is not responsive to the need, and forces the preparation of an in-house specification or the use of a quasi-legal document like the Engineering Purchasing Specification to define the requirement. When a situation like this arises with a company specification and hardware is rejected because of it, one is bound to require an Engineering Change Directive (ECD)[1] for correction. The local AFPRO[1] or NAVPRO[1] monitors this commitment.

The opportunity exists for DoD to either improve its specifications revision system so as to respond effectively in a more timely manner to requests submitted on Form 1426, or to take advantage of the voluntary preparation groups as discussed above.

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[1] See Appendix C.

5.8 DATA BASE

5.8.1 AVAILABILITY OF DATA

No specification is better than the data on which it is based. It is important, therefore, that adequate data be available for specifications. The ramifications of this problem are discussed in the balance of this section.

Most DoD contracts for development of weapons systems require that pertinent materials be fully characterized. These data should be quite adequate for specifications. Unfortunately, there is no contract requirement for the format of data presentation and too often the data are scattered throughout development contract reports without organization, so that it is difficult to collect the information for use in specifications. It would seem appropriate and it is recommended that contracts requiring generation and reporting of data should also stipulate that the data be presented in a useful and organized form, such as in the format of MIL-HDBK-5. Cost of such reports should be funded by DoD. Regulations specifically prohibit the use of standardization funds for data generation. Data generation is considered to be part of materials development and is funded out of RDT and E moneys.

5.8.2 DATA FOR METALLIC MATERIALS

5.8.2.1 GENERATION AND PRESENTATION OF DATA

When discussing the data base for metallic materials specifications, it is essential to refer to the confidence level assigned to the data. MIL-HDBK-5, Metallic Materials for Aerospace Applications, has specific guidelines for the generation and presentation of data. This type of data is also used in preparing and maintaining the AMS series of specifications for corresponding materials. Similar guidelines are used by ASTM; for example, E-177, the "Recommended Practice for Use of Terms Precision and Accuracy as Applied to Measurement of Property of a Material."

These guidelines represent the ideal conditions for developing a data base for specifications. However, the guidelines are expensive to implement and, as stated in 5.8.1, Defense Standardization Program funds may not be used for the generation of such data. A typical data base for developing a specification for a new material is illustrated in Figure 3.

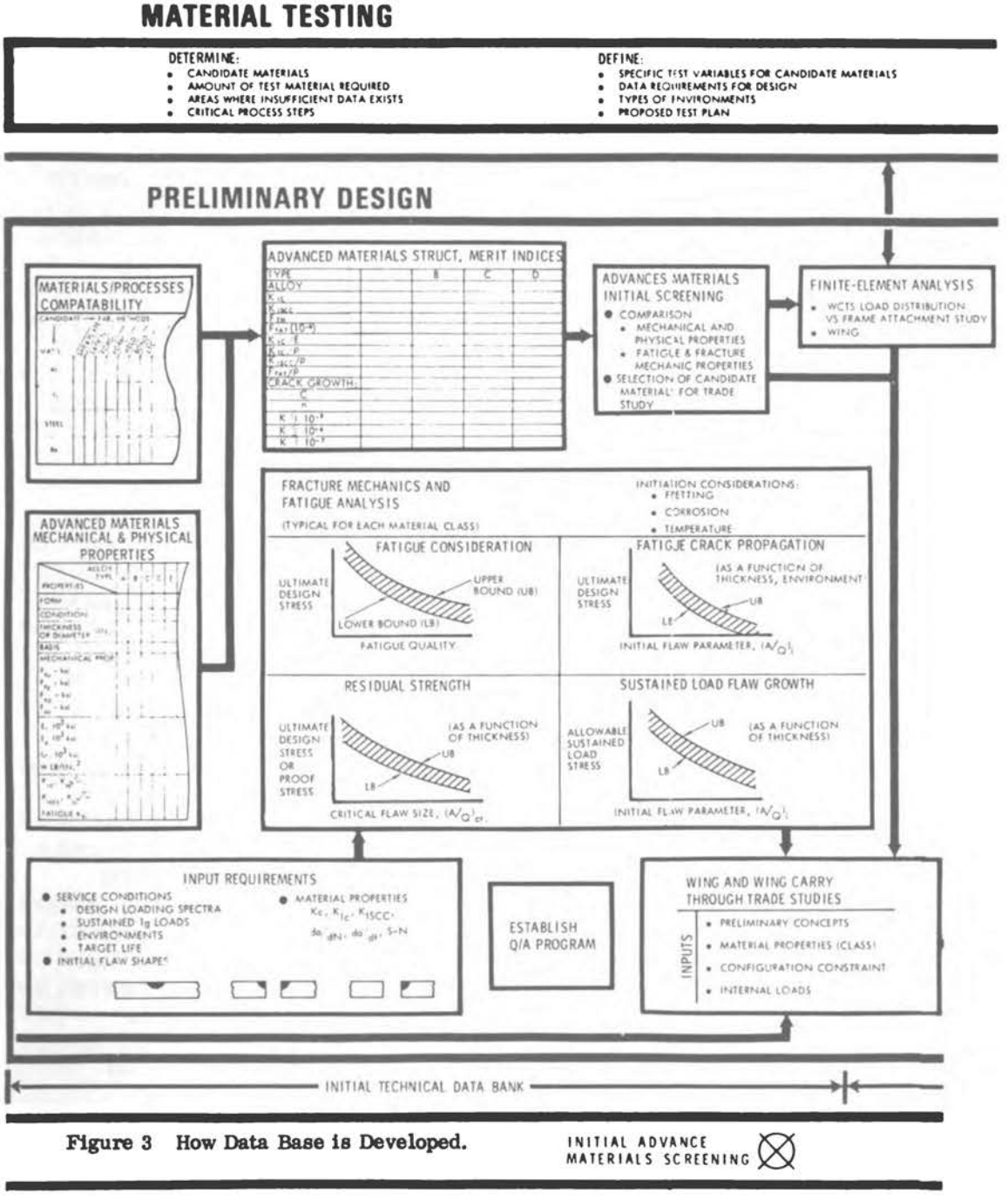

Figure 3 How Data Base is Developed.

5.8.2.2 STEPS IN THE DEVELOPMENT OF A SPECIFICATION DATA BASE

When the RDT&E function identifies a candidate new material for the design engineer, it must be validated in the sense that the observed properties which made it a candidate are real and reproducible, that it can and would be produced in production lot quantities by existing or latent state-of-the-art technology, preferably by more than one producer.

The candidate material that has emerged from this cycle has, in all probability, been described in a series of specifications called "Purchase Descriptions" or "PDs." This series of PDs represents a refinement process whereby, starting from the research stage, as experience with the material is gained, there is a constant feedback of test results to provide the data base to support both the established requirements and quality assurance provisions (tests) of the eventual specification. The requirements can be chemical, physical, mechanical, or functional. The test methods may be destructive or nondestructive and a sampling plan is essential. Development laboratory, pilot plant, and production-engineering operations are involved in these stages.

There is thus an iterative process whereby the data base, through a series of PDs, is continuously expanding and being refined through the exploratory, advanced, and engineering development phases. PDs are intended to be one-time (single procurement) documents. The end of this chain is the final "Specification" (as opposed to "PD"). The material has now reached the stage where the purchaser can institute full-scale procurement of production quantities with some degree of confidence that the material will meet specification requirements. Even in production the learning cycle is not over, and feedback from quality assurance functions and user experience provides an awareness of need for change or refinements.

5.8.2.3 EVALUATION TESTS

The foregoing sequence of steps involves various categories of evaluation. In 1970, an NMAB report[1] detailed an approach that would enable the Services, the producers, and the materials engineers to decide upon the materials

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[1] NMAB-246, "An Approach for Systematic Evaluation of Materials for Structural Applications," National Research Council, NAS-NAE, Washington, D.C., February 1970. Available from NTIS, Springfield, Va. 22151, NTIS No.AD 705664.

evaluation tests that must be performed for purposes of obtaining screening, selection, and design data for structural applications.

The necessary tests are indicated by a system that takes into account the system, vehicle, component, environment, and operation criteria. The system is based upon the preparation of a large number of application case histories, the data from which must be recorded according to a rigid format. The compilation of case histories makes up what is called the Applications Analysis Data Bank. The system can be coded so that the case history data can be computer-analyzed to answer a number of pertinent questions for which answers are not easily obtainable at present. A complete materials evaluation system would consist of three data banks: (1) Application Analysis, (2) Material Properties (these now exist), and (3) Material Evaluation Techniques.

A flow chart of how such a system can be used to evaluate materials for a new fighter aircraft is shown in Figure 3 and indicates the material property data, testing, and screening needed in advance of design to characterize materials for such application to allow an optimum choice to be made. The scope and complexity of an adequate technical data base for a specification is evident.

5.8.3 DATA FOR NONMETALLIC MATERIALS

5.8.3.1 PLASTICS

Most of the information for new or improved plastics comes from industry sources. Most of the significant engineering data is generated in support of MII-HDBK-17 on "Plastics for Aerospace Vehicles." The handbook contains effective guidelines for the generation and presentation of data. (Although the aerospace industry is being used to focus the discussion in this chapter, other industries could have been discussed pari passu.)

5.8.3.2 RUBBER, ELASTOMERIC, AND GASKET MATERIALS

Most of the data is generated by the manufacturers. Government laboratories participate in ASTM round-robin testing of new materials. New elastomeric formulations are identified using the ASTM D-2000-75 Standard: "System of Classification of Elastomers for Automotive Applications."

5.8.3.3 PAINT, LACQUER, AND OTHER COATING MATERIALS

Information regarding new or improved coatings is obtained from paint companies, new material manufacturers, or users of the materials. To prepare a specification, samples are obtained by government laboratories and

comparable products are formulated and tested. Coating materials are usually described by a combined performance and composition specification. In recent years, OSHA and EPA have had considerable impact in this area.

5.8.3.4 FUELS AND LUBRICANTS

As described in 5.8.3.1 through 5.8.3.3,, most of the basic data are generated by industry.

5.8.3.5 STRUCTURAL CERAMICS

This is a new and emerging field. General testing methods appropriate for metallic materials are not readily adapted to testing ceramics. Test results are very sensitive to test parameters. Correlation between test results and performance has not yet been satisfactorily demonstrated.

5.8.4 ROLE OF VALUE ENGINEERING

Motivated by a desire to maximize cost-effectiveness, value engineering challenges the need and functionality of anything used in implementing any part or all of a system design. Its use within DoD and GSA has been previously applied to products or things rather than materials and processes. Value engineers are appropriate additions to the specification preparing and revision teams.

5.9 TESTS AND INSPECTIONS

5.9.1 TEST METHODS FOR DURABILITY PREDICTION

Generally speaking, the record for developing test methods for use in specifications and standards has been excellent, with a great deal of credit due to ASTM. The use of tests has been almost entirely in quality control for purposes of duplicability or reproducibility rather than in the prediction of performance or durability.

There is presently an effort within ASTM Committee E06.22 on Recommended Practice for Developing Short-term Accelerated Tests for Prediction of the Service Life of Building Components and Materials. Ideally, long-term performance would be based upon long-term tests under many types of climatic or environmental conditions. However, such long-term tests would delay the use of new materials to such an extent as to be impractical. It would also relegate practice to past states-of-the-art. Existing short-term tests are seldom fully adequate for predicting long-term performance. Yet it is difficult to design meaningful tests since degradation mechanisms are complex and seldom well understood. While this methodology is evolving for application in the construction and building industry, it

should have direct applicability to DoD end items and systems--particularly since performance is basic in designing to cost and life cycle service. DoD should follow and support the development and application of this performance prediction methodology. (See also "Testing for Prediction of Material Performance in Components and Structures (NMAB-288), National Research Council, Washington, D.C.: 1972*.)

5.9.2 AIRCRAFT, MISSILE, AND SPACECRAFT MATERIALS

5.9.2.1 INTEGRITY REQUIREMENTS; FRACTURE CONTROL

There is a real need to develop and have available test and inspection techniques in specifications that reflect not only the integrity of materials as concerns chemical and composition requirements but also macroscopic and microstructural requirements having to do with structural integrity and safety.

The DoD maintains authority over specifications for basic weapons systems and those which contribute to their development. These are exemplified by MIL-STD-1530, Aircraft Structural Integrity Specifications, and the MIL-A-8860 series of requirements having to do with design criteria and durability. These directly relate to materials and process specifictions and derived properties obtained by test procedures imposed by these "criteria" specifications. As an example, the following list of specifications and standards are involved with fracture control and, in turn, are related to material properties and process requirements.

Fracture Control Specifications and Standards

MIL-STD-1530	MIL-A-8867
MIL-A-8344	MIL-I-6870C
MIL-A-8860	NASA-SP-8040
MIL-A-8866	NASA-SP-8095

In addition, conceptual fracture mechanics considerations require a number of tests to be performed to obtain derived data on which designs may be based and

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* Available from National Technical Information Service, Springfield, Va. 22151 as AD-743991.

lifetimes determined, and from which inspection intervals may be established to assure safety of flight. However, test methods procedures and data reduction and presentation are not only costly but inadequate for meeting all of the requirements of these criteria specifications.

5.9.3 SOME SPECIAL PROBLEMS IN ELECTRONIC MATERIALS SPECIFICATIONS

5.9.3.1 THERMAL STRESSES[1]

Thermal stresses are an ever present problem in electronic assemblies, such as in integrated circuits (ICs), printed wiring boards (PWBs) and microwave strip transmission line (stripline) board. The practices used in fabrication produce fixed joining of various materials, each of which has a different coefficient of expansion.

There is need to better select and define the materials of construction used in integrated circuits, printed wiring boards and stripline, and to define and control the finishes and processes in order to minimize stresses and attendant failures. Burn-in criteria should be studied. Uniform practices for obtaining structured test values must be developed.

5.9.3.2 PURPLE PLAGUE

In many cases, users cannot purchase devices according to MIL specifications because the devices will not meet the high reliability requirements of their system. Whereas purple plague (degeneration of bonds to gold surfaces) is mentioned in MIL-STD-1250, the phenomenon does not have visibility commensurate with the problems it causes[2],[3]. ASTM Committee E-1 on Electronics held a symposium in late 1975 to address the problem of purple plague and to establish a plan for standards action.

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[1] It is not implied that thermal stresses are only an electronic material problem. Some other important thermal stress problem areas are associated with turbine blading and discs, reentry vehicles, solar collection, etc.

[2] MIL-STD-1250, "Corrosion Prevension and Deterioration Control in Electronic Components and Assemblies," pp. 9 and 24.

[3] "Purple Plague Problems Result from Short Memories," Circuits Manufacturing, November, 1975.

5.9.3.3 TEST METHODS

5.9.3.3.1 INADEQUATE DOCUMENTATION

To compound the problem, most of the materials and processes used for electronics are not well defined, if at all, in specifications. Further, test methods must be custom designed for each electronic application[1].

5.9.3.3.2 ACCELERATED-LIFE TESTS

Specially designed accelerated-life tests, which simulate the cyclic thermal stresses are used to perform long-term reliability studies. Alternating high and low expansions when two or more materials are rigidly connected together, as in integrated circuit boards, can produce three types of cyclic deformation; namely, (a) none of the elements deform plastically, (b) only one element deforms plastically, and (c) plastic deformation occurs in more than one element and is called "thermal ratchet."

5.9.3.3.3 BURN-IN TESTS

Some manufacturers use the time-temperature regression plot in MIL-STD-883 for the burn-in test, shortening testing time by subjecting devices to higher temperatures without considering the potential danger for devices with gold-aluminum interconnections, thus inducing the serious defect, "purple plague" by the act of testing.

5.9.3.4 SOLDERED JOINTS

Mechanically and thermally induced stresses in solder joints can generate microcracks that often result in circuit failure[2]. For example, in a multi-layer printed wiring board, the solder in plated-through holes sometimes causes the copper plating to separate from the base laminate. Preliminary study of the problems associated with the strength of solder joints, problems often encountered in the military electronics industry, have led to recommendations for further study to stimulate the generation of a reliable data base and to determine corrective measures that could be implemented.

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[1] "Understanding Cyclical Thermal Stress in Electronic Assemblies: The Key to Improving Accelerated-Life Testing," E. Baker; Insulation/Circuits, October 1975, pp. 49-56.

[2] "Pursuing the Reliable Solder Joint," Circuits Manufacturing, November 1975, pp. 50-54.

5.9.3.5 REWORK PRACTICES

Thousands of dollars can be represented in one electronic assembly, so it is essential that there be reliable rework and repair practices and that their authorized use be carefully controlled. There are few, if any, established standards for reworking or repairing electronic assemblies.

5.9.3.6 FAST MOVING STATE-OF-THE-ART

It is understandable that specifications and standards documents are not always abreast of the electronic state-of-the-art. There is scarcely time to generate a document before it becomes obsolete. Yet, with the extremely high costs involved in the development and manufacture of electronic systems, it is essential that standardization, control, and documentation be implemented to ensure maximum reliability at minimum cost. Just as the electronics industry is relatively new, perhaps new procedures need to be instigated which would provide for a simpler, quick turn-around and control of specifications and standards.

5.10 SHORTAGES AND SUBSTITUTIONS

Materials, energy and the environment are being recognized as an interconnecting triad where an action in one area will likely create repercussions in the other two; for example, energy is developed, for the most part, by materials reactions (burning of coal, petroleum, etc.), and environmental problems have been termed "materials out of control". Thus, material shortages may stem from either of these sources. Corollary considerations are conservation, substitution, and the requirements imposed by EPA, OSHA and other government regulatory agencies. Material and process specifications are obviously affected by these relatively new social forces and, in turn, may effectively ameliorate undesirable situations of supply and demand. Specifications for material to be stock-piled provide another illustration of a role to be considered. Again, the need for an efficient, effective, flexible, responsive specification system is apparent.

5.10.1 ACTUAL AND MAN-MADE SHORTAGES

There are two types of material shortages. Actual shortages are caused by the world's diminishing supplies or increasing demands, which either exceed the ability to produce the materials or which are not economic to offer in the marketplace. Man-made "shortages" are caused by actions of regulatory agencies restricting or, in some cases, actually prohibiting their use, and by the economics of procurement, by unjustified ("frantic") excessive procurement or because of lack of production capability.

5.10.2 ENERGY SHORTAGE

For some years, it has been recognized that the potential exists for near future energy shortages. It is a truism that the world's resources of fossil fuels and materials are finite. The Arab Oil Embargo of 1973 and the severe January 1977 winter led to massive local supply disruptions. Energy shortages are the threat of the future. Until major new energy sources are developed with production anticipated at the end of the next decade or later, energy conservation will be the means to keep the American economy in gear along with present domestic and foreign fossil fuel and nuclear energy supplied.

Energy conservation is not merely the non-use of energy; it is its wise use to produce desirable outputs for reasonably low inputs. All materials in the forms required for further fabrication and assembly have had a varying but intensive investment of energy. New processes with smaller energy requirements for extraction are badly needed as high quality ores, such as hematite from Minnesota and bauxite, are exhausted. The need exists for the ability to recycle materials as well as to plan for the substitution of more abundant materials for less abundant materials. The development of specifications and standards has rarely if ever considered the energy content of materials and processes to which they relate. It is highly important that such consideration take place. The Committee cautions that all end-use decisions must be based upon function on a life cycle basis. Cheap energy can lead to wasteful practices. Expensive energy requires careful examination at every step. The energy investment in materials and their processing may be as much as two-thirds of the total energy content of the product using them.

An example of specifications that could conserve energy by changes in requirements and usage is found in those covering Portland cement. Low alkali cement requirements have been included in cement specifications or standards intended for use where only alkaline aggregates are available. These areas of use are not widespread but the specified use of low alkali cement is. A greater amount of energy is required to produce the low alkali types. Fineness requirements in these specifications are also unnecessarily high when the final physical properties are considered. (About 7 percent of the BTU content of Portland cement is in the final grinding operation). The ultimate result is a substantial wastage of energy in this application.

The National Bureau of Standards Center for Building Technology with ERDA support is working to improve the technical basis for standards for blended cements, e.g., cements which may contain waste products such as fly ash,

etc. Blended cements generally require less energy to manufacture.

Public Law 94.163, The Energy Policy and Conservation Act of 1975, establishes a number of energy conservation measures. One is to promote energy conservation and efficiency through procurement policies and decisions of the federal government. Responsibility for this was delegated to the Office of Federal Procurement Policy by Executive Order 11912, April 13, 1976. In turn DoD and GSA were requested to jointly develop appropriate uniform regulations for inclusion in the Armed Services Procurement Regulations and Federal Procurement Regulations. Since specifications and standards are indissolubly involved with procurement, it follows that the energy investment in materials and processes, which are affected by their specifications, must be a primary consideration.

5.10.3 CRITICAL MATERIALS USAGE AND SUBSTITUTION

What is needed, then, is a mechanism by which specifications that involve critical materials or that can be affected by federal regulatory activities can be selected, reviewed and updated to reflect the latest situation. Thereby, expeditious changes can be made in a manner that will maximize materials conservation but with minimum adverse effects on weapons systems under development or in production that employ these specifictions and standards. In some cases, certain materials may be in such short supply that substitution or other measures become necessary. The role of specifications is critical. The situation must be continuously monitored in the national interest.

5.11 "COST DRIVER" SPECIFICATIONS

A Task Force[1] under the Defense Sciences Board (DSB) has examined the impact of certain kinds of specifications and standards on materiel acquisition with the objective of reducing costs. The Task Force has not yet issued its final report, but some of its recommendations are already being woven into the rules for application of certain specifications. In a recent memorandum[2], the Deputy Secretary of Defense stated in part, "The main cause of cost escalation was identified to be in the application, interpretation, demonstration of compliance and enforcement of specifications and standards in RFP's and contracts."

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[1] The DSB Task Force is more frequently referred to as the Shea Committee.

[2] See Reference 1 on page 47.

Included in the long list of "cost drivers" were general design specifications, quality control, reliability, maintainability, environmental requirements and test methods, documentation, and others.

The Department of Army has carried out the intent of the above memorandum by issuing a directive listing specific "cost drivers" by number and requiring that these be either tailored to better suit the intended application in specific programs, or eliminated, if in the program's best interests.

The opportunity exists for DoD to issue a comprehensive directive, applicable to all agencies.

This committee suggests that the above DSB report, when released, be studied jointly with this report to insure compatibility.

5.12 UNIFICATION OF EXTANT MULTIPLE SYSTEMS

Both DoD and industry have become increasingly aware of the Services' deteriorating specification development resources and capability to cope with DoD's increasingly complex needs in the field of materials and process specifications and standards. The proliferation of specifications, the lack of a national policy, the need for greater management attention to this subject and the many other deficiencies cited earlier in this report all point to the necessity for installation and implementation of a changed system of operation.

In certain high technology companies, there is an overwhelming preference for company specifications in lieu of military specifications. Recapitulating some of the reasons for this preference, there is concern of over-specification of quality for some applications; there is obsolescence in some military specifications (where changes in the state-of-the-art have occurred); there is language in some military specifications that leads to difficult interpretations; there are new impacts by OSHA and EPA regulations and, sometimes, overreliance by engineers on procurement functions rather than developing a sound specification. Many of these problems are aggravated by DoD manpower reductions, differing requirements for the same generic material requiring a new specification, downgrading of design allowables for economic reasons, and a scattered, inadequate data base with insufficient funding and no organized reporting system to retrieve data generated on contracts and major weapons systems.

It seems obvious that a joint government/industry effort must be mounted. To accomplish this, common interests must be identified which are continuing and broad-based. Materials and practices important to both government and industry are those most immediately susceptible to standardization. These should be undertaken at the earliest feasible date. All of the problems cited earlier are amenable to common action. All can be resolved by concerted effort of government and industry specialists dedicated to the solution of these problems.

5.12.1 OPPORTUNITIES AND RECOMMENDATIONS

5.12.1.1 IMPROVE DoD PARTICIPATION IN VOLUNTARY STANDARDS ACTIVITIES

With the recommendations made in the recently concluded studies on "Specifications and Standards and Their Effect on Weapons Systems Cost," together with the new DoD Directives on the use of voluntary standards, an excellent opportunity exists to assure the adequacy of the Defense Standardization Program (DSP) in the specific area of materials and processes used in the design and procurement of DoD materiel by implementation of the recent DoD Directive on the Use of Voluntary Standard Systems. For reasons already discussed, cost reduction and enhancement of product integrity, as well as from advantages, should follow. It is, therefore, of prime importance that a unified, acceptable voluntary specifications and standards preparation activity be instituted so that specifications and standards will be more useful in satisfying DoD requirements.

5.12.1.2 EXTENDED USE OF VOLUNTARY SOCIETY DOCUMENTS

Specific areas should be identified where increased use of voluntary specifications and standards would be advantageous to the DoD and policies and action adopted to expedite this increased use.

An opportunity now exists to determine the best mechanism by which the services of the national societies involved in specifications and standards preparation can be used to: (1) obtain the best documents; (2) avoid direct competition in a number of materials areas; (3) assure a good source of adequate test method standards; and (4) develop a criterion for approval of a specification/standard to be published by the originating body and to be proposed for listing in the DoDISS.

5.12.1.3 AVAILABILITY AND ENVIRONMENTAL IMPACT OF MATERIALS

Working groups should be established to identify specific problems with materials and process specifications and standards as they relate to materials and processes

availability with respect to system design and production. Energy requirements and environmental impacts should be simultaneously examined.

5.12.1.4 UPDATE OF DOCUMENTS

Specifications and standards that need to be updated, cancelled, or consolidated should be identified and appropriately treated.

5.12.1.5 COORDINATION OF GOVERNMENT AND VOLUNTARY STANDARDS ORGANIZATIONS

Efforts should be coordinated among the DoD and non-DoD federal groups, industry (trade) associations (e.g., Aerospace Industries Association); and other standards groups (e.g., National Bureau of Standards; American National Standards Institute; American Society for Testing and Materials; Society of Automotive Engineers, etc.).

An objective should be to maximize the total methodological effectiveness of all groups, whether government or nongovernment, involved in material and process specification preparation. Effecting coordination of materials and process specifications across the major segments of the DoD and other parts of government, industry and trade organizations, and professional societies, will upgrade practices and provide opportunities for increased benefit to all who are directly concerned and to the Nation.

5.12.1.6 CREATION OF AN OPTIMUM SET OF SPECIFICATIONS AND STANDARDS

A major objective should be the establishment of an orderly mechanism to determine how best to prepare an optimum set of Materials and Process Specifications for the DoD, using all available sources, removing antiquated specifications, upgrading useful specifications with the most recent data, and determining the mechanism by which nongovernment specifications can be more readily listed in the DoDISS. The mechanics of this operation are impractical for this committee to delineate and might better be developed by a DoD task force.

A review of present practice for authorizing listing of Materials and Process Specifications in the DoDISS should be performed. Recommendations should be evolved as to how these specifications are prepared and approved or authorized by discrete Federal Supply Classification Codes or other appropriate criteria.

5.12.1.7 CONCENTRATION OF MANPOWER

The manpower presently involved and scattered throughout many agencies in specification writing and review, must be concentrated to work on the specifications of highest priority and in a much more timely and economic fashion.

5.12.1.8 DETERMINATION OF COST BENEFITS ON A SYSTEMS BASIS

Cost-benefit analyses of specification changes, downgrading, reviews, etc., as they may affect total systems cost and procurement, should be performed in order to do selectively only those things with a positive advantage to DoD rather than across-the-board pro forma activities.

5.12.1.9 INCREASE OF DATA FLOW

New technology should be more quickly translated into specifications by making sufficient data more readily available (see 5.8 et seq.).

5.12.1.10 PARTICIPATION IN INTERNATIONAL SCENE

A more effective link of the U.S. effort in the field of Materials and Process Specifications with those organizations participating on the international level would provide for a substantial national benefit in DoD and non-DoD areas (see Chapter 7).

5.12.1.11 IMPROVE DoD-INDUSTRY COORDINATION

A formal mechanism by which industry could be involved with DoD on a regular basis should be arranged. By industry involvement in specification deliberations, it should follow that the resulting specification(s) will automatically be coordinated, in a timely manner, with the capability of the industry supplying the commodity to the end that government needs are fully met.

5.12.2 COMPUTERIZED LISTINGS

5.12.2.1 UPDATING OF GOVERNMENT LISTINGS

There should be an updating of the present materials and process specifications used by the government (federal and MIL specifications and standards) in terms of computerization of these specifications and standards. There should be wider circulation of SD-4 ("Status of Standardization Projects", Federal Supply Classification Codes) to concerned activities and industries.

5.12.2.2 ADDITIONS TO GOVERNMENT LISTINGS

A computer program should be created, freely available to all concerned, that will yield the following information on each specification:

(1) Its currency and its listing in the DoDISS

(2) The preparing activity

(3) Its review status

(4) Its priority for review. Elements of review should include need for updating, obsolescence, need for replacement, similarity to other voluntary industry specifications, e.g., those issued by AMS, ATMS, etc.

(5) The review noted above should be in the available program information.

5.12.2.3 ADDITION OF VOLUNTARY SOCIETY LISTS

A mechanism should be created for the review of the various classes of commodities and their individual specifications so that in the process of reviewing each government specification, as detailed in 5.12.2.1 above, similar specifications from the voluntary standards organizations in the United States can be simultaneously reviewed to determine applicability to the federal and DoD needs.

For this review mechanism, the preparing activity should identify, prior to the review of the federal or DoD specification, the appropriate voluntary standards organizations that would be the key reviewers organizations, based on their specification and standards systems. The specifications thereafter should be circulated to all interested trade associations, voluntary specification writing organizations, and others, who have previously expressed interest in reviewing the specification in question.

5.12.3 STANDARDIZATION OF DoD RULES FOR CANCELLING, ORIGINATING OR REVISING DOCUMENTS

Rules should be established for originating, updating or revising DoD and federal specifications, as well as rules for replacing these specifications, when obsolete, with substitute or equivalent voluntary specifications.

5.12.4 SPECIFICATION WRITING

5.12.4.1 CONTRACT WRITING

For certain classes of material the preparing activity should consider contracting out the preparation of new specifications. These draft specifications should be circulated to all interested organizations and coordinated prior to listing in the DoDISS.

5.12.4.2 CRITERIA FOR SPECIFICATION WRITING

To prepare for the above, it is necessary that writing criteria be drafted and reviewed by all of the participating voluntary specification writing organizations. These criteria, when established, should determine whether the systems utilized by the contractor will lead to a product that satisfies DoD requirements. When approved finally by DoD, these criteria should be disseminated and utilized in subsequent contracts.

CHAPTER 6

ECONOMICS OF THE PRESENT SITUATION AND OF A UNIFIED SYSTEM

6.1 INTRODUCTION

It is conservatively estimated that materials and process specifications represent almost 1 percent of the total hardware acquisition costs in DoD. The DoD hardware acquisition figure for FY 1974-75 was approximately $18-billion. The materials and process specifications and standards effort was just under $140 million for that period (Tables 4 and 5). Additional data can be found in the files of the National Materials Advisory Board.

Private sector technical societies and industry personnel spent an additional $3.5-million on specifications for materials, processes, and test methods. (Tables 3 and 5.) These private sector societies are "not for profit" organizations that develop and publish specifications and standards, with ASTM and SAE being the largest groups in this respect.

Over 1,000 of the private sector specifications are already listed in DoDISS and, therefore, are a part of the DoD effort. DoD spent an additional $68,000 in FY 1974-75 for purchase of hard copies of these DoDISS-listed society specifications just for internal use.

Although this report, by assignment, addresses specifications and standards related to materials, processes, and test methods, readers are reminded that the content in large part could be applicable to or related to all specifications and standards projects.

6.2 HANDLING COSTS FOR SPECIFICATIONS AND STANDARDS

A sizable portion of the cost of specifications is the printing, stocking, and processing of orders for the documents (see Table 5).

Approximately 13,500 line-item materials and process specifications are stocked for distribution. The primary originators are DoD, ASTM, and SAE/AMS. Approximately 900,000 documents are shipped per year. It is estimated that 20 percent of these documents are shipped outside the United States. Considerable impact on world trade is indicated.

In addition to the three issuing agencies noted above, there are over 400 other specification-issuing organizations in the United States. Some of these publish materials, processes, and test methods documents.

TABLE 5 Estimated Cost of Stocking, Handling, and Distributing Materials and Processes Spec. and Test Methods

	No. of Line Items for Materials and Processes	No. of Items Listed in DoDISS	Total No. of New and Revised Line Items	No. of Requests Processed	No. of Spec. and Std. Shipped	Estimated Cost of Printing, Processing, Mailing, etc. for Materials and Processing
Dept. of Defense Single Stock Point—materials and processing specs. (all single copies)	4,000 M&P and test	4,000	1,030/yr.	34,340/yr.	20,470	$400,000/yr.
ASTM	2,200 M&P[1]	500	1,700/yr.	10,000/yr.	150,000/yr.	
Single copies	4,480 Test		(200 new 1,500 rev.)			$1,861,000[3]
Bound books	48 books/set			30,000/yr.	220,000/yr.[2] (individual books)	
SAE/AMS:						
Single copies	1,680 M&P	520	215/yr.	430,000/yr.	487,500/yr.	$1,336,000
Subscription sets	1,680 documents/set				2,200/yr.[4]	
Other Technical Societies[5]	3,800					

[1] In addition, there are compilations of specialty standards such as ASTM's for building codes.
[2] Includes approximately 6,000 books shipped outside of the U.S.A.
[3] Includes approximately $66,000.00 in postage.
[4] Includes 200 compilation of special categories only.
[5] There are over 400 specification-issuing technical societies in the U.S.A.

Besides the distribution of hard copies of specifications, Visual Search Micro Film[1] (VSMF) machines and cartridges may be purchased for in-house viewing of the specifications. VSMF carries the government specifications, ASTM, AMS and many other kinds of specifications and standards. One can view the document on a scanning screen or obtain a temporary print of the film image by pushing a button. Costs of cartridges are shown in Table 6.

TABLE 6
COST OF VSMF CARTRIDGES
(1975)

Source of Cartriges	Comments	Cost ($/yr)
Government	Selected Cartridges for Specifications	$3,700.00
ASTM	All documents	955.00
AMS	All documents	230.00
	Total	$4,885.00

6.3 UNRECORDED PRIVATE SECTOR COSTS

There are other specifications costs not specifically included herein, particularly the cost of company-originated specifications and the cost in time and money of industry personnel participation in the preparation of technical society documents.

There are unique specifications generated by contractors against specific DoD contracts and charged directly to that contract. These documents are for items not yet covered by published specifications. There is no realistic estimate of what these documents cost DoD since there is no cumulative DoD fiscal breakout available for this item and its consequences in contract accounting. It is roughly estimated that it may be as much as 0.5 percent of the total contract cost.

[1] Marketed by Information Services, an Indian Head Company, Engelwood, CO.

In addition, many companies have their own system of in-house company specifications, largely directed to bringing uniformity to their in-house practices. Company specifications can reduce operating costs and improve reliability of the equipments being produced. Company specification systems are necessitated because the specification documents in the United States are decentralized in origin and are all too often contradictory.

To appreciate the extent to which industry's personnel contribute time and dollars to the preparation of society specifications, one has only to study the activities of a specification committee to establish these unrecorded costs.

For example, ASTM D-15 Committee for "Engine Coolants" has been operating for 28 years. It has an average of 50 members, each of whom pays a $25.00 committee membership fee in addition to his individual ASTM dues. The cost of D-15 Committee operations over the 28-year period is estimated to be as follows, all of which is contributed by industry and not included in the ASTM budget.

Dollar-Value committee membership fees	$ 35,000
Dollar-Value time of members off the job	784,000
Dollar-Value hotel, meals & travel	318,000
Dollar-Value round-robin testing	
Labor (100 hours/member/yr)	2,800,000
Materials costs (to run tests)	280,000
Total for 28 yrs.	$4,217,000
Total average/yr.	$ 150,608

Another example of unrecorded industry contributions is in an ASTM committee studying corrosion of stainless steels. It cost $0.25-million just to get the specimens together so testing could commence.

ASTM recently experimentally streamlined its operation, developed and issued an ASTM standard in 180 days at a cost of $40,000. This was exclusive of the cost of the participants doing their homework on the document on company time in their own office.

The estimated magnitude of man-power involved in voluntary society committees for materials, processes, and test methods for specifications is shown in Table 7.

TABLE 7

MATERIALS AND PROCESS SPECIFICATIONS AND STANDARDS COMMITTEE STRUCTURES

All Societies

Operating Technical Committees	500
Spec.-Writing Membership	25,000*

* Many people serve on more than one committee, e.g., ASTM's 23,000 members represent approximately 50,000 units of participation.

6.4 OVERALL PRIVATE SECTOR COORDINATION

Within the private sector, ANSI endeavors to coordinate all the efforts of U.S. standards developing organizations. This is particularly true in the area of international standardization in which it is the accepted U.S. representative (see below).

Under any proposed plan for a unified, government supported national system of specifications and standards, ANSI (or a counterpart coordinating body) would have to be substantially strengthened if it were to be effective and sufficiently prestigious to handle the job that must be done within an acceptable time frame.

At the present time, ANSI's international activity is not financially supported by the U.S. Government.

6.5 LEGAL IMPLICATIONS

In particular, the legal aspects involved in the use of specifications cannot be overlooked. The number of class action suits over faulty performance is rising rapidly in many states[1]. Personal accountability and liability are ever increasing concerns to industry.

[1] Phillips, Samuel D., General. "Craftsmanship and Defense Dollars". Performance, Sept./Oct. 1972, p. 26.

The Federal Trade Commission (FTC) is interested in standardization procedures and activities related to the possible anticompetitive activities (see 4.3.4). The FTC has no responsibility for specifications, but interprets the anti-trust laws to preclude specifications being written to restrain trade.

6.6 COST IMPLICATIONS

It is highly significant that there are unnecessary costs built into the existing specifications/standards systems, including:

- Duplicate specifications;
- Unnecessary technical requirements;
- Inadequate user inputs to the document;
- Order of selecting specifications as established by each DoD contract.

The high costs reflected in the documents result from differences between the agencies within DoD, between DoD and other government agencies, between the functions and charter responsibilities of the various specification-producing organizations in the private sector, and between DoD and the various private sector bodies. Further, the Defense Standardization Program (DSP) specifically prohibits the use of DSP funds for generation of data. But, generation and evaluation of data are a function that is vital to the preparation and maintenance of effective materials, finishes, and process specifications.

Also contributing to the high costs are the methods of operation used by government agencies and private sector organizations. Not to be overlooked are the varying degrees of stimulus for accomplishment, as demonstrated by (a) the thousands of volunteers who work in private sector committees to generate specifications and standards and (b) the hundreds of industry users not convinced it would be valuable to name volunteers to these committees and who do not authorize or encourage active participation. Upper levels of industry management may accept the process of generating specifications, but they do not necessarily understand it. In spite of the top management attitude, the volunteer time devoted by industry personnel to attending specification meetings, developing and writing the documents, and conducting tests to verify the values shown in the specifications is all donated free of cost to the technical societies and is credited to industry as shown in Table 8. Compared to the outlay shown in Table 8, DoD devotes a minuscule amount to materials and process specifications, as shown in Table 4 and the direction

TABLE 8

ESTIMATED ANNUAL COST OF PREPARING PRIVATE SECTOR SPECIFICATIONS AND STANDARDS

Responsibilities	Private Sector Expenditures[1]
Individual Private Societies:[2]	
Headquarters activities	$ 19,740,000
Travel, committee work, testing etc. by industry participants	300,000,000[3]
ANSI:[4]	
National coordination and standards approval	47,000
International secretariats in related fields	140,000
International participation	73,000
TOTAL:	$320,000,000
All DoD related M&P	$107,000,000[1]

Footnotes:

1. Approximately 1/3 of the total effort is for materials and process standards as related to DoD.
2. Estimates based on survey of ASTM, SAE, AWS, NEMA, NFPA, and ASME.
3. In DoD, testing is not permitted to be paid for out of specification development funding; within ASTM activities, testing is performed in conjunction with specification development.
4. ANSI costs represent 7% of the total ANSI budget and 14.8% of the ANSI Technical Operations budget.

appears to be downward. Therefore, any drastic reduction[1] in the DoD budget would make it impossible for DoD to address this area adequately even on the previous low level.

Appendix D calls attention to a few specifications that illustrate real-life problems that contribute to the high cost of generating and using materials and process specifications and standards. There are untold hundreds of other documents that could have been listed, many more comments on the herein listed specifications that could have been cited, and documents from other agencies and organizations that could have been included.

6.7 NEED FOR A UNIFIED SYSTEM

Since the principal sources of expertise in materials and processes reside in the private sector, it is of concern that some DoD skepticism exists that the established private sector bodies could meet DoD needs with the use of voluntary standards as the groups are now organized and functioning.

The two systems (private and government) are not perfect. Neither system has, or probably ever could, by itself, completely serve the total needs of both areas. On the other hand, duplication of effort is usually a waste and should be minimized. A cooperative effort would be very helpful.

From the point of view of the charge to this committee, however, it would be a mistake to look at minor flaws in the system and say that the present voluntary system cannot be used. The strengths far outweigh the weaknesses, and the individual standards which are suitable should receive wide government use and support. Those which are not suitable should be improved. In this way, DoD can take advantage of the large effort which has been and is being exerted in the voluntary system without relinquishing performance requirements.

In previous portions of this report it has been demonstrated that two principal problem areas of the present Department of Defense system are that it is conducive to proliferation of specifications and standards and, in a real sense, is not now nor is it likely to be maintained with adequate manpower and funding.

It can no longer be acceptable to let documents become outdated for lack of manpower to service their upkeep or to

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[1] From loss of buying power of the dollar of otherwise.

generate urgently needed new documents, as is now happening in DoD.

Accordingly, it is essential that we have a unified, structured system of specifications and standards that can be maintained in an up-to-date condition if it is to be responsive to the needs of the Department of Defense. It appears quite possible to develop a unified system utilizing the existing specification activities under an organized and structured mandate[1],[2].

The voluntary societies have demonstrated their capability to respond with fast turn-around when requested to undertake a particular specification task. These organized talents and ongoing activities could be utilized as the nucleus for a national system of specifications, especially since 90 percent of needs of this country for materials, processes, and test methods specifications already exists under the present decentralized system.

Writing a specification is a major technological project and it must be considered, described and defined as carefully as in contracting for a particular product. On this basis, any unified system of specifictions must be under the prestigious leadership of a permanently qualified body of experts. The management record of DoD suggests that it is not in a position for reasons stated to react adequately to its own specification needs and must, therefore, place increasing reliance on the private sector. Placement of functional leadership within the private sector would also tend to make the operation more acceptable as well as economical.

The decentralized sources from which specifications presently emanate, place an unnecessary burden of duplication, confusion, and cost on the issuing agencies, users, and materials manufacturers. To add to the problem, specifications appear to be the most neglected essential step in our industrial complex. This is shown by underfunding and lack of managerial attention. The economic impact of specifications dictates that they require better than their current rating if this country is to realize cost-effective savings in materiel (equipment) procurement. It must be realized that this country has a significant investment in specifications that must be protected. A unified system of materials and process specifications,

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[1] S. H. Meiselman, "Proposed: A National Standards Program," Defense Management Journal, April 1975, p. 52.

[2] Air Cdr. C. T. Nance, RAF, "A National Standards Program," Defense Management Journal, October 1975, p. 60.

bringing order and technical integrity to the documents in this field would, according to one estimate, reduce the current inventory of specifications by perhaps 30 percent, with attendant savings of millions of dollars per year in direct and indirect costs.

6.8 A UNIFIED SYSTEM OF SPECIFICATIONS AND STANDARDS

To be effective, a unified system for specifications and standards should have at least these essential elements. Please note that specific organizational details have not been identified; they may properly be the subject of a later study.

6.8.1 COORDINATING TECHNICAL STANDARDS ORGANIZATION

A body to identify and deal with accomplishing needed standards projects is an essential element. Ideally, it should function on the international as well as the domestic level and be the U.S. spokesman abroad. The responsibility of this body would be to serve the national purposes in specifications and standards.

6.8.2 VOLUNTARY STANDARDS ORGANIZATIONS

A responsible voluntary standards organization with permanent staff and ad hoc working committees would form the backbone of the unified system. It is here that the main thrust of Department of Defense participation to obtain satisfaction of its needs would occur.

6.8.3 POTENTIAL RESULTS

It is anticipated that over a three year period a unified system could eliminate more than 95 percent of the government specifications for materials and processes that are presently used by the Department of Defense and replace them with existing selected documents that are in better keeping with current technology.

For example, for the aerospace industry the selected specifications might be SAE-AMS documents for materials, finishes, and processes and ASTM documents for test methods. Specifications for specialty electrical and electronic applications could be prepared by existing organized groups such as ASTM, EIA, IPC and other established specification-writing bodies, providing the documents would comply with a pre-established level of quality and content and were compatible for integrated systems usage with SAE-AMS and ASTM documents. Whenever a test method is needed for a specification, the originating society would request the appropriate document from ASTM. It is essential that, on a continuing basis, representatives of DoD agencies serve on the ASTM, AMS, and other specification-generating

committees. Similar considerations would apply to the specification needs of industries other than aerospace used in this example.

6.8.4 STATUTORY AUTHORITY

The National Science and Technology Policy Organization and Priorities Act of 1976 (Public Law 94-282) passed by Congress on May 11, 1976 stated among other things: "...it is a responsibility of the federal government to promote prompt, effective, reliable, and systematic transfer of scientific and technological information by...(supporting) programs conducted by...industrial groups and technical societies, in particular, it is recognized as a responsibility of the federal government not only to coordinate and unify its own science and technology information systems but to facilitate...institutional scientific research with commercial application of the useful findings of science[1]."

It has been demonstrated that specifications and standards are an important part of scientific and technological information and important to technology transfer. Thus, to implement PL 94-282 directives (cited above), it would be logical that a Coordinated Standards Program, with adequate funding, be established. Department of Defense specifications could well be integrated into a unified system as an initial demonstration of the benefits that other parts of the federal government might realize.

6.8.5 DIRECTORY

While a unified system is being achieved, a directory is urgently needed to provide traceability and retrieval of the existing specifications and standards issued by the more than 400 associations and government agencies. The directory should be a "who/what/where" booklet that lists the societies, government agencies, trade organizations issuing and/or working on materials and process specifications and the availability of machine data base retrieval. There would be a summary of the charters and prime responsibilities of each agency, the types and kinds of specifications they issue, the user-vendor-government agency working relationship of each issuing agency, whom to contact, and how to procure the documents. As the unified system expands and becomes more refined, the image of this directory would change accordingly. This directory may well

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[1] MCIC - Newsletter - Battelle-Columbus Laboratory - 6(9) - September 1976.

be based on the existing National Bureau of Standards data base and the task of maintaining such a directory might well be assigned to the National Bureau of Standards.

6.8.6 PROCUREMENT, INVENTORY, AND DISTRIBUTION OF DOCUMENTATION

The present methods of physically obtaining published specifications and standards vary according to the issuing agency practices and the relationship of the documents to the contracts. Table 5 summarizes costs of some of the more prominent agencies for stocking, handling, and shipping materials, processes, and test methods specifications. Changing to a unified system of specifications would not increase these agency costs greatly.

Government specifications are stocked as single hard copies and may be obtained free of charge by contractors upon request. There is an active and thriving business in shipments of hard copies as shown in Table 5. For ASTM, SAE/AMS, and other technical society specifications and standards, contractors must purchase the hard copies directly from the issuer. These may be single hard copies, or compilations in either sets of bound books (e.g., ASTM), subscription loose leaf sets (e.g., AMS), or compilations of special interest documents such as ASTM building codes or AMS plastics specifications.

Table 5 shows that there are nearly twice as many private sector materials and processes documents as there are government specifications in the materials and processes category. ASTM and SAE do a substantial business in the sale of their specifications and standards, including a considerable amount of business outside the United States.

Under such a national system of specifications, it appears that the Naval Publications and Forms Center might well continue to be the focal point for distribution of all specifications and standards listed in DoDISS. Further, it is recommended that an arrangement be developed whereby DoD continues to distribute these documents to contractors free of charge.

Document procurement relationships between DoD and originating technical societies would have to be developed in a separate study. It is important to contractors to be able to order all DoDISS-listed documents from one source, even though the documents may be originated by many different sources. Such an arrangement would not and is not intended to jeopardize the direct sale of voluntary society documents to anyone who wishes to purchase the private sector specifications and standards.

In consonance with the proposed unified system, MIL-STD-143 would require specific changes.

It is apparent from Table 5 that the volume of shipments of ASTM and AMS documents would increase under the proposed system of specifications. The volume increase would largely be due to replacing 95 percent of the existing 4,000 government specifications with private sector documents.

It is not anticipated that the number of documents within the private sector would significantly increase, because basically about 90 percent of the needed specifications currently exist. The cost of maintaining and up-dating existing documents is already being carried out by the voluntary society specification originators.

What it would mean is that the increased usage of ASTM and AMS specifications (in lieu of government) would increase the volume of hard copy specifications.

Assuming that the 4,000 government specifications were replaced by existing private sector documents and were purchased by contractors, the 20,400 materials and process specifications now being shipped by DISC might roughly cost $1.80 per copy, making an added overall cost to these contractors of approximately $37,000.00 per year, plus postage. This cost is an insignificant portion of the overall investment of $300-million per year, which the industries now spend in the technical development activities of technical societies that issue materials and process specifications (Table 8).

6.8.7 MANPOWER CONSIDERATIONS

It is a cause of real concern to learn that the Department of Defense (excluding the Defense Supply Agency) has less than 100 people working on materials and process specifications. In 1966, there were 200 people so engaged. This manpower scale down helps to explain why government agencies cannot give as much attention to their specifications as is needed.

In the meantime, the specification-issuing voluntary societies are organized and well structured to address the private sector needs for specifications. ASTM and AMS in particular, have maintained well balanced technical teams that maintain their documents in an up-to-date condition and that rapidly respond to the need for new materials to keep pace with the state-of-the-art.

6.8.8 COST CONSIDERATIONS

In a unified national specification system, many more industries than heretofore will have to participate in technical society activities if they are to make direct inputs to specifications being generated and if they are to defend their competitive position in world trade. It might be that the present industry support of $300-million (Table 8) would have to be increased by roughly $50-million to maintain a cost-effective system of specifications that is technically sound.

It is doubtful that industry would or could bear the direct cost burden of the additional $50-million, especially since many industries presently lean heavily on free government specifications and do not participate in the existing $300-million technical support effort. It would appear that action at a high government level, possibly Congress, would be necessary to ensure availability of government monies to establish a national system of specifications and standards. However, before this is done, there should be a detailed study to actually establish a working mechanism for the operation of a national system.

Industry has voluntarily provided 90 percent of the solid base needed to operate a national system and appears to stand ready to continue the voluntary efforts. Appropriate government financial contributions to a joint effort would make it possible for the voluntary societies to achieve and maintain a current national system that has quick turn-around capability and that can respond to DoD and other government and industry needs in a most creditable fashion. Without materials and process specifications, there can be no technical integrity and safety in our hardware.

6.9 SUMMARY AND RECOMMENDATIONS

6.9.1 SUMMARY

In light of DoD spending approximately $2.5-million a year on specifications and standards for materials, processes, and test methods; the private sector societies spending $3.5-million per year; and the estimated $300-million per year that industry contributes in the form of manpower and testing to prepare private sector specifications; one realizes the vast economic impact that specifications must have on our society to justify these expenditures.

In spite of these expenditures, specifications are in trouble. One of the primary reasons for the difficulty is the lack in the United States of a unified, coordinated system of specifications. Specifications are issued by over 400 private organizations, plus a great number of agencies in the federal government[1]. Who can find what and where? Which ones have mandatory usage and which ones are voluntary? Why are so many agencies issuing specifications?

DoD no longer has adequate manpower to give proper attention to the specifications they impose on contractors. Outdated and inadequate specifications are ineffective and destroy the users' confidence in them and other specifications.

It has been established here that there is immediate benefit to the Department of Defense in a unified system of specifications in the United States and that the basic nucleus for such a system already exists within the private sector organizations. However, certain things must be done before we can proceed with confidence to a unified system.

6.9.2 RECOMMENDATIONS

Because of the significant benefits that would accrue to the Department of Defense through the implementation of the recommendations that follow, it is suggested that the Department of Defense vigorously pursue the listed goals and actively enlist the cooperation of other federal agencies and the private sector.

- Determine the feasibility and detailed procedure for centralized printing, stocking, and responding to contractors needs for documents that are listed in DoDISS, including those government and technical society specifications listed therein.

- Establish the sequence and priorities for replacing government specifications listed in DoDISS with existing voluntary society specifications.

- Develop and issue a directory of all presently existing sources for specifications and standards on the lines described above. Continue to update the directory as the system becomes more refined.

- Undertake an immediate educational program to promote knowledge of the importance and impact that materials and processes specifications have on our economy.

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[1] See pages 1 and 2, NBS-SP 417 (previously cited).

- Develop a preliminary long range plan and priorities for a unified system of specifications and standards, using the category of materials, processes, and test methods as a pilot program.

- Determine the cost-effectiveness of the DoD pilot program for materials, processes, and test methods specifications for further planning purposes.

- Prepare and coordinate the need and justification for government action to establish a national system of specifications and standards; i.e., what the system would be and the amount of government money needed to support such a system.

- Determine how ANSI or its equivalent could become the prestigious body that is necessary to coordinate a unified system of specifications and standards; and examine in detail how this enhanced body would work with the technical societies including international standards representation on behalf of the United States. The DoD and civil agency standardization programs should be retained until the organization of a unified system of specifications and standards is sufficiently developed to meet the need.

- Establish standard criteria as to format, content, and approval of specifications that could be used to qualify a document for entry into the unified system of specifications.

- Encourage federal government agencies to work more effectively with private sector organizations to establish coordinated documents by consensus.

- Give due consideration to the special needs of aerospace systems for specifications in the mechanical, structural, electronic, radar sub-systems that are mutually compatible.

- During metric conversion of documents, eliminate duplicate and unnecessary specifications and standards.

6.9.3 TIMETABLE AND LIST OF OPTIONS

The ideal system would embody government-wide specifications and with whatever legislative changes are necessary. This might take considerable time to accomplish.

Put in place the best possible system for DoD with full Congressional and Executive backing. This would take less time.

Put in place the best possible system under DoD's existing authority with voluntary cooperation by industry and with financial and manpower resources furnished by DoD. This could be done soonest with largest proportional beneficial effect cost-wise.

CHAPTER 7

INTERNATIONAL SITUATION

7.1 INTRODUCTION

The DoD has an interest in the international situation for several reasons. It is involved through NATO; through the ABCA[1] Standardization Board; and through the sale and use of U.S. military equipment to various countries around the world. Standardization is involved in both the operation and maintenance of this equipment. (See Appendix H for details of selected international materials standards groups.)

Until a truly international system covers all materials and processes, the operations are carried out on a specific basis with the details being dependent upon the circumstances in each country.

The overall question of international standardization is one of great complexity, involving a number of government and nongovernment groups in many countries, regional voting blocs, politics and trade in addition to technology, inevitable overlap, implementation of SI metrics, and other factors. Obviously, it was neither practical nor desirable for the committee to address this broad picture in its many ramifications. Instead, a small but important segment particularly pertinent to DoD and materials has been selected for consideration and recommendation.

7.2 FOREIGN ORGANIZATIONS

7.2.1 GENERAL

While the European Economic Community (EEC) is endeavoring to unify its standards procedures through ISO and the IEC, the EEC countries present a different posture compared to the U.S. system. The standards organizations in Europe are quasi-governmental operations with financial support from both industry and government.

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[1] ABCA refers to the standards activities of the Armies, Navies, and Air Forces of the American, Britain, Canadian and Australian Quadripartite.

In the USSR, the status of standardization is such that there is now a 5-year plan for standardization[1] directed by the Council of Ministers of the USSR. The Japanese government has also funded standardization activities which have supported its mass production facilities in highly technical areas. There may be a special message for the United States that those countries (Russia, West Germany, and Japan), most devastated by World War II, have led the world in recovery and they fund standardization activities upto 100 percent.

7.2.2 EUROPEAN ASSOCIATION OF CONSTRUCTORS OF AEROSPACE MATERIEL (AECMA[2])

AECMA is a European group covering a wide variety of topics and standardization, including committees on materials. The countries represented are Germany, Belgium, Spain, France, Italy, the Netherlands, United Kingdom, Sweden, Switzerland and the Eurospace group. Headquarters are in Paris. Meetings are held approximately twice a year, in a member country, with extensive agendas involving several days of discussions of specification details, similar to the meetings of the SAE (AMS) group. In the materials field, major focus is on metals. Previously, standards were produced to be converted into national specifications. The trend now is to produce documents, essentially specifications, with AECMA numbers. Good liaison and exchange of documents and representatives exist between AECMA and SAE (AMS).

7.3 INTERNATIONAL ORGANIZATIONS AND UNITED STATES PARTICIPATION

In contrast to the European Economic Community, the Union of Soviet Socialist Republics, and Japan, the international activities of the the United States (other than military, see Section 7.4.2) are carried out by a voluntary organization, ANSI. The latter does not have the funds to represent the United States on all of the technical committees nor to assume its share of the secretariats. In some cases, for example rubber, the United States holds the secretariat and the rubber industry supports the work by special contributions to the committee. The secretariat of the aerospace international committee requires support of about one half million dollars per year. This is the cost

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[1] USA Foreign Service and Technical Center Report CW01-104-74, dated August 31, 1973, "The Development and Use of Standards in the Soviet Union", by Dr. A. Allen Bates.

[2] AECMA denotes Association Europeenne des Constructeurs de Materiel Aerospatial.

of meetings, simultaneous translations, and document translation. There is no private standards organization in the United States with available funds to carry on the work of this important committee, since the U.S. groups get their support from private individual memberships and the sale of documents. Of interest is the A.I.A.'s recent accession to the secretariat of the TC-20 Committee on Aerospace. Appendix H dicusses "United States Participation in International Standards Work" in considerable depth. An abbreviated version follows.

7.3.1 INTERNATIONAL STANDARDS ORGANIZATION (ISO)

The international organization for standardization (ISO) is the specialized international agency for standardization, comprising the national standards bodies of over 80 countries. The work of ISO is aimed at world-wide agreement on international standards in virtually every area of technology, with the exception of electrotechnical questions.

The ISO member body for the United States is ANSI. ANSI pays the total U.S. dues to ISO and, with the help of its federated membership, provides the management leadership, coordination and administrative as well as financial support for the U.S. participation in ISO. In addition to its membership on most of ISO's technical bodies, ANSI plays an active role in ISO's policy-making and programming bodies.

7.3.2 INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

The International Electrotechnical Commission (IEC) is a worldwide organization whose members are National committees representing over 40 countries. The object of the IEC is to facilitate the coordination and unification of national electrotechnical standards by issuing International Standards which express as nearly as possible an international consensus on the subjects dealt with. The work of the IEC covers almost all of electrotechnology, comprising the power field as well as the fields of electronics, telecommunications and nuclear energy.

ANSI has been responsible for U.S. representation in IEC; this responsibility was fulfilled by the U.S. National Committee (USNC) on behalf of ANSI. ANSI paid the total U.S. dues to IEC and with the support of its federated membership coordinated the activities of the USNC with national standards programs. The membership of the USNC includes representatives of concerned trade associations, professional societies, government bodies and testing laboratories as well as individual technical experts. (See Appendix H for current problems in the relationship of ANSI and USNC.)

7.3.3 RESOLUTION OF PROBLEMS

The rate of resolution to these problems and others presented below (see 7.4) will be slow until the United States makes its own intentions clear. U.S. international activities are carried out primarily through ANSI, but neither government nor industry has given ANSI adequate support to do an effective job. The use of international standards in the United States has begun but needs considerable support, not only in usage but also in the development of standards. Many U.S. standards are, in effect, international standards by reference, but new international standards are being developed with only minimal input from the United States. ANSI states that, given proper financial support, it is prepared to manage the international part of the U.S. standards activities. ANSI could maintain the various secretariats that are involved either directly or by assigning them to other parts of the voluntary system.

7.4 PROGRAMS CURRENTLY IN PROGRESS

7.4.1 GENERAL

Several programs are underway. The DMSSO is planning to set up an international management group to work through ANSI on international standards of interest to the DoD. In NATO, advisory documents are being developed to show the equivalency of specifications for operation and maintenance of equipment. The ABCA group is working on interchangeability. The cost of the lack of standardization (for all equipment) in NATO alone has been estimated to be between 20 and 40 billion dollars per year. A DoD estimate places the U.S. part of this at 5.5 billion.[1]

Congress is considering legislation to amend the military appropriations bill to require that equipment procured by DoD from NATO "be standardized and interoperable with equipment of the NATO allies."

7.4.2 DoD ACTIVITIES (Also see Appendix I)

7.4.2.1 ABCA[2]

The ABCA Standardization Program results from the "Basic Standardization Agreement 1964" (BSA 1964). Prior to

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[1] Congressional Record, page S16834, Sept. 26, 1975.

[2] ABCA refers to the standards activities of the Armies, Navies, and Air Forces of the American, British, Canadian and Australian Quadripartite.

this time, it was known as the Tripartite - ABC for the American, British and Canadian Services. The aims of the program are to ensure the fullest collaboration and cooperation among the Services, to achieve the highest possible degree of interoperability among the signatory Services through materiel and non-materiel standardization, and to obtain the greatest possible economy by combining resources and efforts.

The basic program is operated through what are known as Quadripartite Work Groups (QWG's) of which there are several. The QWG's essentially work towards developing what are known as Quadripartite Standardization Agreements, or "QSTAG's". Each of the several QWG's is concerned with a specific area of standardization; for example, there is the QWG on "Proofing, Inspection, and Quality Assurance", or QWG/PIQA for short. Each of the Services assigns a senior official to represent the national interests. The QWG operates by establishing a number of basic projects within its overall charter. Each project is assigned to a country. The other countries assign action offices to work with the assignee. Annual meetings, hosted by each country in rotation, are normally held to review progress of the projects and to propose and approve QSTAG's.

A look at the QWG/PIQA situation will illustrate the scope and nature of a typical QWG. Considering the broad areas of mutual interest, and the large number and variety of tasks pursued by QWG/PIQA (including areas such as: statistical sampling, classification of defects, quality assurance terminology, nondestructive testing, and pyrotechnic and ballistic testing methodologies), the accomplishments of the group up to and including the 6th QWG/PIQA meeting have been encouraging and mutually beneficial. Success is noted by issuance of several QSTAG's covering important areas of standardization in quality assurance practices. At the above noted meeting, there were 35 agenda items for discussion and action. One of the key QSTAG's apprroved at this meeting, for example, was QSTAG 335 on "Certification of Industrial Ultrasonic Testing Personnel" which has been in development for several years.

There are 124 QSTAG's currently listed in the DoDISS for the Armies of the Quadripartite, 44 for the Navies, and 269 for the Air Forces.

7.4.2.2 NORTH ATLANTIC TREATY ORGANIZATION (NATO)

Within the present structure of NATO organization and agencies, standardization is achieved by:

(a) The Military Committee working through the Military Agency for Standardization (MAS) and the International Military Staff (IMS), and

(b) The Conference of National Armaments Directors (CNAD) through the Defence Support Division and the Main Groups working under the CNAD.

Standardization proposals arise principally from the need to standardize operational and logistic procedures, tactical doctrine, and measures to achieve interoperability of current items of equipment. The proposals are normally processed by MAS or certain groups of IMS. Standardization proposals arising from the tasks of CNAD are considered by the appropriate CNAD Group. These proposals normally deal with the development of major equipments or weapons systems and not with Assemblies, Components, Spare Parts, and Materials (ACMS).

Standardization contributes greatly to the flexibility and thus to the overall effectiveness of NATO forces. However, flexibility is not achieved solely by standardization; it is also realized when equipment is interoperable. Within NATO, a number of initiatives are underway to achieve short-term results by removing major impediments to interoperability of communications, aircraft cross servicing, fuels, and tank ammunition. These have been taken to correct deficiencies which result from nationally oriented development and procurement policies resulting in proliferation of diverse and frequently incompatible weapons system. In recent years, much attention has been focused on the need for ACSM standardization as a means of achieving a higher degree of interoperability of equipments by standardizing several levels below the weapons systems/major equipment stage.

NATO Unclassified document AC/259-D/512 dated 30 June 1976 covers a "Study on Standardization of Assemblies, Components, Spare Parts, and Materials (ACSM)" which was submitted to the National Armaments Directors meeting held in April 1976. As a result of this study, the several nations involved have embarked on a series of programs to determine short- and long-term ACSM standardization areas which should be addressed. These programs require more precise planning in the materiel area. In this country, the Defense Materiel Specifications and Standards Office (DMSSO) is participating with NATO's ACSM planning group and with the STANAG subcommittee of the Interoperability Committee.

Studies have been planned to encompass the four areas of ACSM. Three such studies have already been initiated:

Engineering Practices Study - Needed STANAGS[1] for Hardware

Engineering Practices Study - Needed STANAGS for Electronic Components

Engineering Practices Study - Needed STANAGS for Materials

These studies were scheduled to be completed 20 January 1977.

An initial look in the materials area indicates that there are perhaps 100 to 200 candidate standardization agreements for the many materials used in NATO weapons systems. Although generally recognized as a formidable task, an accurate count of the number of pertinent agreements or specifications that may be involved has yet to be made.

One suggested way of achieving the goal is for NATO to adopt certain international standards such as those accepted by the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). Alternatively, selected national standards, presently available in the various NATO countries, could be adopted for use by all NATO partners, if acceptable. However, such decisions must await completion of the study to identify and quantitatively assess the numbers and subjects of specific types of involved documents.

7.4.2.3 INTERNATIONAL STANDARDIZATION ORGANIZATION (ISO) AND INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

A detailed discussion of ISO and IEC, including ANSI relationship with these groups, is given in Appendix H. (Also see 7.3.1 and 7.3.2).

7.5 INTERNATIONAL TRADE IMPLICATIONS

Standards may also act as Non-Tariff Trade Barriers (NTTB). An international "Code of Conduct" for the

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[1] The DoDISS currently lists 126 STANAGS for the Army, 82 for the Navy, and 267 for the Air Force. STANAGS refers to Standard Agreements.

formulation of standards and acceptance of material has been proposed by a GATT (General Agreement on Tariffs and Trade) Working Group in an attempt to deal with this type of Non-Tariff Trade Barrier (NTTB). Product standards can often be very effective NTTBs and are an appreciable part of the official complaints. The common market and its associated groups have set up a separate European coordinating committee for electrical standards which is working through the ISO and the IEC to unify the European position. In addition to the unification of standards, there must be the harmonization of testing, inspection, and other procedures to eliminate this type of NTTB. U.S. producers have different and onerous procedures to overcome before being able to sell in the Common Market. The GATT "Code of Conduct" should ameliorate some of the difficulties, but the outcome is not clear. The subject is discussed at greater length in Appendix G, an address by Mr. William McAdams, former president of IEC and president of ASTM.

CHAPTER 8

EDUCATIONAL ASPECTS

8.1 INTRODUCTION

The principal originators of new and improved materials and process specifications, testing methods and standards, of interest to the Department of Defense, are (1) the engineers in the voluntary societies, industry, and DoD concerned with technical innovation as well as equipment or systems procurement, and (2) the technical specifications developers who work with those engineers when translating engineering requirements into written form for use in design and procurements. Thus, a prime purpose of educational programs in the subject area is to disseminate new information to engineers, in the private and public sectors, who apply materials and process specifications, testing methods and standards on DoD contracts, as well as to provide, where needed, a better understanding of the basic specifications process. An added benefit of such information dissemination is the transfer of knowledge to other technical specifications and standards development groups, particularly those in the private sector, so that they may correlate their specifications and standards with DoD practices where pertinent and where it is advantageous to do so in terms of product improvements, elimination of confusion, reduction of costs, and the introduction of new design techniques.

8.2 SITUATION WITHIN DoD

Within DoD, education occurs informally through regular on-the-job contacts between engineers, during casual conversations, in briefing sessions, at meetings with personnel from diverse functions, in conferences concerning engineering programs and procurements, and through working relationships between project engineers and technical specification developers. On a formal level, education occurs during seminars, short courses and technical conferences (conducted within agencies or by professional societies) that are attended by people from government and industry who are knowledgeable in the subject area and meet to compare notes and exchange information. The professional societies, particularly ASM, SAE, ASME, and IEEE, sponsor educational programs of merit in this area for the benefit of engineers from the private and public sectors. In general, such existing patterns of knowledge dissemination and transfer are adequate for seasoned engineers in DoD, other government agencies, and industries (who develop or use materials and process specifications, testing methods and standards) and should be continued as the field advances. Cooperative (work/study) opportunities for undergraduates with DoD, and to a degree in industry, have

been effective on a modest scale, in transferring pertinent information about specifications and standards into academic design courses. This effort should be expanded, particularly among universities that have cooperative work arrangements in industry and with DoD.

8.3 NEED FOR SPECIALIZED EDUCATION

With the turnover of personnel in federal agencies, and the introduction of new engineering and physical sciences graduates into the work force, it is necessary to provide a variety of opportunities for education in the development and applications of specifications, testing methods and standards. This training would augment learning-on-the-job and help accelerate the process required by many recent graduates to become productive in a creative way in government or industry. In fact, there is cause for concern, emphasized by the findings of this committee, that this training is especially needed because of the absence of such material in most collegiate curricula in engineering, technology and the applied physical sciences.

For these reasons, it is believed that prudent intensification of education in the development as well as in the application of specifications and standards, particularly among new engineering personnel in government and industry, should lead to improved compliance with requirements of DoD contracts. To be effective, however, the education should include intensive survey courses offered by federal agencies responsible for the generation and application of specifications and standards, and by those industries that participate in the process and are further contractually required to use specifications and standards on government procurements.

A prime objective of these educational programs for undergraduates as well as seasoned engineers, however, would be to supplement on-the-job learning with technical knowledge that needs to be disseminated broadly or is too difficult and time-consuming for individuals to acquire alone or on the job. Established educational patterns in government agencies concerned with procurements could continue to serve as the backbone for the total educational effort. These educational efforts should be augmented with information relating to pertinent industrial practices and applications problems. Experienced generators of new technical knowledge are available as resource people for this purpose.

8.4 EDUCATIONAL MEANS

8.4.1 SHORT COURSES

Probably the most cost-effective means for keeping experienced design engineers, as well as materials and process specialists, abreast of new or improved materials and process specifications, testing methods and standards, is to exchange information among themselves and with other experts in the field during short courses, seminars, and workshops at national centers located in key geographic regions of the country. These short courses, given under the aegis of DoD, or societies such as ASM, ASTM, SAE and IEEE, should draw regionally on a voluntary basis and be of one to several days duration according to the time needed to cover the course. Longer, intensive short courses, possibly of up to two weeks duration, could serve to provide background data for inexperienced personnel who will eventually develop or utilize specifications, testing methods and standards.

8.4.2 MINI-COURSES IN-HOUSE

Additionally, a variety of in-plant mini-courses, each of eight to twelve contact hours, and given during one or two days, or extended over a four- to six-weeks period in the form of one two-hour session per week, usually after working hours, could be used to update a variety of personnel such as managers unfamiliar with the subject, design engineers, senior inspection or production control personnel, contract negotiators and other marketing personnel, as well as government project engineers. These mini-courses could focus on the significant roles of specifications, testing methods and standards, and their functional relationships to the various disciplines including design, inspection, and marketing. TV tapes, audio cassettes, handbooks and other literature can be used to reinforce such coursework or provide instruction on a self-paced basis.

8.4.3 INSTRUCTORS, INTERACTIONS

Instructors for all courses could be drawn from among experts in the development or application of materials and process specifications, testing methods and standards at government agencies, industry, technical societies, and in consulting practice. It is expected, however, that during such courses, participants will have opportunities to interact with each other as well as with the instructors in dealing with practical problems and requirements for decision making encountered in their jobs. Appendix 8-1, illustrative of an introductory course for new professionals, is tailored to meet the needs of selected participants in terms of their disciplinary concerns for

specifications and standards. Similar courses can be structured to meet diverse educational needs, such as introducing new engineers without practical work experiences to the subject area of informing non-technical personnel about the importance of specifications and standards.

8.5 DESIRABLE RELATED PROGRAMS

A variety of other educationally-related activities would enhance the understanding, importance, and use of materials and process specifications, testing methods, and standards in equipment development, design, materials procurement, inspection and handling, manufacture and maintenance. Probably the most promising of such activities would be as follows:

- Undergraduate colleges with curricula in the applied sciences, engineering or technology could be suitably encouraged to retain and/or develop courses in engineering design within which the significance of materials and process specifications, testing methods and standards, and practices in preparing, assessing and applying specifications are included. In particular, students ought to develop an awareness for the need to evaluate the role of specifications in product reliability, user safety, manufacturing methods, purchasing techniques, costing, and quality control as an integral part of engineering and standards design. Engineering students would then acquire an understanding of why specifications and standards are necessary, how specifications and standards are generated, how to select the proper specifications, where to find them and the liability implications when the specifications and standards are misapplied in engineering design.

- Expanded cooperative-work opportunities in industry and government would expose students to R&D activities, engineering design, and product manufacture utilizing materials and process specifications, testing methods and standards. Students not participating in cooperative work-study programs could be encouraged to seek summer jobs to learn more about the real world.

- University professors would benefit from practical experience assignments with industry, during summers and sabbatical years, so that they may become intimately exposed to industrial methodologies and the usage of materials and process specifications, testing methods and standards. They would then be prepared to strengthen their courses in the practical aspects of engineering endeavor. Professors who teach design could profitably spend some of their work time with specifications and standards groups to gain a deeper understanding of the related problems and rewards in terms of reliable engineering design.

- Requestors of specifications and standards, with limited experience in procurement activities, could be made aware of the many Materials Data Centers that have been established, what the various Centers offer, as well as how to avail themselves of their information content and services.

- The professional levels of technical specification developers ought to be sustained or elevated to assure the retention and continual enlistment of competent personnel. The contributions of professional engineers to the development of specifications and standards merit special recognition that would enhance the status of their work and help attract new qualified personnel to such activities.

- In an attempt to create a desirable climate of appreciation for the importance of specifications and standards, national and international meetings could be held periodically, perhaps on bi-annual basis, to exchange ideas and information as to the creation and wise use of materials and process specifications and standards in the procurement, design and manufacture of complicated systems.

8.6 LONGER RANGE PERSPECTIVE

Only a few engineering and scientific schools prepare their students in the use of materials and process specifications, testing methods and standards in research, development, design, and manufacture. Most schools do not. The rationale behind this prevailing situation is that virtually all educators maintain that their students need strong theoretical backgrounds and they will pick up their practical knowledge on the job and through job-related continuing education after graduation. However, many graduates find it increasingly difficult to catch up with a fast moving field and some never make a contribution to their field in a creative sense.

There is considerable indifference to the practical educational needs of industry among academic traditionalists. This attitude is forcing the current rapid consolidation of industrial educational programs into consortia that serve the integrated educational and training needs of their constituent companies.

Fortunately, there are practicing engineers who are or can be motivated to remain current, competent as well as competitive, and who commit themselves to a regimen of continuing education in topical areas that supplement learning on the job. They provide a means for implementing interactive continuing education programs in which much of the technology transferred originates with the participants. In such programs, the instructors and other resource people learn as much or more from the students as the students

learn from them. Appendix 8-2 illustrates an interactive seminar and workshop series in development and design engineering. Particular emphasis is placed on the role of materials and process specifications, testing methods and standards in engineering development and design with a view to provide the students insights to related problems and an appreciation of the difficulties often associated with the generation and applications of specifications and standards.

8.7 CONCLUSIONS

The development of materials and process specifications, testing methods and standards is poorly understood by most professionals, management and the public. This lack of understanding is due primarily to a lack of appropriate education. Hence, a need exists for a comprehensive program, both short- and long-term, to create awareness of requirements for and uses of specifications, testing methods and standards.

At present, on-the-job training and professional contacts are the principal educational means for the generators and users of specifications, testing methods, and standards to acquire requisite knowledge. Occasionally, this means of knowledge acquisition is augmented by short courses and technical conferences. No particular attention is directed, however, to assuring that the work of technical specification developers or design engineers is part of the learning experience. Learning on the job ought to be a central feature of professional development. To assure its effectiveness, such learning should be supplemented by formal coursework in selected subjects. Moreover, it is necessary for some engineers to study at their own pace; additional means need to be developed for acquisition of pertinent new knowledge on a self-paced basis.

It is further believed that technical specification developers and user engineers could benefit from publications and conferences on materials and process specifications, testing methods and standards produced or sponsored by organizations such as the Federation of Materials Societies and its member societies, the National Standard Reference Data System of the U.S. National Bureau of Standards, the American Society for Testing and Materials, the American Welding Society, the Mechanical Properties Data Center, the Metals and Ceramics Information Center, the Plastics Technical Evaluation Center, the Shock and Vibration Information Center, the American National Standards Institute, the Society of Automotive Engineers and the National Fire Protection Association.

An additional need exists for both generators and users of specifications and standards to exchange information and transfer knowledge on national and international bases if

advances in the performance of materials is to be achieved and marked economies in the applications of materials are to be realized. Such intellectual cross-fertilization would also (a) help top managers of government agencies and industry recognize the importance of specifications, testing methods and standards; (b) place the work of technical specifications developers and users in proper perspective; and (c) maintain or enhance the professional status of such workers so that high level personnel would continually be attracted to such activities.

Although a few engineering schools do provide excellent coursework in engineering design where specifications and standards are considered, many engineering curricula avoid design courses where the pragmatic aspects of equipment development, materials and process specifications and standards, or equipment procurement are discussed.

8.8 RECOMMENDATIONS

On the basis of the foregoing discussion and conclusions, several recommendations are made here:

- A variety of short courses, seminars and workshops should be given at national centers by government agencies, professional societies, and those industries that generate or contractually apply materials and process specifications, testing methods and standards. These educational programs should focus on technology transfer amongst participants and supplement on-the-job learning with information that is new, too difficult or too time-consuming for individuals to acquire on their jobs.

- Mini-courses, of short duration, should be developed for personnel engaged in the generation or use of specifications and standards and managers of such people.

- The use of existing prepackaged instructional materials should be amplified and a concerted effort made to develop new instructional materials -- literature, books, video lectures, and audio cassettes.

- Studies should be conducted for the elucidation and evaluation of needs for education and the impact of formal coursework, educational meetings, and self-paced instruction on improvements in the generation and applications of specifications, testing methods and standards.

- Opportunities should be available for requestors of new or improved specifications, testing methods and standards to contact or visit established materials information centers.

- More national and international meetings for generators and users of specifications, testing methods and standards

should be conducted with the support of those that are concerned with the proper applications of specifications and standards. These meetings should favor the exchange of pertinent information and new knowledge, suggest policy, and provide means for discussing problems amongst people with diverse views.

- Undergraduate engineering design courses, in which materials and process specifications, testing methods and standards are considered, should be encouraged by government and industry through appropriate means.

- Tours of work for engineering professors should be provided by industry to give them first-hand experience in the applications of specifications and standards.

- A variety of interactive seminars and workshops in development and design engineering as illustrated by Appendix 8-2 should be made available to personnel at government agencies and industries that generate or use specifications and standards.

Note: The above continuing educational activities should focus on problem-solving and decision-making through the generation or use of specifications and standards as well as on incorporating the applications of new knowledge acquired at the seminars and workshops to the participants' jobs. Feedback from such applications during subsequent classroom sessions would provide opportunities for further interactive discussions and critiques by the participants and stimulate their learning-on-the-job. Cooperation of universities, by providing faculty as resource people, would favor the injection of pragmatic information acquired by faculty from the professional participants into their regular courses.

APPENDIX 8-1

Syllabus For a Specifications And Standards Course[1]

1. What Is a Specification? -- a Standard?

   a. Accepted DOD definition

   b. Generic definition.

2. Purposes of Specifications and Standards in Engineering and Procurement.

   a. Relationships and differences between contracts and specifications.

   b. Specifications for Products: Use of specifications as the acknowledged and preferred means of conveying between the "seller" and the "buyer" or the "producer" and the "user" such recorded information which is mutually acceptable to both parties for clearly, fully and precisely defining the objective limitations on size, shape, weight, color, finish, materials, function, operation, performance, manufacturing processes, testing, demonstration, and use for a product.

   c. "Specifications" for Services: Contractual nature of so-called "specifications" for services.

   d. Relationships and Differences Between Specifications and Standards.

   e. Standards of Designs, Products and Services: The function of standards for limiting variation in design, manufacturing processes, product configuration, testing, technical data and management data.

3. Variety of Specifications and Standards and Associated Requirements Documents Used by NAVAIR for Engineering and Procurement Programs. (Discussion on the sources, formats, content, and applications of the following specifications and related documents):

   a. Federal Specifications and Standards.

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[1] Based on a proposed NAVAIR Specifications and Standards Course.

b. Military Specifications and Standards.

c. Aeronautical Materials Specifications and Standards.

d. Avionics Specifications.

e. Electronics Test Documents.

f. Electronics Instruction Documents.

g. Aeronautical Purchase Descriptions.

h. Ordnance Purchase Descriptions.

i. Aeronautical Data.

j. Ordnance Data,

k. Weapons Specifications.

l. Weapons Purchase Descriptions.

m. Aeronautical Requirements.

n. Commercial-Industrial Specifications and Standards.

4. Review of DOD Standardization Program: Authority, Organization, Procedures and Publications.

   a. Emphasis on Review and Coordination Process for Military Specifications and Standards.

5. Review of Industry Specifications and Standards Organizations and Procedures.

6. How to Prepare NAVAIR Specifications, Standards, Purchase Descriptions, and Associated Requirements Documents:

   a. Review of MIL-STDs-961 and 962

   b. Contract Requirements vs. Specification Requirements

   c. Format

   d. Content of Each Basic Section in Specification

   e. Special Clauses and Words

   f. General Requirements

g. Detailed Requirements

h. Correlation of Test and Demonstration Requirements with Performance, Function and Configuration Requirements

i. Use of Appendices

j. Amendments

k. Revisions

l. Notices

m. Specification Sheets

n. Procedures and Requirements for Qualified Products Lists

o. General Design Specifications

p. Product Specifications

q. Process Specifications

r. Data Requirements

s. The "-ility" Specifications (standards)

7. Tailoring Requirments for Cost Effectiveness

a. Application Analyses

b. Testing Compatibility with Intended Use

c. Environmental Conditions Compatibility with Intended Use

d. Data and Reports Minimization

e. Packaging and Packing Suitability

f. Limitations in Referencing General Specifictions

g. Coordination with Interfacing Technical Divisions

8. Specification Tree Analyses and Requirements Interface Analyses

9. Preparation of Manuscripts

10. Printing and Distribution

APPENDIX 8-2

An Interactive Seminar and Workshop Series in Development and Design Engineering Focused on the Application of Materials Specifications, Standards, Processes and Tests

In an interactive program, personnel from diverse functions meet to reflect upon, discuss and recommend action leading to the possible solution of each other's on-the-job technical problems. The group is arranged in a round-table setting so that individuals may see as well as hear each other, because non-verbals are essential to interactive communication. Diversity of backgrounds, viewpoints and attitudes help elicit information that may at times be critical, but also insightful, stimulating, and occasionally objective.

The group consists essentially of peers, and most of the learning that occurs comes from knowledge contributed by the participants, but it is led by a resource person, skilled in learning theory and able to conduct interactions among professionals. This resource person serves primarily as a catalyst to develop problem-solving interactions amongst individuals within the group, keep discussions heated and focused on the subject, help the group over rough spots as they develop, and bring in other resource people as needed when the group gets involved in controversial, speculative or otherwise difficult subject matter outside the competence of anyone in the group or the resource person.

For an interactive program in design and development technology; focused on the application of materials specifications, standards, processes and tests to the individual participants' job; it is advantageous to draw personnel from functions that relate directly or indirectly to such technology as follows:

Engineering Design -- Designs final products to meet customer requirements;

Development Engineering -- Develops experimental products;

Materials Engineering -- Reviews, approves and recommends materials utilized in manufacturing;

Test Engineering -- Experimentally evaluates the adequacy of equipment designs to perform desired functions;

Product Engineering -- Designs equipment used in production or related processes;

Manufacturing -- Produces approved products;

Field Service Engineering -- Installs and services products in the customer's facilities;

Engineering Management -- Leads the development and design efforts;

Marketing -- Surveys customer needs, provides guidance in development and design work, and sells the products;

Finance -- Monitors and regulates expenditures and maintains records of work in progress;

Purchasing -- Obtains materials, parts and components for equipment that are not produced in-house.

Individuals selected should number between 15 and 20, so that there is opportunity for interaction and yet not so many participants that individual involvement is stifled. It is the responsibility of the instructor or resource person to draw reticent individuals into the action. At least half of the subject matter should be contributed by the participants, who come to the teaching/learning experience with a body of knowledge to share. No particular learning methodology is involved exclusively. The group "plays it by ear". Yet, a broad outline may be followed, which, if flexibly applied, permits the group to focus on each problem presented. Here is a suggested topical outline for a 20 to 30 session seminar and workshop series:

TOPICS

Session

1. Orientation, group processes, techniques of technology assessment, and methods for preparing individual reports on difficult problems encountered on the job.

2. Problem census, reports of individual barrier problems by participants, and categorization of barrier problems.

3. Brief general discussion of all barrier problems presented and determination of a priority order for their consideration by the groups. Dates set for presentations of individual problems by each participant. Discussion of topical areas for seminars by resource persons based on problem indications. (See list of suggested seminar topics below).

4. Seminar on emergent technologies with emphasis on the anticipated role of materials specifications, standards, processes and tests. Detailed consideration of Barrier Problem I, with recommendations from participants as to possible approaches for its solution.

5. Seminar on Materials Developments Applicable to Product Manufacture to illustrate the roles of specifications, standards, processes and tests. Feedback from Problem I in terms of recommendations applied on the job; followed by discussion from group. Consideration of Problem II, with recommendations from participants as to possible approaches for its solution.

6. a. Seminar on selected topic from list prepared in Session - 3.

   b. Feedback from jobs relating to previously considered barrier problems.

   c. Consideration of next problem in priority order.

   d. General discussion as to effectiveness of program to date with suggestions for improvements.

   e. Assignments (reading, problem solving, etc.).

   f. Other matters that merit consideration.

19. Format identical or similar to 6.

20. Overall discussion of interactive program with attention focused on unresolved matters.

Formal evaluation. Discussion of follow on plans.

<u>A possible list of Selected Seminar Topics to be considered in Session 3</u>

1. Machine-aided design concepts and techniques illustrating the applications of materials specifications, standards, processes and tests.

2. Noise and vibration reduction during equipment operation.

3. Design for standardization and interchangeability of equipment components.

4. Improvement of equipment cost-effectiveness through design.

5. Materials selection for improved performance and cost-effectiveness.

6. Design of equipment for compatibility with customers' numerically-controlled production operations and compliance with specifications and standards as stated on contract.

7. Equipment characteristics and capabilities to enhance customer acceptance.

8. Current maintenance problems and their possible correction.

9. Development procedures to simplify design for ease of production.

10. Non-destructive testing of critical equipment parts.

11. Working with key customers in equipment development and design with emphasis on compliance with required specifications, standards, processes and tests.

12. Utilizing feedback from field in equipment design and materials selection.

13. Make or buy decision making principles and practices.

14. Revolution in aesthetic requirements for equipment.

15. Design requirements for integrating equipment in customer production lines; with emphasis on line feeds, operating speeds, and setup changes.

16. Bearing design and their lubrication to prevent product malfunction.

17. Coping with difficult product design problems and updating developments.

18. New materials and their adaptability to existing product designs.

19. Electric motors and controls for equipment actuation.

20. Design for rapid adjustment for changes in product function and versatility.

21. Equipment operator training requirements.

22. Design procedure for adapting purchased components consistent with required materials specifications, standards, processes and tests.

23. Requirements for increased accuracy in product operation and resistance to environmental factors and effects.

24. Design of fixtures and adaptors to feed and hold products during manufacture.

25. New design concepts for current and anticipated products.

26. Human factors aspects affecting product manufacture and usage.

27. Synthesis and dynamic analysis of product elements.

28. Development of user instruction manuals and related installation, operating and maintenance procedures.

29. Design for fail-safe product operation.

30. Equipment design for periodic updating and service flexibility.

31. Authoritative interpretation of materials specifications, standards, processes and tests -- especially where questions arise as to their correct applications in materials purchasing, product development, and equipment manufacture.

32. Occupational health and hazard aspects of materials applications -- particularly during product manufacture, testing, and utilization. Familiarization with OSHA requirements and operations. OSHA compliance inspections and procedures for correcting deficiencies.

33. Bases and approved procedures for obtaining waivers from compliance with contractual requirements for particular materials specifications, standards, processes and tests.

34. Approved procedures for correcting deficiencies in products arising from failure to comply with

required specifications, standards, processes and tests.

35. Preparing proposals in which problems are foreseen with respect to compliance with specifictions, standards, processes and tests in Requests for Proposals (RFP's).

36. Dealing with new, upgraded or otherwise modified specifications, standards, processes and tests in supplementary procurements or product retrofit programs.

37. Coping with confusion as to which materials specifications, standards, processes and tests apply.

38. Procedure for confirming customer requests for substitutions of materials in product design or manufacture.

39. Procedure for confirming customer requests for changes in contractually required materials specifications, standards, processes and tests.

40. Procedure for reporting inability to comply with required materials specifications, standards, processes or tests during contractual negotiations or the actual manufacture of a given product.

It is anticipated that other pertinent topics for seminar presentations will be suggested by the participants. Sufficient time must be allowed, however, for the resource person to find and arrange for presentations by individuals expert in each topical area accepted for a seminar.

Although a cursory evaluation of the seminar and workshop series is made during its last session and many benefits may be observed while the series is being given, a complete assessment of the program's impact on individual learning and competences; particularly in terms of improved performance on the job, new knowledge acquisition, technology transfer, new technology utilization and better products or services; cannot normally be made until a sufficient time has elapsed to observe long-range impact, effects and benefits. Moreover, considerable data must be accumulated to prepare an accurate assessment, but the accumulation of numerical data, such as numbers of patentable ideas submitted, equipment designs completed, new component and equipment developments, increased sales, and the like, are important measurable indicators of the program's lasting effectiveness.

APPENDIX A

DEFINITIONS[1]

1. Specifications[2] - As used herein, specifications are definitive tools for communication.

(1) Specification. A document intended primarily for use in procurement which clearly and accurately describes the essential technical requirements for items, materials, or services including the procedures by which it will be determined that the requirements have been met. Specifications for items and materials may also contain preservation, packaging, packing, and marking requirements. Specifications are prepared for items, and processes relative to the manufacture of items, which vary in complexity from paper clips to missile weapon systems. They establish requirements in terms of complete design details or in terms of performance, but in most instances in terms of both design and performance. Specifications may cover a single item such as a camera or thousands of items such as bolts which, for each single item, there may be several materials, several finishes, and hundreds of sizes.

(2) Standard.[2] A document that establishes engineering and technical limitations and applications for items, materials, processes, methods, designs, and engineering practices. Standards are documents created primarily to serve the needs of designers, and to control variety. They may cover materials, items, features of items, engineering practices, processes, codes, symbols, type designations, definitions, nomenclature, test, inspection, packaging and preservation methods and materials, define and classify defects, and standardize the marking of material and items parts and components of equipment, etc.

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[1] Definitions listed here describe the intent as used in this report. They may not be identical in phraseology to definitions used elsewhere.

[2] But compare the definitions in Directory of United States Standardization Activities, SP417, National Bureau of Standards, Sophie J. Chumas, Editor, p. 1 as quoted here: "For the purpose of this Directory, the term 'standards' encompasses the following words: specifications, tests and test methods, analyses, assays, reference samples, recommended practices, guides, codes, forms and contracts, criteria, methods and codes of practices."

2. DoD Specification - As used herein, a DoD specification is one which is used by or for the Department of Defense and which has been originated or legitimatized by the DoD. These carry the "MIL" designation, e.g. MIL-H-6088 or MIL-HDBK-5.

3. Government Specification - As used herein, a government specification is one which is used by or for the government and which has been originated or legitimized by the government. These carry a DoD or other government designation, e.g. QQ-P-416, MIL-H-6088.

4. Private Sector Specification - As used herein, a private sector specification is one that has originated under nongovernmental auspices, e.g. ASTM B 209 or John Doe Co.'s xxx.

5. Technical Society Specification - As used herein, a technical society specification is one that has originated and been published by a technical society, e.g. SAE or ASTM.

6. Trade Association Specification - As used herein, a trade association specification is one which has been developed and published by a trade association, such as E.I.A.

7. Company-Originated DoD Specification - As used herein, a company-originated DoD specification is one which was originated outside of DoD by contract or otherwise and which has been accepted by DoD for its use.

8. DoD Standard - As used herein, a DoD standard is one which is used by or for the Department of Defense as a control or measurement document and which has been originated or legitimatized by the DoD. (Also see 2 above).

9. Government Standards - As used herein, a government standard is one which is used by or for the government and which has been orginated or legitimatized by the government. (See 2 above).

10. Private Sector Standard - As used herein, a private sector standard is one that has originated under non-governmental auspices. (See 2 and 5 above).

11. Technical Society Standard - As used herein, a technical society standard is one that has originated and been published by a technical society, e.g. SAE or ASTM.

12. Trade Association Standard - As used herein, a trade association standard is one which has been developed and published by a trade association, e.g., E.I.A.

13. Company-Originated DoD Standard - As used herein, a company-originated DoD standard is one which was originated outside of DoD by contract or otherwise and which has been accepted by DoD.

14. Company Standard - As used herein, a company standard is one that has been originated and published by a single organization primarily for its own use, e.g. Lockheed Standard, General Electric EMPIS, etc.

APPENDIX B

LIST OF SPECIFICATIONS AND STANDARDS APPEARING IN THIS TEXT

MIL-H-81200	Heat Treatment of Titanium and Titanium Alloys
MIL-H-6088E	Heat Treatment of Aluminum Alloys
MIL-F-6875F	Heat Treatment of Steels (Aircraft Practice), Process for
MIL-HDBK 5	Military Handbook 5, Metallic Materials for Aerospace Applications
MIL-L-7808E	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
MIL-S-7720	Steel, Corrosion Resistant (18-8) Bars, Wire, and Forging Stock (Aircraft Quality)
MIL-T-6845	Tubing, Steel, Corrosion Resistant (301), Aerospace Vehicle Hydraulic System, 1/8 Hard Condition
MIL-STD-143	Standards and Specifications, Order of Precedence for the Selection of
QQ-A-367f	Aluminum Alloy Forgings (f revision)
QQ-A-367g	Aluminum Alloy Forgings (g revision)
QQ-S-763	Steel Bars, Shapes, and Forgings - Corrosion-Resistant
MIL-BULL-343A	Documents Applicable To Aircraft Engines And Propellers, Use Of

APPENDIX C

LIST OF ACRONYMS AND FORMS

ABCA	American, British, Canadian and Australian (Standardization Board)
ACMS	Assemblies, Components, Materials and Spare Parts
AIA	Aerospace Industries Association
AMS	Aerospace Materials Specification (SAE)
ANSI	American National Standards Institute
ASTM	American Society for Testing Materials
AFPRO	Air Force Plant Representative Cffice
AWS	American Welding Society
BSA	Basic Standardization Agreement
CIGRE	Conference Internationale des Grands Reseaux Internationale (International Conference on Large High Tension Systems)
CNAD	Conference of National Armaments Directors
DoD	Department of Defense
DSA	Defense Supply Agency
DSB	Defense Science Board of the Dept. of Defense
DD Form 1426	Specification Analysis Sheet
DCAS	Defense Contract Administration Service Regional Office
DMSSB	Defense Material Specifications and Standards Board
DSP	Defense Standardization Program
DODISS	Department of Defense Index of Specifications and Standards
ECD	Engineering Change Drawing
EEC	European Economic Community
EIA	Electronic Industries Association

EPA	Environmental Protection Agency
FSC	Federal Supply Classification
GAAT	General Agreement on Tariffs and Trade
IEC	International Electrotechnical Commission
ILO	International Labor Office
IMS	International Military Staff
IPC	Institute of Printed Circuits
ISO	International Standards Organization
ISONET	International ISO Standards Information Network
ITU	International Telecommunication Union
MAS	Military Agency for Standardization
MICOM	U.S. Army Missile Command
MIL	Military
MIS	Missile Interim Specification
M&M	Materials and Methods
MOCA	4,4' methylene -Bis(2)-chloroaniline
NASA	National Space and Aeronautics Agency
NBS	National Bureau of Standards, U.S.
NDE	Non-Destructive Evaluation
NDI	Non-Destructive Inspection
NDT	Non-Destructive Test
NAVPRO	Naval Plant Representative Office
NMAB	National Materials Advisory Board National Research Council National Academies of Sciences and Engineering
NRC	Nuclear Regulatory Commission
NTTB	Non-Tariff Trade Barriers

ODDRE	Office of the Director, Defense Research and Engineering
OSD	Office of the Secretary of Defense
OSHA	Occupational Safety and Health Administration, Department of Labor
OTA	Office of Technical Assessment
QWG	Quadripartite Work Group
QSTAG	Quadripartite Standardization Agreement
R&D	Research and Development
RDT&E	Research, Development, Test and Evaluation
SAE	Society of Automotive Engineers
SDSS	Standards Development Services Section, National Bureau of Standards
SE-4	Status of Standardization Projects
SIAS	Standards Information and Analysis Section, NBS
SSP	Single Stock Point for Specifications and Standards
UN	United Nations
USNC	United States National Committee (IEC)
WHO	World Health Organization
WS	Weapons Specification (Navy)

APPENDIX D

EXAMPLES OF SPECIFICATIONS THAT CONTRIBUTE TC HIGH COSTS

1. DIFFERENT SPECIFICATION REQUIREMENTS FROM EACH DoD AGENCY (Example: Soldering)

1.1 MIL-S-45743 - Soldering, Manual Type, High Reliability, Electrical and Electronic Equipment.

Custodian - Army, Navy & USAF

Preparing Activity - MICOM

1.1.1 There is a great deal of "how to" in the requirements, instead of defining end-product requirements. It is difficult if not impossible for all user plants to comply without incurring unnecessary added costs of equipment, facilities and personnel training.

1.1.2 Requires solder iron be capable of making repetitive soldered joints (min. of 10 joints of same mass). In actual work, joints do not have the same mass or heat sink qualities. Requirement would necessitate additional procurement and qualification expense.

1.1.3 Requirements too restrictive for plated-through holes. Test data substantiates that plated-through holes, without reinforcement, are acceptable for interfacial connections.

1.2 MIL-STD-454, Requirement 5 - Soldering (of electrical and electronic equipment).

Custodian - USAF

Preparing Agency - USAF

1.2.1 Specifies limited use of MIL-S-45743 and MIL-S-46844, but does not specify MIL-S-46860.

1.2.2 MIL-STD-454 permits types R or RMA solder only. MIL-S-45743 permits types R, RMA RA or S.

1.3 MIL-S-46844 - Solder bath soldering PW Assy.

MIL-S-46860 - Soldering metallic ribbon leads.

Custodian - Rev. A, Army

Rev. B (proposed), Army, Navy & USAF

Preparing Agency - MICOM

1.3.1 (Comments similar to MIL-S-45743).

1.4 HDBK NHB 5300.4 (3A-1).

Custodian - NASA

Preparing Agency - NASA

1.4.1 More restrictive than 1.1, 1.2, 1.3 cited above.

1.5 Conclusion It would be desirable to have one set of requirements for soldering electrical and electronic equipment that would be acceptable to all agencies in DoD. In particular the "how to" instructions should be eliminated and end-requirements be provided.

2. DUPLICATE SPEC. (Example: Materials)

2.1 Metals - The specifications in each of the following groups are for metals having the same compositions.

2.1.1 Oxygen Free Copper

ASME - SB152

ASTM - B1, B2, B3, B49, B152, B187, B188, B189,

B246, B272, B298, B355, B506,

CDA - 104

FED - QQ-B-825, QQ-C-502, QQ-C-576, QQ-W-343

MIL- MIL-W-3318

2.1.2 Alloy Steel

ANSI - 4130

AMS 6370

ASTM A322, A331, A505, A519, A646

FED- QQ-S-624

MIL- MIL-S-16974

SAE- J404

2.2 Nonmetallics

AMS-3582 is still current.

MIL-I-23053/2 cl. 1 is still current but MIL-I-23053 C is a superior specification, is supposed to have supplemented the two earlier specifications, but all 3 are legal to use. This exemplifies the problem.

3. INSPECTION AND TEST REQUIREMENTS (Example: Soldered Joints)

3.1 Pits, Depressions and Voids

3.1.1 MIL-STD-454, Reg. 5, MIL-STD-275, and MIL-S-46844 all require there be no pits, depressions, or voids in solder fillets.

3.1.2 In wave soldered joints, the above is merely cosmetic in nature and has no effect on function or reliability. To rework pitted joints by hand is unnecessary and costly. Further, the reheating of an existing solder joint may be damaging to the joint.

3.2 Solderability Test Methods

3.2.1 IPS- S-801, ANSI C99.1, EIA RS-319, and EIA RS-178 are all solderability test methods for electrical and electronics materials. MII-P-46843 specifies that EIA RS-178 be used. MIL-P-XXXXX (Proposed) specifies that ANSI C99.1 be used.

3.2.2 It would be desirable to have one solderability test method.

4. DIFFERING REQUIREMENTS BETWEEN DoD AGENCIES FOR COMPANY-ORIGINATED SPECIFICATIONS

Army MICOM - Spec. Control Drawings (SCD) or

Missile Interim Spec. (MIS)

Navy - Weapons Spec. (WS)

Army Arsenals - Dwg. No.

4.1 Same item can be repeatedly documented; one for each DoD agency. It would be desirable to have one form, format and designation that could be used by all DoD agencies.

5. LACK OF GOVERNMENT SPECIFICATIONS FOR NEWER MATERIALS

5.1 Refractory The following specifications are for Stelite 21, which does not have any government specification. It would appear that there should be only one specification for this material. Two of the technical Society specifications should be cancelled and certainly no government specification should be created.

AMS -5385

ANSI- G81.40

ASTM--A567

5.2 Plastic (for Stripline) MIL-P-55617 copper clad laminated polytetrafluoroethylene (PTFE) glass sheet is used for low power microwave stripline boards. Spec. MIS-19835 was company-originated for the Army, because there was no government specification for PTFE-glass with a higher dielectric constant for greater band widths. A better test method is also needed to determine the higher dielectric constant of this material.

FINISH SYSTEM SPECIFICATIONS

6.1 Some finish system specifications, such as MIL-STD-186, require finishes to be specified on drawings by code number. This is a big problem on Army contracts since the Army still requires use of MIL-STD-186. Other finish system specifications, such as MII-F-7179 require finishes to be specified by specification number.

6.2 It is desirable that all finishes be specified by specification numbers. Code number (present system) necessitates that all users of drawings have the code key. Code keys encourage errors, and the specification callouts under the code keys are so out of date that they are not usable.

APPENDIX E

THE VOLUNTARY STANDARDS SYSTEM OF THE UNITED STATES OF AMERICA

An Appraisal by the American Society for Testing and Materials

AMERICAN SOCIETY FOR TESTING AND MATERIALS
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NOTE

The Society is not responsible, as a body,
for the statements and opinions
advanced in this publication.

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Foreword

The ASTM Board of Directors, at its meeting on 15-16 Jan. 1973, established a permanent Board Committee on The Voluntary Standards System. The Committee was created to study the role of ASTM in the total standards system, the efficiency of the system, and the relationships of the parts of the system.

The President appointed the Committee immediately, and it held its first meeting four weeks later. It has since had a number of meetings and wide-ranging discussions. It has also extended its knowledge and understanding of the system through research and liaison contacts by its members with outside groups.

This is the first major report of the Committee. The following ASTM officers and members of the Board served at various periods on the Committee during the preparation of this report:

W. A. McAdams, Chairman
F. E. Clarke
C. C. Colyer
J. D. Hoffman
R. A. Jones
R. N. Johnson
F. J. Kovac
Bryant Mather
G. H. Nelson
J. G. O'Grady
F. J. Rarig
E. I. Shobert
R. B. Smith
V. L. Tofany
J. S. Wheeler
F. K. Willenbrock
F. C. Wilson
W. T. Cavanaugh, Managing Director
J. W. Caum, Secretary, Board Committee

11 Feb. 1975

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I. Introduction

Standards have become an essential part of the socio-economic development of all nations. They open channels of communication and commerce; they promote understanding of the products of technology; they form the basis for achieving health, safety, and higher quality of life.

In the United States most national standards are generated through a loosely knit voluntary system made up of government and industry, producers and consumers, institutions and individuals. The system is called "voluntary" for two reasons. First, participation in the system by the many interested parties is voluntary. Second, the standards produced by the system usually are intended for voluntary use. However, many standards prepared for voluntary use have been made mandatory by governmental bodies, and some parts of the voluntary standards system are now providing special procedures to develop standards for this purpose.

The voluntary standards-making system has always been a highly complex one, but in spite of this it has produced the best, most widely used collection of standards in the world. Nevertheless, the changing attitudes and expectations of the public have resulted in criticisms of the system. These criticisms have also been implicit in a number of governmental actions taken in response to public needs which, for one reason or another, the voluntary system has not yet dealt with satisfactorily.

As a result of these government and public criticisms, and the realization of the changing needs for standards, ASTM and the other organizations which comprise the U.S. voluntary standards system have been changing their structures, scopes, methods of operation, and standards approval procedures. This may be leading to more, rather than less, complexity of the whole system and may require other adjustments within the system to make it properly responsive to current and future needs.

The American Society for Testing and Materials (ASTM), as one of the largest components of the system, has been analyzing the U.S. voluntary standards system and the changes it is undergoing. This report presents ASTM's view of the existing system and the problems the system has now and will be facing in the future. The report also presents ASTM's concepts of an improved, more credible voluntary system, ASTM's role in such a system, and the way ASTM expects to interface with others who contribute to the system.

With the completion of this report, ASTM believes it now has an understandable policy base that can and should be used as an effective guide in all its relationships with other organizations. Recommendations for applying the report in a policy way are included in the last section (Part IX).

It should be noted that the discussions in this report are limited to

the voluntary standards system within the United States. It does not deal with the interfaces of this system with international standards systems or standards systems of other countries. ASTM plans to prepare a separate position report on these areas of standardization.

II. Sources of Standards

There are several hundred organizations in the United States engaged in voluntary standards-making activities. They include branches of government, professional and technical societies, manufacturing and nonmanufacturing trade associations, public service and consumer groups, testing and inspection bodies, and organizations like ASTM whose main purpose is the development of standards.

This is a heterogeneous array of standards development organizations, and it comprises a system which operates with a highly complicated, and sometimes overlapping machinery. The standards produced by some elements of the machinery attain national and, often, international acceptance as a result of the broad-based consensus procedures used to develop and approve them. Standards produced by different parts of the machinery assure varying kinds of consensus, and most of them satisfy quite well the needs of the sectors for which they were developed. Many of these standards are quite parochial in both development and use, but, despite this, they can be and often are fed into another part of the system for accreditation on their own, or for blending with other inputs, to become nationally accepted standards.

Each organization in our voluntary standards-making system has developed its own standards-making machinery through its experience and has tailored the machinery to fit its own scope and objectives.

These organizations may be classified into several groups:

A. *Bodies Concerned Exclusively With Standards*

Two organizations in the United States are concerned exclusively, or nearly so, with the preparation, approval, and publication of the voluntary consensus standards. These are ASTM and ANSI (American National Standards Institute). The Standards Development Services Section (SDSS)[1] of the National Bureau of Standards (NBS), U.S. Department of Commerce, has a similar function and so do major parts of other organizations, a typical one being the Codes and Standards Division of the American Society for Mechanical Engineers (ASME).

ASTM was incorporated for "the promotion of knowledge of the ma-

[1] Previously Office of Engineering Standards Services (OESS).

terials of engineering, and the standardization of specifications and the methods of testing." In 1971 a modified scope was adopted "the development of standards on characteristics and performance of materials, products, systems, and services; and the promotion of related knowledge." It is now concerned entirely with the preparation of standards and with the well-being of the voluntary standards system. It is the source of more than half the existing American National Standards approved by ANSI.

ANSI is also concerned with the well-being of the system. It seeks to accomplish this through procedures for:

Certification of standards-making processes of other organizations.

Initiation of new standards-making projects.

Examination of standards prepared by others to determine if they meet the requirements for a consensus of interested parties to an extent suitable for approval as American National Standards.

ANSI also organizes, supervises, and controls the membership of many committees that prepare standards for approval under the ANSI procedures. Usually ANSI does this only at the request of several of the affected parties or when it concludes no other organization is suitable to carry out the work. Almost 25 percent of the American National Standards currently come from these committees.

The SDSS manages the Voluntary Product Standards program established by Part 10, Title 15, of the Code of Federal Regulations. It develops standards under a prescribed consensus procedure. An important criterion for undertaking the development of a standard by SDSS is that the standard "cannot be processed according to the needs or the desires of the proponent group by a private national standardizing body." However, SDSS finds it difficult to enforce this rule in all cases. Some groups prefer to use the SDSS to develop standards, believing the SDSS adds a "federal presence" that makes the resulting standards more credible and sometimes legislative pressures encourage this. While the SDSS procedure is an important stopgap in the voluntary system, it has processed relatively few standards—about 3 percent of those extant.

The Codes and Standards Division of ASME prepares the well-known Boiler and Pressure Vessel Code which is now referenced in the laws of most states, most large U.S. cities, and all the Canadian provinces. The ASME Codes and Standards Division is also responsible for 40 performance test codes for turbines, combustion engines, and other large mechanical equipment.

There are some smaller organizations concerned almost entirely with voluntary standards. Some typical examples are the Industrial Fasteners Institute, Insulated Power Cable Engineers Association, and Manufacturers Standardization Society of the Valves and Fittings Industry.

B. *Trade Associations*

These organizations produce voluntary standards that usually are a consensus of only producers or suppliers. The standards may cover safety, interchangeability, test methods, and other product characteristics which the association members believe are technically desirable to standardize. They describe what the industry is prepared to supply, but often they may require a sophisticated purchaser to understand them. In some cases users of the product are able to participate, at least to some extent, in the development of the standards. In other cases the associations rely on their contacts with user organizations or individual customers for user inputs. A number of trade association standards have gained national acceptance.

Some of the trade associations that have produced large numbers of standards include the Aerospace Industries Association, American Petroleum Institute, Association of American Railroads, Electronic Industries Association, Manufacturing Chemists Association, and the National Electrical Manufacturers Association.

It should be pointed up that some trade associations willingly conduct their standards-writing efforts within professional standards-writing bodies such as ASTM.

C. *Professional and Technical Organizations*

Professional societies in the scientific and engineering fields usually have been organized to advance their professions or the branch of science or engineering with which they are concerned. Many of the standards they develop are of the technical, nonproduct, noncommercial type (nomenclature, graphical symbols, test methods). Many others deal with processes and materials and components of interest to the profession. Usually only members of the society can serve on the committees that develop these standards, but the society membership may be representative of producers, users, academia, government, and other interests. Some societies achieve an excellent balance of interests on their standards-development committees.

There are a number of technical organizations that have been formed for particular industries. A good example is the Technical Association of the Pulp and Paper Industry. Their membership includes all kinds of scientists and engineers who are working in the industry. Many of these organizations are allied closely to trade associations but operate much like professional societies.

The professional and technical organizations contributing the most standards to the system are the American Concrete Institute, American Oil Chemists Society, American Society of Agricultural Engineers, American Society of Mechanical Engineers, Institute of Electrical and Electronics Engineers, Society of Automotive Engineers, and the Technical Association of the Pulp and Paper Industry.

D. *Other Organizations*

There are a number of standards-making organizations that cannot be classified into any of the previous groups. Several are of major significance:

1. *National Fire Protection Association (NFPA)*—The purposes of NFPA are to develop national standards to reduce loss of life and property by fire and to educate the public about fire and its control. Its standards, published as the National Fire Codes, which includes the National Electrical Code, are written to serve as the basis for state and local fire control ordinances and are accepted widely by fire and building code officials. Many have also been approved as American National Standards.

2. *Underwriters Laboratories, Inc. (UL)*—UL develops safety standards, including testing procedures, for use in evaluating and listing materials, products, and systems for adequacy to prevent fire, crime, and casualty. Many of the UL standards have been approved as American National Standards.

3. *Factory Mutual Engineering Corporation (FMEC)*—FMEC develops safety standards and testing procedures for use in evaluating equipment in a manner similar to UL but in a number of other fields. The standards have wide recognition by insurance and safety officials but are not submitted for approval as American National Standards.

4. *Building Code Organizations*—There are four organizations of building, zoning, construction, and inspection officials that have prepared model building codes covering a wide range of products and practices. They are the American Insurance Association; Building Officials and Code Administrators, International; International Conference of Building Officials; and Southern Building Code Congress. Thousands of state and local governments apply one of these model codes within their jurisdictions. The codes incorporate or reference many American National Standards and standards of other organizations just described.

E. *Other Sources of Standards*

There are two other important sources of standards that should be recognized:

1. *Single Company Standards*—Particularly in the case of companies with several divisions or locations which exchange products or materials, it is common for company standards to be developed for internal use. Sometimes in the past, where such standards have existed prior to any organized effort to develop standards on a broader base, they have received wide acceptance and have been used as the chief inputs for the more broadly based standards.

2. *Purchase Specifications*—These are standards prepared by companies, trade associations, government agencies, and other purchasers to describe specifically the things they are offering to buy from others. Often they

also serve to encourage competition among suppliers. Many of these specifications are tailored to the particular needs of those preparing the standards and may not be satisfactory for other users. However, some others become the basis for more widely accepted national standards. Probably half the standards being used in the United States come from these sources.

III. Consensus and the Voluntary Standards System

A basic principle of standards-development, supported by both theory and experience, is that a standard will be used voluntarily only to the extent that it serves an identified need, and only if it has considered the views of all those who share that need. It follows that the degree of acceptance depends on the procedures used to develop and approve the standard. Consensus has become the keystone about which procedures designed to assure maximum voluntary acceptance of standards are assembled.

The word "consensus" is threaded through the literature on development and application of standards, but its definition varies from one document to another. The differences in definition result for the most part in differences in the perceived need and expected application of the standards. Some organizations, ASTM for example, consider the need for most of their standards to be very wide indeed, while others, most trade associations for example, try to serve a smaller group of interested parties. The consensus required by the procedures in the first case is a broad-based one; in the second case, a rather narrow one.

During the last few years the type of consensus used in approval of voluntary standards has been under scrutiny by several federal agencies. The examination is being directed at the organizations claiming a consensus of all interests, and also at those whose standards were not intended to represent a broad consensus but are actually used by or applied to groups having no part in their development. Some federal agencies question the claims of proper balance of interests in the standards development and also suggest that any consensus guarantees an inadequate standard.

A 1971 report from the Stanford Research Institute,[2] appraising the impact of antitrust and liability legislation on standards development, predicted that, within several years, "Many organizations will be hard-pressed to demonstrate that their standards are arrived at in a truly

[2] "Industrial Standards," Report No. 431, Long Range Planning Service, Stanford Research Institute, January 1971.

representative manner. Litigation will force some to abandon their standards activities, while others will elect to join forces to achieve a broader consensus."

This prediction is beginning to come true and some of the impetus is the recognition that more and more standards are becoming *de facto* national standards without any action by the organizations that produce them. ASTM believes that the definition of a consensus standard must encompass the *de facto* national standards as well as those recognized in other ways.

Definition of a Consensus Standard

ASTM hereby defines a consensus standard as follows:

> A consensus standard is a standard produced by a body selected, organized, and conducted in accordance with the procedural *standards of due process*. In standards-development practice a consensus is achieved when substantial agreement is reached by concerned interests according to the *judgment of a duly appointed review authority*.

ASTM believes consensus implies much more than the concept of a simple majority but not necessarily unanimity, which often can be achieved only by compromises that reduce the quality of the standard.

Due Process

The standards of due process are the general ones of equity and fair dealing and include:

1. Timely and adequate notice of a proposed standard undertaking to all persons likely to be materially affected by it.
2. Opportunity of all affected interests to participate in the deliberations, discussions, and decisions concerned both with procedural and substantive matters.
3. Maintenance of adequate records of discussions and decisions.
4. Timely publication and distribution of minutes of meetings of main and subcommittees.
5. Adequate notice of proposed actions.
6. Meticulously maintained records of drafts of a proposed standard, proposed amendments, action on amendments, and final promulgation of the standard.
7. Timely and full reports on results of balloting.
8. Careful attention to minority opinions throughout the process.

Review Authority

To develop a consensus standard, ASTM believes it is essential to have established procedures that will guarantee the elements of due process and the achievement of substantial agreement of the concerned interests. There must be a *duly appointed review authority* to establish these procedures, to decide what constitutes substantial agreement, and to judge when a substantial agreement is reached. Some of the responsibilities of the duly appointed review authority are to set requirements for:

Committee organization and operation.
Balance of committee membership.
Voting and public review.
Resolution of negative votes.
Appeals.

Some protagonists have questioned whether consensus procedures, which by nature are quite democratic, can be an adequate basis for safety and health standards. ASTM believes that its definition of consensus standards is flexible enough that it can be made to work in this situation as well as in others, but acknowledges that the *duly appointed review authority* may have to establish somewhat different procedures and requirements to ensure this.

General acceptance of the ASTM definition of a consensus standard should also help dispel some of the worries that standards developed by the voluntary system restrict competition, innovation, and customer choice. The standards produced are for voluntary use. They do not have to be used by anyone. Consensus alone will not always prevent undesirable restrictions. Each organization in the standards-making system must constantly monitor the content of its standards to determine if they will impose unnecessary hardships on those who will be affected by them.

Consensus is also important in the acceptance of voluntary standards for mandatory use by government bodies. If the consensus for the voluntary standard is sufficiently broad to cover all the parties affected by the mandatory standard that is needed, there is no reason why it cannot be at least the major input in formulating the mandatory standard. A standard with limited consensus may be less acceptable, and either or both may have recommendations, advisory parts, or options that are not suitable for a mandatory standard. On the other hand, the voluntary standards system is capable of producing standards especially for mandatory use if it is given proper guidance by the governmental authority that wants the standard. It should be remembered, however, that the voluntary standards system generally produces standards for *voluntary use*. Only a governmental body can make a standard *mandatory*.

IV. Comparison of Standards-Development Operations

Most of the organizations in the U.S. voluntary standards system have well-established procedures for their standards-development operations. Practically all of these procedures set forth some rules of due process, ensure some type of consensus, and give some special consideration to minority voting positions. There are a number of other similarities scattered among the procedures of these many organizations, but the total picture is marked with dissimilar:

1. Methods of organizing the standards-development work.
2. Structural arrangements of the standards-making responsibility.
3. Ties between the governing bodies and the standards-making functions.

The charts on pp. 10-15 show ASTM's understanding of the standards-development operations of several different kinds of organizations.

V. Major Problems of the U.S.A. Voluntary Standards System

With a voluntary standards system as complex as we have in the United States, it is not surprising that there are problem areas. In July 1974, the Library of Congress submitted a report on the voluntary standards system to a House Subcommittee. The report cited ten problems with the system that it said may warrant further Congressional examination. Some of the problems listed are really not problems of the *voluntary standards system,* but are problems of the *regulatory use of standards* which may emanate from the voluntary standards system. However, these problems and others demand the further attention of all organizations that are part of the system. The particular problems which need attention are as follows:

A. The need for an improved coordinating force in the system.

B. The lack of a single set of national standards.

C. The need for a national policy on standardization by the U.S. government.

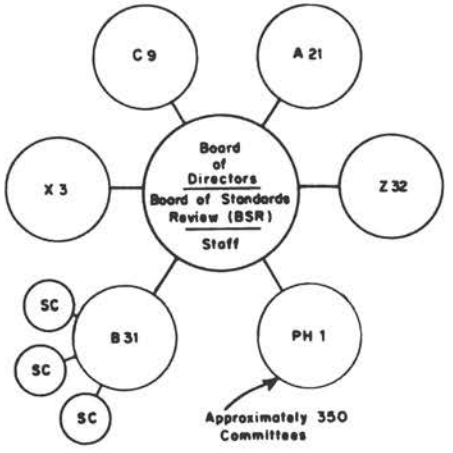
D. The need for a better understanding of:

Consensus procedures.

Limitations of standards.

Transfer of standards from voluntary to mandatory use.

American National Standards Institute



Special Comments

Each committee is semiautonomous but officers and membership approved and classified by central body.

Consensus and public review required.

Procedure

Need established by Advisory Board, Council, or Public Conference.

Secretariat Assigned

Secretariat has consensus procedure and develops standard in normal way	Secretariat operates ANSI committee in accordance with ANSI procedure to produce standard	Secretariat has no consensus procedure, develops standard as it usually does. May publish for use
↓	↓	↓
Public review after internal approval	After approval by ANSI committee standard submitted to ANSI BSR	Submits completed standard to national canvass of those organizations interested
↓		↓
Revision and publication by secretariat body as national standard		Revises and submits to ANSI BSR
↓		↓
Submission to ANSI BSR		

↓

ANSI BSR asks for public comment

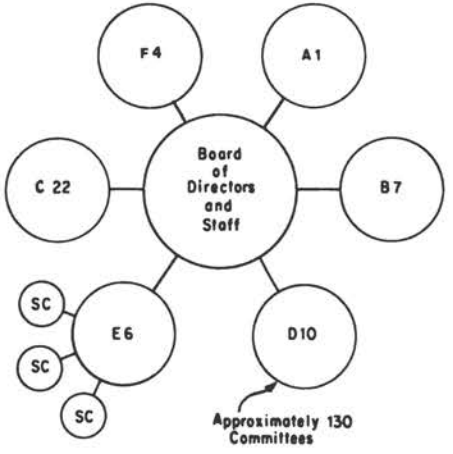
↓

Revision through Secretariat (if necessary)

↓

Publication as American National Standard

American Society for Testing and Materials



Special Comments

Each Technical Committee is semiautonomous—elects own officers.

Technical Committee approves its membership, classifies membership, except when this is not required by rules, and maintains balance in accordance with rules.

Rules for Committee operation established by Board through standing committees.

Consensus and public review required.

Procedure

Public organization meeting or other mechanism establishes need

↓

Balanced committee with open membership writes draft standard

↓

Subcommittee and committee ballots approved

↓

Draft standard submitted

↓

Process through approval procedures

↓

Full membership ballot and public review

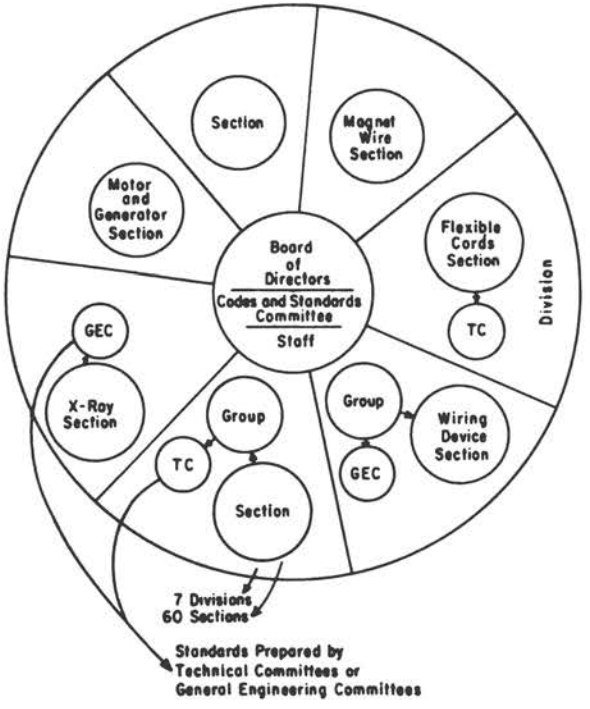
↓

Published as ASTM standard

↓

Submit to ANSI for approval as American National Standard

National Electrical Manufacturers Association



Special Comments

Membership on technical committees and general engineering committees limited to member companies.

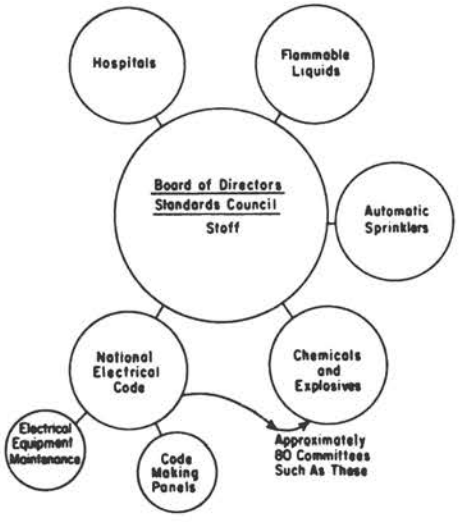
Some inputs by users obtained.

Approval by 90 percent of Section and majority of Codes and Standards Committee required.

Procedure

NEMA Section
↓
General Engineering or Technical Committee proposes standard
↓
Letter ballot of NEMA Section
↓
Approval by NEMA counsel
↓
Final approval by NEMA Codes and Standards Committee
↓
Publication as NEMA Document
↓
Some submitted to ANSI through canvass of outside interests

National Fire Protection Association



Special Comments

Committee officers and membership approved by council.

Operation in accordance with Association procedures.

Consensus and public review required.

Public review augmented by open forum at Association meeting.

Procedure

Request to NFPA circulated for interest

↓

Council evaluates response, establishes and approves committee

↓

Committee prepares standard. ⅔'s vote required for approval

↓

Published for wide distribution in Semi-Annual Technical Committee Report. Simultaneously submitted to ANSI for concurrent public review

↓

Committee reviews comments and documents actions

↓

Published for wide distribution in Technical Committee Documentation

↓

⅔'s vote of committee approves for submittal to association meeting

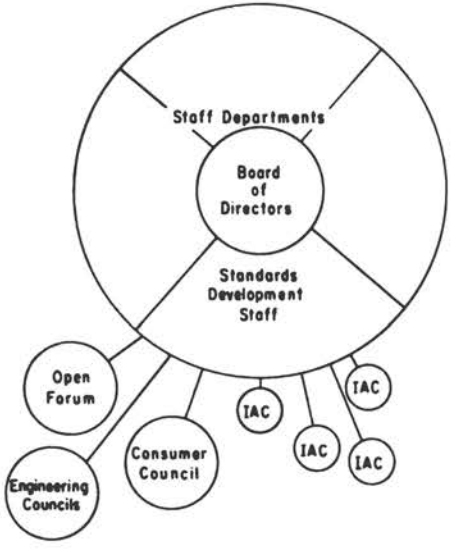
↓

Association meeting in open forum takes final action

↓

If approved, published as NFPA standard. Usually approved later by ANSI

Underwriters Laboratories Inc.



Special Comments

Drafts prepared by UL staff in consultation with Industry Advisory Conferences of Manufacturers (IACs).

Review by Engineering and Consumer Councils and by open forum mailings.

Final approvals by UL staff.

Procedure

Draft proposal by UL engineers based on
1. Applied requirements
2. Field experience
3. Survey of existing standards
4. Compatibility

↓

Discussion with Industry Advisory Groups or Conferences (IAGs or IACs)

↓

Review and comments by appropriate UL Engineering Councils, Government Agencies, UL clients, and other identified interests

↓

Standard revised and resubmitted for comments to IAGs, IACs, and others

↓

Revision and publication as UL standard

↓

Submission to ANSI with national canvass

↓

Further revision if necessary or feasible

↓

Usually approved as American National Standard, but after use for some time

Department of Commerce
National Bureau of Standards (NBS)

* SRC - Standard Review Committee
Limited life (2 years) then replaced by Standing Committee

Procedure

Interested group submits proposed standards to NBS

↓

If proposal meets DOC criteria, NBS provides or arranges for impartial technical review

↓

NBS may circulate proposal to public for comment

↓

NBS establishes Standard Review Committee (SRC) with balanced membership

↓

SRC reviews proposal and recommends (with approval of ¾ SRC) circulation to public to determine acceptance

↓

NBS circulates standard, invites comment through Federal Register notice and press releases, and submits standard to ANSI for concurrent review

↓

NBS analyzes public response and establishes standard if proposal is supported by consensus (75 percent average industry acceptance and at least 70 percent of producers, 70 percent of distributors, and 70 percent of consumer/users responding, with no substantive objections) (objections are sent to SRC for evaluation)

↓

NBS appoints balanced Standing Committee to assist in keeping standard up to date

↓

NBS publishes standard and submits it to ANSI for listing as an American National Standard

A. *The Need for an Improved Coordinating Force*

Practically every study of the U.S. Voluntary Standards System made during the past 15 years has concluded with some concern that the system does not have adequate coordination.[3] Most of the same studies point up that the American National Standards Institute (or one of its predecessors) has been considered to be the coordinating force for the system but has not been able to carry out this role successfully.

Various reasons that have been given for this can be summarized this way. ANSI has defined its coordination role quite well but has not yet developed an efficient way to administer the role. Its proliferation of classes of membership for participation, and its complex organization of boards, councils, and committees, each having poorly defined roles and responsibilities, have generated a superstructure too cumbersome to effectively administer the task, and too confusing to encourage or permit participation. As a result, the member organizations are unwilling to give ANSI the authority to make basic coordination decisions.

ASTM believes that ANSI's efforts during the last few years to name "secretariats" for standards development projects is a partial solution to the coordination problem. Under this procedure, ANSI assigns the operational functions (secretariat duties) to a single standards-writing organization that has demonstrated capability of administrating the standards-making process, and also has internal procedures accredited by ANSI. However, many of the "secretariats" assigned by ANSI under these procedures are to organizations that do not have accredited procedures or even consensus procedures. ASTM believes that further improvements in coordination by ANSI can come only through an improved organizational structure and better understanding by ANSI of the capabilities of its organization members.

It should be recognized that a major ANSI difficulty is that its financial base is shared with the same standards-writing organizations it serves to coordinate. Thus, the same companies must carry multiple membership support, also the limited available resources are diluted over a broad range of activities not related to standards coordination.

ASTM has good reason to support ANSI in its coordination role. Some 43 percent of ANSI's Organizational Members are also ASTM members, as are 43 percent of its Company Members. Likewise, 55 percent of ASTM's standards are ANSI standards, and 51 percent of ANSI's American National Standards come from ASTM. ASTM believes the obvious solution to the problem is a drastic simplification of both the ANSI superstructure and the massive procedures that are required, at least in major part, to provide checks and balances for the structure. Good coordination is not likely to come until ANSI compresses its central organization to make

[3] See references in Appendix.

maximum use of the capabilities of its standards-generating member bodies. Likewise, ANSI must examine its financial base to determine new sources of funding and to make maximum use of its available resources to support the key issue of standards coordination. ANSI must continue to strive to develop and present a unified image for the voluntary standards system of the United States.

B. *The Lack of a Single Set of National Standards*

In most countries the only standards that have broad national acceptance are those approved by national standards bodies. This is not the case in the United States which is the only country in the world where the national standards body is not a part of or supported by the federal government. In the United States, in addition to ANSI, there is a long list of organizations who have some standards that are used widely in both the public and private sectors. Actually, the standards approved by ANSI represent only about 25 percent of the total that have such national acceptance.

The lack of a single set of national standards breeds criticism of the whole voluntary standards system and is often cited as evidence that the system is unable to serve the needs of the country. The criticism stems mainly from the confusion that results when there are two or more widely accepted standards on the same subject.

The lack of a strong coordinating force is, without doubt, a part of the problem, but another important factor is the lack of an efficient mechanism for approving standards as national standards. The present practices are so confusing, duplicative, and time-consuming that they discourage requests for approval. When the procedures are used they often operate so slowly that an old standard remains as the "officially" accepted standard long after an updated version is in wide use.

ASTM believes the solution to this problem is a central accreditation board which will have as its major function the approval of standards-making procedures of standards-making organizations. Once the procedures of an organization have been accredited, all its future standards would be recognized as "official" national standards. The accreditation board would reexamine the procedures regularly and reaffirm or withdraw the accreditation as required. Since the procedures of many standards-making organizations would not be accreditable, the central board would have to establish a separate procedure to consider accreditation of individual standards from these sources. ASTM also believes that it is essential to have an indexing and numbering system for accredited national standards which present a national series while preserving the source identity.

While ANSI has recently adopted a revised set of procedures at its December 1974 Board of Directors meeting, which incorporate many of the concepts embodied in this paper, it has not taken the steps to streamline

the system to provide for the elimination of duplicative or overlapping jurisidiction of committees, boards, and councils; the strengthening of its financial base; the elimination of compromise "ANSI committees" which administer controversial standards areas in lieu of assigned secretariats; and the establishment of "approved" standards-making organizations. ASTM believes that these additional steps probably will have to be taken by ANSI to strengthen the national coordination role it has assumed, and to provide the strong unified image of the voluntary standards system that must be achieved to attain the stature required to interface with the federal government.

C. *The Need for a National Policy on Standardization by the U.S. Government*

One weakness of the voluntary standards system is the lack of a national policy on standardization. Various studies sponsored by branches of the federal government have produced recommendations calling for U.S. government action to establish or at least formally recognize a national coordinating body for voluntary standards development, either in the private sector or as a quasi-government body, as has been done in many other countries.

Part of the problem stems from the lack of a strong image of the voluntary standards system in Washington. Other parts of the problem are the assignment of standards to lower levels in the various involved agencies with little or no understanding of the problems at the Secretarial level; lack of Congressional awareness of standards problems or their financial impact on the U.S. economy; lack of understanding by government people as to what standards are or can do in the legislative or regulatory process; and failure of U.S. industry and consumer organizations to present a unified statement of the benefits to be derived from a national standards policy.

In the meantime, more and more federal departments and agencies are being given authority to promulgate standards without a uniform policy as to the acceptance of existing voluntary standards or the use of the technical expertise and extensive resources of the voluntary standards-making system. There appears to be little appreciation for the tremendous investment of manpower and dollars that the private sector has been making in the development of standards.

This same lack of a national policy and understanding continues to make it unclear how government employees can participate in the voluntary system. The failure to present a strong positive image to the federal establishment has provided an Achilles heel from which the system will not easily escape. The lack of a positive image leads to accusations of lack of clout, domination by industry, and failure to provide participation by consumers. This lack of a coordinated policy, now accepted at higher levels

of government, continues to make it impossible to understand how government employees can participate in a credible and effective manner representing the federal establishment in the voluntary standards system. It also makes industry, labor, and consumers wary of federal intent to develop consensus standards.

ASTM believes all organizations in the voluntary standards system must continue to seek better recognition of the system by the federal government and work together to shape the system in a way that can be endorsed by Congress.

D. *The Need for a Better Understanding of the System*

Criticism of the voluntary standards system, especially in recent years, has continued to demonstrate the concern about:

Efficacy of consensus procedures.

Possibility that some standards may restrict competition, discourage innovation and limit customer choice.

Desirability of using voluntary standards for mandatory regulations.

ASTM believes that criticism on these points is largely due to misunderstandings or inaccurate information about the voluntary standards system and how it works. Much of this misunderstanding and inaccurate information can be attributed to the differences in procedures and philosophies of the standards-making organizations presently extant in the United States. However, both the misunderstandings and the differences in the information and philosophies can be attributed to the procedures and problems of the system noted earlier in this report.

Certainly a large part of the criticism and the reasons for it are tied to confusion about consensus and what it means. ASTM has discussed consensus in detail in Part III of this report.

VI. The Ideal System

The voluntary standards system of the United States is, in its present form, not the ideal system. Since we, in ASTM, intend to contribute to improvement of the system, we here attempt to outline the "ideal" system.

The total standards system includes both the voluntary standards system and the nonvoluntary, regulatory standards system. The degree to which the voluntary standards system has matured and become effective in a segment of society may be expected to have an effect on the degree to which the nonvoluntary, regulatory standards system is developed in that segment of society. For the purposes of this report, it is assumed that the

voluntary standards system provides criteria and may recommend regulatory limits, but does not directly participate in setting legally binding regulatory limits on permissible behavior of individuals and organizations. It is also assumed that the need for standard methods, standard definitions, standard classifications, standard procedures, standard criteria, and standard practices, covering more aspects of properties, composition, performance, and behavior of materials, products, systems, and services will increase with time.

The principles upon which the ideal voluntary standards system is based must be selected to maximize the degree to which the system operates to achieve:

(*a*) Timely response to needs for standards.

(*b*) Adequate response to needs for standards.

(*c*) Selection of activities to be undertaken for the development and application of standards.

(*d*) Inclusiveness of participation of all parties at interest in the standards-making process.

(*e*) Fairness in resolution of the differences among parties at interest.

(*f*) Creation of regulations governing procedures for standards-making with built in flexibility to meet changing conditions.

(*g*) Coordination among groups engaged in standardization, nationally and internationally.

The ideal voluntary standards system includes a mechanism that:

1. Continually surveys the need for standards by all elements in the society and provides access to the system by all parties.
2. Evaluates these indicated needs and their priorities.
3. Initiates projects for which standards-making action is required.
4. Indicates the appropriate time frame within which action should be completed.
5. Identifies the parties of interest, and the procedures to be followed to assure consideration of their views.
6. Selects the appropriate standards-development procedure and assigns the project to the body best able to carry out that procedure, avoiding duplication to the extent practicable.
7. Reviews each standard produced.
8. Assigns each standard an appropriate classification and designation which is a part of a national series.
9. Arranges for distribution of work and coordination among the various organizations involved.
10. Provides for periodic review and maintenance of standards produced.

Even though this is a voluntary standards system, the mechanism for

accomplishing these various management functions must involve both the public and private sectors of the society.

The need for standards development can arise within industry, government, labor, consumers, academia, or within the standards development community itself. Such a need may or may not be related to a need for regulation, certification, accreditation, communication, or product interchangeability or interconnection. Regardless of where or for what reasons the need arises, it may be initially addressed by the community in which it arises or it may be taken immediately to the standards-making management or coordination body or both. If, after completion, the consequences of the use of the standard impinge on communities in the society other than those where the need arose, there must be coordination and management provided from outside that community. The number of cases in which a community that consists even of a single corporate body can develop and use standards developed in-house to govern its own internal operations is progressively becoming fewer. Hence, the scope and complexity of the standards management system and the diversity of the areas of societies with which it must interact will progressively enlarge.

The time frame within which the need for a standard must be met by production of a suitable standard will vary from as short as a few weeks to as long as a few years. The voluntary standards-making system must include provisions for the employment of expedited procedures when such are needed.

The keystone of any voluntary standards system is the acceptability of the standards produced. Acceptability implies more than technical soundness and can be attained through due process as described in Part III of this report under the definition of a consensus standard.

The ideal voluntary standards system must include provisions for categories of voluntary standards, not only with respect to the matters standardized (as methods, definitions, practices, etc.) but also with respect to the breadth of the consensus reached (that is, within a single enterprise, within an industry, within a geographical area, within the nation, within a group of nations). For example, there may be an Eastman Kodak Company standard relating to a photographic product or process; a plywood industry standard for a plywood product or process; a Virginia Highway Department standard for highway marking; an American National Standard for automobile safety belt testing; or an international standard method for determining the concentration of mercury in seawater. Regardless of the size of the population affected by the standard, a consensus of interested and affected parties from that population must be determined to have been achieved if the resulting standard is to have credibility within that population.

The ideal standards management system must create procedures that guarantee such consensus and additional procedures for reviewing actions taken to ascertain that due process was followed. When it has been demonstrated that the procedures were followed properly, then the standard must be assigned an appropriate designation in its proper category and disseminated for use. The standards management system must put in place an authoritative body to administer the procedures and rule on the acceptance of the standards generated under them.

Coordination in the Ideal System

A major part of the ideal voluntary standards system is its coordinating force—a private or quasi-public body with national recognition by government, industry, academia, labor, and other elements of society. This *coordinating body* will provide a mechanism to:

1. Appraise the existing standards, their scope, and usefulness.
2. Determine the capabilities of standards-development organizations.
3. Keep abreast of the standards development work in progress and the timetables for its completion.
4. Determine the need for standards not already under development.
5. Establish priorities for new standards, taking into account the development procedures, capabilities, and resources of the existing standards-making bodies.
6. Identify and eliminate overlap and duplication of standards and standards development work to the extent practicable.

This part of the ideal system can work only if the many standards-writing organizations are willing to give the coordinating body the authority to make basic coordination decisions. Such decisions would include:

1. Determination of the most competent organization to do a particular standards development task.
2. Resolution of disputes on the scope of work to be carried out by the various standards-writing organizations.

The coordinating body should not have this authority if it has a standards-writing operation of its own.

Identification of National Standards

The ideal voluntary standards system will include a plan for classifying and identifying standards approved as national voluntary standards. This identification will appear on each standard and, if necessary, in addition to the identification which the organization producing the standard has

assigned to it. This will permit the publication of a single catalog of all approved national voluntary standards.

Accreditation of Standards-Making Organizations

The ideal voluntary standards system for the United States is one that gives special recognition to those standards-making organizations that produce standards that represent a consensus of all interested parties. To provide this recognition, the ideal system will have an accreditation board for the examination of standards-making procedures of various organizations and the accreditation of those that are able to produce national consensus standards. As long as the procedures of an organization have been accredited, all its standards would be recognized as official national standards. The accreditation board would re-examine the procedure regularly and reaffirm or withdraw the accreditation as necessary. Standards produced by unaccredited organizations would not be accepted as official national standards until the completion of further procedural steps specified by the accreditation board. The additional steps might not be the same for all situations.

Central Organization

Most of the work of the ideal voluntary standards system will be carried out by the several hundred standards-making organizations that comprise the system, but there will have to be at least a small central organizational structure to:

Operate the coordinating body.
Operate the accreditation board.
Classify and identify the standards approved.
Publish the rules governing the operation of the system.

The central organization may be able to assume other public relations or public service functions, but its major role in the ideal U.S. voluntary standards system is that just described.

VII. ASTM Role and Position in the Ideal Voluntary Standards System

The ASTM Role

Original articles of incorporation described ASTM's area of interest as "materials of engineering;" however, the present ASTM scope includes "materials, products, systems, and services" and covers an almost unlimited

array of subjects. What, then, are the factors that distinguish the extent of ASTM activity and, at the same time, engender the wide participation in its voluntary work? The ASTM role in standards-making activities is characterized by its "due process" procedures. If standards are to be developed under the ASTM system, compliance with the ASTM idea of "due process" is essential, as is interest and participation by balanced numbers of volunteers representing opposing points of views. These conditions are prerequisites for ASTM participation in the development of voluntary standards. In other words, ASTM's role is determined by its process, rather than subject matter. It's a matter of "how" rather than "what" and an essential part of the "how" is the guarantee that everyone may have his say. The preeminence of ASTM in standards-making activity stems in large part from the acceptance of the ASTM process and the recognition of the fact that ASTM standards are developed from a multibias point of view.

Because ASTM is a body dedicated exclusively to development of voluntary standards, and available to all who have need for such standards, it can play an important part in the ideal system discussed in Part VI of this report. Its due process system which balances biases, provides opportunity for public involvement, and requires a high level of agreement and thorough formal review of minority opinion, fits well with the concept of the voluntary standards system. The ASTM assembly of committees[4] is capable of handling many foreseeable needs for standards for materials, products, systems and services, and the open-ended management structure of ASTM facilities handling of standards-development projects which do not fit conveniently into another part of the ideal system.

Relation With Central Body

To be an effective and compatible element of the system, ASTM must relate properly to a central body (ANSI) which is given the authority to survey needs of standards, to certify standards development procedures, to assign standards-making responsibilities, and to coordinate efforts where more than one component of the system is properly involved. It also must submit its standards for registry in a national series, and assume an equitable share of responsibility for supporting and implementing management operations of the central body. These are not troublesome requirements. The ASTM system has the prerequisites for accreditation, and its standards can be placed in a national system without sacrificing identity or revenue. Cooperative projects on subjects of national interest probably can be con-

[4] About 130 in mid-1975.

ducted in a manner which does not unduly compromise the due process procedures of the Society.

Relations With Others

Effectiveness of the Ideal Voluntary Standards System will depend largely on proper working relations among the several elements. Some of this can be achieved through effective coordination by the parent body. The remainder must be sought through liaison contacts, reciprocal membership, and meaningful interaction with all who write or use standards, including the public sector.

ASTM has managed to maintain rather effective relations with others in the present loosely-knit voluntary standards system through a multiplex of contacts with groups and individuals. These contacts start at Board level and permeate the entire ASTM structure. Members of the ASTM Board come from government, producer and user industries, educational institutions, and a variety of general interests, including the ultimate consumer. Their combined leadership experience represents more than 100 organizations—private establishments, government advisory boards and commissions, and other bodies. The interfaces in the technical committees also are extraordinary. These include representatives of more than 1150 branches of government, 360 trade and professional societies, 172 colleges and universities, thousands of organized general interested bodies (for example, consumer groups), and individuals. Formal liaison contact is maintained with about 80 standardization bodies, and ASTM members are active participants in 40 international standardization groups. This great breadth of experience accounts for the fact that ASTM standards are well constructed and accepted.

ASTM also has formal relationships with other standardization groups, many of which are listed in the ASTM yearbook. These include joint standards-writing committees and ASTM representation on national material and standard projects, planning and review panels, advisory groups, and technical data exchanges.

ASTM also acts as secretariat of several American National Standards Committees operating under ANSI procedures and is represented on a number of other ANSI committees.

Easy access to the ASTM system where interaction with a wide spectrum of expertise can occur in an atmosphere of excellent administrative and publications support is attractive to those who have standardization problems and needs. Hundreds of agencies have taken advantage of the opportunities and support provided by the ASTM system.

Despite these many working relationships, more may be required to

implement the Ideal System. ASTM may have to develop special procedures and arrangements to ensure continuing mutually acceptable coordination and cooperation without compromising the ASTM system. These changes would not appear to present insurmountable obstacles.

Sections VIII. Conclusion, IX. Recommendations and the Appendix have been omitted in the interest of brevity.

APPENDIX F-1

SPECIFICATIONS & STANDARDS

GENERATION & PUBLICATION

Army Materials and Mechanics Research Center
Watertown, Massachusetts 02172

6 February 1976

SPECIFICATIONS & STANDARDS - GENERATION & PUBLICATION

1. POLICIES & PROCEDURES.

(a) The Defense Standardization Program (DSP). The DSP is organized and manged in the Department of Defense in implementation of Title 10, US Code, Chapter 145, the "Cataloging and Standardization" Act. This Chapter of the Code provides that in standardizing supplies to the highest practicable degree, it is essential to standardize:

(1) Items used throughout the DoD by developing and using single specifications, eliminating overlapping and duplicate specifications, and reducing the number of sizes and kinds of items that are generally similar; and

(2) The methods of packaging, packing, and preseving such items.

The Cataloging and Standardization Act also provides the Secretary of Defense shall:

(1) Develop and maintain the Defense Standardization Program.

(2) Direct and coordinate progressive use of the supply catalog in all supply functions within the DoD from the determination of requirements through final disposal.

(3) Maintain liaison with industry advisory groups to coordinate the development of the Standardization Program with the best practices of industry in order to obtain the fullest practicable cooperation and participation of industry.

(4) Establish, publish, review, and revise, within the DoD, military specifications, standards, and lists of qualified products and resolve differences between the Military Departments, bureaus and services, and commands within the DoD when practical and consistent with their capacity and interest.

(5) Establish time schedules for assignments.

(6) Make final decisions in all matters concerned with the Standardization Program.

(b) The Federal Standardization Program (FSP). Policies and procedures for the Federal Standardization Program are delegated to the Standardization Division of the Federal Supply Service by the General Services Administration. For practical purposes, the only difference between the two programs are the commodity areas addressed;

military versus civil. The DoD, however, uses Federal Specifications and Standards for procurement of civil commodities and items and is responsible for the preparation and maintenance of many of the documents because of areas of interest and expertise. Preparation of Federal Specifications and Standards is covered in DSM 4120.3-M. Federal use of military specifications and standards is limited.

(c) Program Peculiar Specifications. There are other types of specifications and standards which are not directly associated with either the DSP or FSP although they could become candidates if certain criteria are met. They are specifications and standards written for "Program Peculiar Items, Processes, and Materials" and are covered by MIL-STD-490 on "Specification Practices". This Standard, although primarily intended for use in preparation of program peculiar specifications, recognizes the probability that some items, processes or materials covered by specifications prepared to this Standard will be subject to conversion by Government activities to Federal or Military specifications for use as a Mandatory Specification as required by ASPR 1-1202(a). Therefore, specifictions prepared in accordance with this Standard, when subjected to all pertinent conversion requirements of DoD 4120.3-M and assigned Federal or Military specification numbers, will be in full compliance with requirements for Federal and Military specifications. MIL-STD-490 is covered here because many of the advanced materials specifications are generated during new systems development.

2. DEFINITIONS.

(a) General. The following definitions have been taken from the Defense Standardization Manual 4120.3-M on "Standardization Policies, Procedures, and Instructions" of January 1972.

(1) Specifications. A document intended primarily for use in procurement which clearly and accurately describes the essential technical requirements for items, materials, or services including the procedures by which it will be determined that the requirements have been met. Specifications for items and materials may also contain preservation, packaging, packing, and marking requirements. Specifications are prepared for items, and processes relative to the manufacture of items, which vary in complexity from paper clips to missile weapon systems. They establish requirements in terms of complete design details or in terms of performance, but in most instances in terms of both design and performance. Specifications may cover a single item such as a camera or thousands of items such as bolts which for each single item, there may be several materials, several finishes, and hundreds of sizes.

(2) Standard. A document that establishes engineering and technical limitations and applications for items, materials, processes, methods, designs, and engineering practices. Standards are documents created primarily to serve the needs of designers, and to control variety. They may cover materials, items, features of items, engineering practices, processes, codes, symbols, type designations, definitions, nomenclature, test, inspection, packaging and preservation methods and materials, define and classify defects, and standardize the marking of material and items parts and components of equipment, etc.

(3) Standards and Specifictions Relationships. Standards function in procurement through medium of specifications. Thus they are used to standardize one or more features of an item such as size, value, detail of configuration, etc. In equipment specifications, they are referenced to standardize on those design requirements which are essential to interchangeability, compatibility, reliability, and maintainability. They are prepared to provide the designer with the descriptions and the data normally required for selection and application. Standards disclose or describe the technical features of an item in terms of what it is and what it will do. In contrast, the specification for the same item describes it in terms of the requirements for procurement. Reference to other documents in standards to complete a description whould be resorted to only when it is impracticable to do otherwise.

(b) Discussion. For purposes of this presentation, whenever a specification or standard is discussed it will be used in the literal sense described above, no matter what the government, industry, or technical society designation for a particular document may be: for example, specification, standard, standard specificatien, recommended practice, and so forth. Thus a specification is the procurement document, and a standard is an engineering or technical reference for a procurement document.

3. RESPONSIBILITIES.

(a) General. Delegation and control of responsibility for standardization is essential to an effective program whether it be the DSP, FSP, or non-government efforts. It is also essential that the scope and authority of such responsibility be understood. The following definitions apply to the DSP but the elements they represent are common to any standardization program. It is in the scope and authority of the responsibilities that differences between government and non-government standardization efforts are most apparent.

(1) Assignee. The Military Department or DoD Agency to which responsibilities for standardization have been assigned by the Assistant Secretary of Defense (Installations & Logistics) and to which the Secretary of Defense has delegated authority to act in his behalf within those assignments.

(2) Activity. One of the organizational elements of the Army, Navy, Air Force, Defense Supply Agency, U.S. Marine Corps, Coast Guard, and other Activities of the Department of Defense.

(3) Assignee Activity. The activity to which responsibility for standardization of a Federal Supply Classification (FSC) Class or Area has been delegated by the cognizant Assignee.

(4) Preparing Activity. The military activity or the activity in a Federal civil agency (for Federal documents only) responsible for document and study projects and for maintenance of the resultant Standardization Documents.

(5) Review Activity. An activity having Departmental, Service, Agency responsibility for the design, configuration or application of an item(s), material(s), or process(es) and which, for these reasons, has an essential technical interest in the covering document that is not susceptible to waiver, thus requiring a review of all proposed actions affecting the document. Defense Supply Centers may declare review interest in standardization documents covering items for which they have procurement, inspection and supply responsibilities and in those instances wherein advance knowledge and review of documents is necessary to assure procurability (including such factors as industrial capability, economics and inspection) of the described items to the specified requirements. Essential comments submitted in this capacity will be limited to the functional areas for which DSA has mission responsibility in management of the items. The decision to be, or not to be, a review activity will be made by the Defense Supply Center concerned.

(6) Military Coordinating Activity. The military activity responsible for coordinating, reconciling and collating the military comment for the Department of Defense on a Federal standard or specification prepared by a Federal civil agency under and established project. Military coordinating activity also identified the military activity responsible for coordination of an industry standardization document in the DoD.

(7) Participating Activity. The activity designated by its Departmental Standardization Office to

represent the department/agency in collaborative standardization effort usually for the purpose of planning standardization for an FSC Class or Area.

(8) Custodian. The activity responsible for effecting coordination and other related functions for its own department in the DoD.

(9) Department of Defense Index of Specifications and Standards. This publication lists the unclassified Federal, Military and Departmental specifications, standards, and related standardization documents, and those Industry documents which have been coordinated for DoD use. This publication is maintained by Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

(10) Standardization Directory, SD-1, FSC Class and Area Assignments. This publication provides a convenient source of information relative to the name, address and responsibility of activities having interest in the conduct of the Defense Standardization Program. Part 1 shows, by appropriate codes or symbols, the assignment of standardization responsibility to the activities of the Military Departments, the Defense Supply Agency and other elements of the Federal Government. Part 2 is a directory of mailing addresses of assignee, participating and other interested activities, showing copy requirements for drafts and approved copies of standardization documents. This publication is also maintained by Naval Publications and Forms Center.

(11) Status of Standardization Projects, SD-4. This document shows the status of standardization projects for the development, revision or amendment of standards, specifications, handbooks, and studies. The document is compiled by the Air Force Logistics Command from data submitted by the military services and the Defense Supply Agency for use in the management of those projects. This document is issued quarterly by the Naval Publications and Forms Center.

(12) Agent. An activity which acts for, or by authority of the Preparing Activity (the Preparing Activity, however, does not relinquish approval responsibility for the work accomplished). Examples of agent actions are: preparation of standardization documents; performance of study projects; and administration of Qualified Products Lists.

4. OPERATIONS.

(a) General. The following steps outline the procedures followed in preparation and promulgation of a

fully coordinated Military or Federal Specification. The same basic procedures are followed for a new, revised, or amended document except where noted.

(b) Need. Obviously, a need must exist for a new specification or standard, or for revising or amending an existing document. Such a need can arise from any one or combination of sources: RDT&E on new or improved materials, materiels, processes, or testing technologies; manufacturing technology; system developments; and so forth. The Standardization Document Improvement Proposal, DoD Form 1426 can be used to establish the need for revising, amending or cancelling a document. Or the need can be identified during the yearly review of five-year-old documents furnished to preparing activities by the Naval Publications and Forms Center. The yearly Program Analysis by the Assignee Activity reviews all documents in their FSC Class or Area to determine the need for revising, combining, or cancelling documents.

(c) Purchase Description. Often, specification preparation is preceded by and takes the form of limited procurement purchase descriptions (PD's). These PD's essentially test the market place to see if what is being sought can actually be purchased in the real world. PD's go through development phases to achieve viable status as procurement documents. Many PD's never do get converted to formal (in the sense of DMS 4120.3-M) specifications but by there very nature and limitations remain as PD's Program peculiar specifications covered by MIL-STD-490 on "Specification Practices" would fall in the PD category. But, MIL-STD-490 also "...recognizes the probability that some items, processes, or materials covered by specifications prepared to this Standard will be subject to conversion by Government Activities to Federal or Military specifications as required by ASPR 1-1202(a)...". Thus, eventually, a certain proportion of PD's are required to be converted to Military or Federal specifications.

(d) Project Assignment. After the need has been identified, the Preparing Activity for the specification or standard receives a project number assignment from the Assignee Activity for the given FSC Class or Area. The DSP Standardization Directory SD-1 lists FSC Class and Area Assignments for Military specifications and standards. The Assignee Activity is responsible to assure that no duplicative or unnecessary effort is undertaken.

(e) Project Initiation. A standardization project is officially established via submission of a DoD Form 1585, "Standardization Project Report" by th Preparing Activity to the Assignee Activity with copies to the Departmental Custodians and other interested activities (review, user, etc.). For new specifications and standards, the starting

point for identifying interested activities is the Standardization Directory, SD-1. The coordination cycle generally establishes the spectrum of interested parties. Existing specifications and standards list interested activities at the end of each document (but before Appendixes). At the close of each quarter of the year, ADP cards on each standardization project for which some action was recorded (project initiation, coordination, completion, or cancellation or rescheduling) are submitted to the Air Force Logistics Command, Wright-Patterson AFB, for inclusion in the SD-4, Status of Standardization Projects.

(f) Draft Preparation. The draft specification or standard is prepared in compliance with requirements of DMS 4120.3-M. The general format for a commodity specification (the so-called "six-section" specification) is as follows:

SCOPE
APPLICABLE DOCUMENTS
REQUIREMENTS
QUALITY ASSURANCE PROVISIONS
PREPARATION FOR DELIVERY
NOTES

The format for a process specification is geared more to the nature and extent of the information presented with descriptive section headings used except that "Scope" and "Applicable Documents" open the specification, and "Notes" provides the closing. The general format for a bookform standard is as follows:

SCOPE
REFERENCED DOCUMENTS
DEFINITIONS
GENERAL REQUIREMENTS
DETAILED REQUIREMENTS
APPENDICES

To the engineer, the requirements and quality assurance sections of specifictions, and the general and detail requirements sections of standards, are the essence of the documents. When these are properly prepared, the rest of the sections usually fall readily in place. These sections will be discussed in detail later.

(g) Coordination. When the initial draft specification or standard has been prepared the document is then circulated to all interested activities for review and comment, both government and non-government (as required). Coordination within the government is effected by the responsible Departmental Custodians for the particular document who are identified by reference to the document itself and the DODISS (for revisions, amendments, or cancellations of existing documents), or to the SD-1

directory (for new documents). All draft documents, correspondence, and approved specifications and standards are identified by the project number for the document. The following statements are taken directly from DMS 4120.3-5 and are essential to effective coordination:

(1) Coordination Policy. As a means of conserving both time and manpower, the number of organizations and people participating, as well as the time required for coordination, shall be kept to the minimum. A preparing activity shall process standardization documents on behalf of all users, coordinating the document in the DoD only with designated review activities. The documents shall then be issued as coordinated and will be mandatory on all users. Activities will always waive coordination and rely upon the preparing activity and review activities to serve and protect their interests unless truly damaging consequences may result from overalooking an essential requirement. Therefore, activities will forego coordination prior to issuance of documents unless the risk involved is unacceptable from a realistic, common sense point of view.

(2) Comments. Comments shall be designated as either "essential" or "suggested". An essential comment must be justified; otherwise, it will be treated as a suggested comment. Diferences regarding the selection of the item name to be used in the title, which cannot be resolved by the preparing activity, shall be submitted as an unresolved essential comment. Letters transmitting comments to custodians and from custodians to preparing activities shall confirm review and user activity designations and shall also indicate the number of copies of the reproduced military or industry documents required by the activity or department and the points of delivery if different from standing requirements.

(3) Resolution of Differences. The preparing activity is responsible for reconciling essential comments. Unproductive conferences or extensive correspondence for resolution of differences shall be avoided. A unification meeting should be called if the comments are voluminous in order to avoid recirculation of a revised draft. If a unification meeting is called, normally a minimum of 30 days advanced notice of the meeing should be allowed. Essential comments which the preparing activity is unable to resolve in a reasonable time shall be processed in accordance with "Procedures for Unresolved Comments."

(4) Procedures for Unresolved Comments. The draft, custodian and industry comments, the record of coordination (see definition), and a recommendation for disposition of unresolved essential comments shall be submitted to the assignee activity. Copies of the correspondence will be sent to the other custodians and

DEPSOs. This procedure for coordination of a draft provides successive opportunities for reconciliation of unresolved comments at several command levels. Upon resolution of the comments, the assignee activity or DEPSO will forward the document to the preparing activity for approval action and reproduction. If neither the assignee nor the DEPSO are able to resolve the difference, the problem will be referred to the assignee for resolution or decision, after which the draft will be returned to the preparing activity for manuscript preparation and reproduction.

(h) Approval and Publication. If there are no unreconciled comments, the preparing activity will approve the document, date and number it, and arrange for reproduction and distribution. A DD Form 1585 completion notice together with a copy of the approved document and the standardization accomplishment report, if applicable, will be forwarded to the assignee activity and custodians. This does not relieve assignee activity of the responsibility for adequate documents. (An ADP card is also forwarded to show completion in the SD-4.)

5. LIMITED COORDINATION DOCUMENTS

(a) General. Limited coordination documents cover items or services of interest to a single activity or department. As a practical matter, a limited coordination document is often the first formal document to describe new materials, materiel, processes, and so forth.

(b) Responsibilities The preparer is cautioned to check the current applicable listing in DODISS and the SD-4 before preparing a limited coordination document to preclude duplication. It is the responsibility of the activity preparing a limited coordination document to inform potentially interested activities. Activities are responsible for using all limited coordination documents wherever they are applicable. When this occurs, the activity(ies) shall register its review/user interest in accordance with procedures.

(c) "Used-In-Lieu-Of" Documents.

(1) Only one "used-in-lieu-of" specification will be outstanding per department for any single coordinated specification. The number of such issuances authorized will be kept to a minimum.

(2) "Used-in-lieu-of" specifications will not be employed as devices to perpetuate deviations from coordinated military specifications.

(3) The issuing activity, if not the assignee activity, will notify the assignee activity of the action and will provide a copy of the specification.

(4) "Used-in-lieu-of" specifications will be identified as prescribed. The assignee activity will take immediate action to initiate a project to revise the existing coordinated specifications, or to request the consideration of the "Used-In-Lieu-Of" specification in the event such a project has been initiated and is not yet completed.

6. INDUSTRY DOCUMENTS

(a) General. DoD activities shall make maximum utilization of industry effort expended in the development of standardization documents and of the facilities of industry groups in the development of industry standardization documents having present or potential DoD use. Industry standardization documents shall be used in the field of research, development design, and acquisition of material whenever considered feasible by the responsible DoD components.

(b) Criteria for Adoption. The primary criteria for determining whether industry standardization documents will be adopted in lieu of preparing duplicate military or Federal documents are as follows:

(1) They fully satisfy the needs of the military with respect to content (technical sufficiency).

(2) There is assurance that there will be sufficient copies available to satisfy demands generated by DoD. An industry document will not be approved as either a coordinated or a limited coordination document unless it has first been ascertained that:

(a) Sufficient copies are available from the industry source to handle the total estimated DoD demands at a cost no more than 20 percent greater per copy than th cost for the NPFC to reproduce like copy.

(b) If the document is copyrighted, that the Government has been granted a royalty-fee license for reproduction for its own use and for future reproduction on the contingency that the industry source may cease to make sufficient copies available at the cost mentioned above.

(3) They are acceptable to interested industry elements. When, in the judgment of the assignee activity, coordination of the industry document has been effected by the industry group to at least the miniumum extent and degree required for a DoD-conducted industry coordination of

a military specification or standard, the industry coordinated process need not be predated. If, however, the industry coordination by the industry group does not meet the foregoing criterion, technical requirements of the document may be incorporated into a military document and processed within the military series, after securing the required industry coordination.

(c) Guidance.

(1) Military documents shall be developed/maintained when:

(a) A satisfactory military document exists, but no satisfactory industry document exists.

(b) A satisfactory military document and a satisfactory industry document are available and the military document offers the most benefit to the Government.

(c) No military document exists, unsatisfactory industry document exists, and industry is not willing, or is unable to update its document in time to meet the needs of the military.

(2) Industry document shall be developed/adopted when:

(a) No military document exists, but a satisfactory industry document is available.

(b) No military document exists, an unsatisfactory industry document exists, and industry is willing to update its document in time to meet the need of the military.

(c) An unsatisfactory military document exists and a satisfactory industry documents exists.

(d) An unsatisfactory military document exists, an unsatisfactory industry document exists, and industry is willing to update its document in time to meet the needs of the military.

(e) No document is available and industry is willing to develop one in time to meet the needs of the military.

(d) Methods of Adoption.

(1) Acceptance Notice. The acceptance notice method shall be utilized when it is more efficient and economical to adopt the complete industry document than direct copying or referencing parts of it for either

coordinated or limited coordination Federal or military documentation. A complete industry document adopted for use, with or without contractual deviations, by the Military Coordinating Activity will be the subject of an acceptance notice which with a copy of the document will be submitted to the DoDSSP for indexing. This document will be identified by the title "Acceptance Notice" and will be in the format indicated, as applicable.

(2) Excerpts. Excerpts from industry documents may be utilized by direct copying of pertinent portions of industry documentation into military documentation whenever it is more economical and efficient than that acceptance notice method and where there is no violation of copyrights.

(3) The referencing of industry standardization documents in their entirety, or in part, in military or Federal specifications and standards is authorized.

APPENDIX F-2

NAVY PARTICIPATION AND PRACTICES RELATING TO SELECTION AND ACQUISITION OF ADVANCED MATERIALS FOR USE IN NAVAL WEAPONS SYSTEMS

By: Samuel P. Miller, NavAirSysCom, Code AIR-52021

The spiralling cost and complexity of modern, military weapons, vehicles and equipment, coupled with the drastic reduction in dollar purchasing power available in recent defense budgets, demands that every available management technique be employed toward increasing the life-cycle-cost effectiveness of weapons systems. It is widely recognized, both in government and industry, that one such management technique is the effective application of STANDARDIZATION imposed during the design and development phases of weapons systems.

The Navy has actively participated in military standardization programs for more than thirty-five years. The early efforts in military standardization were focussed primarily on logistics supply problems involving the more commonly used, interservice supply items. This aspect of the DoD Standardization effort has progressed reasonably well over the past years and the results are visible in the Federal Supply Item Cataloging Programs. The more sophisticated aspect of the DoD Standardization effort involved with the complex equipments and components used in modern weapons systems has not progressed as successfully.

Basically inherent in the process of implementing optimum standardization in the design and development phases of complex, modern weapons systems, is the fundamental prerequisite to make available to the designers the most cost-effective specifications for the various, qualified, standard materials available for use in the manufacture of the components of the systems designed to meet specified military operational requirements.

Under the DoD Standardization Program, all components of DoD are charged with the responsibility for promoting optimum design standardization, both interservice and intraservice, at all levels of engineering. The responsibility is discharged primarily through the imposition of standardized, engineering design requirements in development contracts for systems and equipments. Such standardized, engineering design requirements are made available to the weapons systems designers in the forms of Military Specifications or Standards and Commercial Industry Specifications or Standards having prior approval of the military departments.

Recently, concerted efforts of the Defense Science Board and the Defense Materiel Specifications and Standards Board were directed toward the improvement of the cost-effectiveness of engineering specifications and standards used by the military for procurement of weapons systems and equipments. This effort to improve specifications is being pursued by the DoD components in four principal modes; namely, 1) the review and up-dating of the state-of-the-art technical requirements in overage military specifications and standards; 2) the establishment of engineering management procedures for effectively "scrubbing" and "tailoring" specification requirements for each major weapons system procurement program, prior to release for contract award, to ensure against inclusion of costly, excessive, design and performance requirements; 3) the promotion of adoption and wider use of Commercial Industry Specifications and Standards (for suitable applications) where the more stringent requirements of the Military Specifications and Standards are not required to meet the operational environment; and, 4) promoting greater commonality of similar components and materials specified for different weapons systems.

The Materials Panel of the Defense Materiel Specifications and Standards Board (DMSSB) is the focal point in the DoD effort toward improvement of materials specifications and standards. The Materials Panel was organized and chartered in September 1974. The Panel is comprised of technical representatives from the military departments, other government departments and agencies and the Defense Supply Agency. The Chairman of the Panel is Jerome Persh, appointed by the DMSSB. The Navy Member of the Panel is Richard Schmidt, Head of the Materials Branch in NavAirSysCom. The Chairman of the Panel is empowered to establish ad hoc committees and advisory groups to operate, within existing legal restraints, for examination and resolution of specific materials problems. The ad hoc groups may be comprised of representatives from industry, the academic community, professional societies, voluntary standards organizations, or government research centers. The Panel assigned functions include:

1. Provide policy guidance to DoD components relating to development and coordination of specifications and standards for materials.

2. Identify specifications and standards having problems with materials shortages, or, having problems with energy usage requirements and environmental impact associated with materials production, or, having problems with substitutions for critical materials.

3. Provide a forum and point of contact for DoD interface with industry associations and societies and other

government agencies concerned with materials development, specification and standardization.

4. Establish programs for promoting the improvement of the national stature and recognition of approved, specifications and standards for materials and related manufacturing processes.

The Navy supports continuing research efforts for development of new and improved materials. Research, development and testing programs for advanced materials for the Navy are sponsored by the Naval Systems Command, the Office of Chief of Naval Material, the Naval Research Laboratories and other Naval Engineering Activities. The Research and Development and Test programs for advanced Navy materials are conducted under contract at nine different Navy Laboratories and Research Centers and also at numerous Universities, non-profit private research laboratories, commercial research laboratories and aerospace industries. The total funds available for materials research are distributed approximately equally between government laboratories and industry sources.

Most of the Navy-sponsored materials development and test programs are conducted under the direction and management of the several Naval Systems Commands. Typically, in each command there is a specialized, materials engineering group which is assigned the responsibility for planning, managing and monitoring the development and testing of advanced materials. The materials engineering group is also responsible for developing, coordinating and approving the specifications and standards for the respective materials and related processing and testing specifications for use in Naval weapons systems development.

The advance materials engineering effort in the Navy is coordinated closely with the counterpart organizational elements in the Army and the Air Force. There is thorough exchange of information regarding the nature and technical objectives of all materials research efforts conducted by the three military services. When an advantageous material is developed and tested successfully by one of the military services, it must be reported and offered for use by the other services. Ultimately, all successful material research programs are concluded by the issuance of an approved specification including the definition of the material, the manufacturing process and the testing procedure and performance requirements. Such specifications are usually made available to the defense industry without delay. Government developed specifications are usually coordinated with various industry voluntary standards and specifications organizations who represent the user and producer industries. Coordination of newly developed specifications within the government is conducted in

accordance with the procedures prescribed in the DoD Standardization Manual. After coordination and approval of the specification or standard, the name and number of the document is listed in the Navy Index Of Specifications and Standards and the DoD Index of Specifications and Standards and is printed by the Naval Publications Center, Philadelphia, Pa., for distribution to the users upon request.

The Navy materials engineering group is kept aware of new materials specifications emanating from industry sources through its close relationship with the several industry standards and specifications organizations, principally, the Air Materials Standards Committee of the Society of Automotive Engineers, Inc., the American Society for Testing and Materials, and the American National Standards Institute. These organizations sponsor numerous working panels or committees specializing in one or more classes of materials. Membership on such panels or committees is comprised of specialists from industry associations who represent users of the respective materials. Representatives from producers of the materials are usually non-voting consultants to the committee members. Government specialists may be members or consultants in the committees. Interaction between the Navy materials engineers and working committees is conducted on a continuing schedule through direct exchange of correspondence and, periodically, through personal attandance and exchange of information at committee meetings.

There are more than 2,500 materials specifications and standards in which the Navy has a user or developer interest, and, therefore, must maintain engineering expertise for assessing, verifying, coordinating and approving the related specifications and standards. Included in this quantity, are approximately 1,000 industry specifications and standards approved and adopted by the Navy for use in weapons systems. This is about 40% of the total.

More than half of the materials approved for use in Navy weapons systems conform to established, prior approved, Military or Industry specifications or standards. Such materials are approved on the basis of prior, certified test data indicating conformance with the prescribed material specification or standard. Proprietary materials frequently are acquired on the basis of certification of conformance to minimal test standards which are inadequate to assure the suitability of the material for the intended military use. Such tests sometimes permit variations in quality which can cause costly problems during the life-cycle of the weapon system.

The Navy has always been receptive to exploring new materials offered by industry for sale to the government or for qualification testing. Such materials are often of a proprietary nature and must be subjected to special testing and evaluation prior to acceptance for use in Navy weapons systems. Contractor performance guarantees are sometimes substituted for Navy testing on a temporary basis. It is the policy of the Navy to test new materials offered by industry at the earliest affordable time.

Present efforts in the Navy materials program include new developments and evaluation of the variety of organic and composite materials offered by industry. A recurring problem involved in the use of proprietary materials offered by producers is the short-time availability of the material and the inconsistency of the characteristics and quality from one order to the next. This occurs frequently notwithstanding certification of conformance to industry standards.

Final approval for selection of a non-standard, advanced material for use in a Navy weapons system rests with the Project Manager in the Navy Procurement Activity. His decision is based on the risks and advantages inherent in the use of the material. His decision usually relies on advice from the cognizant Navy materials engineering staff who are consulted as technical experts in each use instance.

APPENDIX G

SHOULD WE INTERNATIONALIZE OUR NATIONAL STANDARDS?

By: W. A. McAdams, General Electric Co., Vice-President, ASTM (October 23, 1975).

Earlier this year, the Senate approved an amendment to the Military Appropriations Bill requiring that equipment procured by the DoD for NATO, "be standardized and interoperatable with equipment of NATO allies." The amendment goes on to say that when equipment is bought to improve NATO standardization, the DoD would not have to observe the "Buy America" Act. It states further that when non-standard equipment is purchased, the Secretary of Defense would have to inform Congress and explain why.

Later, in a Conference Committee, the representatives from the House agreed to accept this Senate amendment, but with some modifications. Another House-Senate conference on the Appropriations Bill is being held this month and will likely consider the amendment further.

Congress has become especially concerned about NATO standardization since the release last year of a study report prepared for the State Department. The report estimated that NATO members are wasting $20-$40 billion a year because of duplication and lack of standardization of military equipment. The report also estimated that the lack of standardization adversely affects the quality and versatility of NATO forces and makes it difficult for separate NATO units to support each other logistically.

I am not in a position to really know how serious the standardization problem is in NATO, but these actions in Congress, and similar concern among top NATO officials, indicate a growing recognition that steps need to be taken to bring about more uniformity of standards within the alliance.

TRADE NEGOTIATIONS

While Congress is considering this NATO amendment, and while the DoD is assessing the impact of the amendment and the findings in the State Department report, there is another and probably more serious development in international standards. It is the proposed international "Code of Conduct" for the formulation of standards and for acceptance of materiel claimed to meet the standards.

I am sure all of you are quite aware that our trade experts have begun negotiations with their counterparts from all over the world to re-negotiate the General Agreement on Tariffs and Trade. The Administration has insisted that any

new agreement must take into account the many non-tariff trade barries (NTB's) that are applied against our products in various foreign markets. The Code of Conduct on standards, developed by a GATT Working Group, is an attempt to deal with one type of NTB's.

Let's look at some of the factors that have led to the development of this Code.

STANDARDS AS TRADE BARRIERS

It is now recognized that product standards and the way they are applied are often very effective NTB's. According to the U.S. Tariff Commission Report on Trade Barriers issued last year, such standards and government regulations based on them account for about 11% of all the complaints listed as NTB's. It is also evident in the report that standards are at least a factor in some of the complaints listed in other NTB categories. Another report by the UN Economic Commission for Europe, compiled in 1972 from its member countries, showed that more than 25% of NTB complaints were due to differences in product standards or their application via inspection, testing, or other quality assurance and certification procedures.

For the most part, the product standards involved in international commerce are national standards which frequently are different from each other. In usual cases, the differences have resulted from different technical approaches and practices, different criteria or philosophy for safety and health, different customs and life styles of people, and different standards of living. As a result, there are different systems of measurement; variations in drafting practices; differences in basic standards such as nomenclature, product classification systems, voltages, frequencies, and rating practices; higher or lower standards of health and safety; alternatives by many countries for selection of materials that are cheaper or more abundant in particular locales; and diverse procedures for quality assurance and acceptance of products.

In competitive situations, it is not unusual for countries to exploit differences in standards to protect or assist their domestic producers. There are many ways to do this. They can adopt national standards calling for dimensions, ratings, or other requirements which they know will exclude the normal products of their foreign competitors. In other cases, when the standards alone will not accomplish this, they can require testing, certification, and quality assurance procedures that are much easier for the domestic manufacturers to meet. They can also use several other NTB's, such as customs classifications, government purchases on the basis of special or unfamiliar standards, documentation on material

content specified in standards, or other time-consuming administrative procedures.

ACTION IN WESTERN EUROPE

Western Europeans have long recognized that harmonization of standards was one of the steps required to simplify trade among themselves. This was emphasized in studies by the OEEC (now OECD) in the 1960's and became a program of both the Common Market and EFTA when they were established.

In 1961, EEC and EFTA established a joint European Coordinating Committee for Standards (CEN) to begin harmonizing standards in Western Europe and a few months later set up a separate European Coordinating Committee for Electrical Standards (CENEL, now called CENELEC).

By the late 1960's, the Common Market and EFTA became convinced that progress in unification was much too slow and began to set priorities and schedules to get the work completed. The result was a rapid expansion of CEN and CENELEC and, because of the number of countries involved, this led to expansion and speed-up of work in the International Organization for Standardization (ISO), the International Electrotechnical Commission (IEC), and other international standards organizations. The work has been further stimulated by the enlarged Common Market which is promulgating Directives requiring member states to establish or adjust their laws and regulations to accept the unified standards agreed to by ISO and IEC or, where these are not available, by CEN and CENELEC, or some other body.

Many Western European countries believe that unification of standards alone will not eliminate standards as trade barriers. They are convinced that harmonization of testing, inspection, and other certification and quality assurance procedures is essential. Many of the Common Market Directives cover such procedures.

It is far from clear how products outside Western Europe will be treated under these harmonization efforts which, in most cases, are instigated or supported strongly by branches of government and industry in Western Europe. Some of the Directives are worded in a way that it would seem to make it easy to exclude U.S. products; others include procedures that would be onerous or time-consuming for U.S. producers to meet.

Also, with or without the Directives, the National Standards Bodies in Western Europe are working with branches of their governments to carry out harmonization in particular cases. The quality assurance system for electronic companies is a good example. A Tripartite

Committee of the UK, France, and Germany proposed such a system in the late 1960's and it was later absorbed and further developed by CENELEC. In spite of an effort by the U.S. and other countries outside Western Europe to bring the system into IEC where all countries could participate, the CENELEC countries with no formal agreement are beginning to apply their system among themselves.

In view of such developments, it is not surprising that, when it was proposed to establish a GATT Code of Conduct for preventing standards from becoming trade barriers, our U.S. government representatives were encouraged by industry to support the study.

THE GATT CODE OF CONDUCT ON STANDARDS

The present draft of this Code is the result of several meetings of a GATT Working Group and consultations by the members of the Working Group with government and private groups within their countries. Comments were also provided by some regional and international bodies.

The main provisions of the Code are as follows:

1. Where mandatory standards are required by an adherent, relevant international standards shall be used where they exist. There is an exception for those standards that are "inappropriate" for the adherent.

2. An adherent is required to seek comments on any proposed mandatory standard from other adherents, and to take all such comments into account. This procedure may be omitted in case of urgent problems of safety, health, environmental protection or national security.

3. Adherents are required to use "all reasonable means" to see that local governments follow the same rules, i.e. 1 and 2 above, in developing their mandatory standards.

4. Adherents shall use "all reasonable means" to prevent voluntary standards from becoming trade barriers and to promote the acceptance of international standards where voluntary standards are used.

5. Adherents shall ensure that procedures and tests for certifying that products conform to standards will not create trade barriers. They are also required to treat imported and domestic products equally in determining conformance.

6. The rules for testing and quality assurance used by any adherent are to be developed in the same manner as mandatory standards, i.e. in accordance with 1 and 2 above.

7. Adherents are encouraged to develop international systems for quality assurance where a number of adherents have such programs.

8. Enforcement will be in the hands of a Committee for Preventing Technical Barriers to Trade.

The present draft completed in 1973 is still not finalized. Here are some of the questions that remain unresolved:

1. The text is a binding Code which would impose different levels of obligations on the development and use of mandatory standards, voluntary standards, and quality assurance systems. It is not clear how this would work out in practice. There would be even greater problems between countries like the U.S., where the states have much of the responsibility for the application of standards, and centrally controlled governments.

2. In some countries all standards are mandatory. How can the Code deal with this situation when other countries make wide use of voluntary standards, which often become de facto mandatory standards?

3. Agreement has not yet been reached as to whether all product certification and quality assurance systems should be open to all adherents. Any kind of a closed system could discriminate against U.S. manufacturers.

4. The enforcement procedures have still not been well defined.

It is not clear from the GATT Code and its definition of standards, as to whether DoD, NASA, GSA, or other government procurement specifications would fall under the requirements of the Code. Certainly, some government procurement specifications could be exempted from the Code under the present provisions.

Some of the GATT officials believe that the Code of Conduct on standards is well enough developed to obtain approval as a separate instrument with a little more negotiation, and there is some pressure now to produce a satisfactory document to show that GATT is making progress, at least in one area. Ambassador Dent and his negotiators

are anxious to propose modifications to the present draft, which would permit the U.S. to accept the document.

What Do These Developments Mean To The United States?

I think it is evident from the NATO developments, the draft GATT Code, the harmonization programs in Western Europe, and the many other international standards activities I have not had time to describe, that there is a growing demand for the acceptance of standards arrived at through international discussion and agreement. The United States is not properly organized to deal with this situation. Our greatest weakness is inadequate attention to the problem by branches of our government, or an inadequate interface between our government and the private standards-making bodies. I would like to review four aspects of the problem. They are:

- the development of international standards,
- the use of international standards in the U.S.,
- the application of new technology, and
- the financing of U.S. participation.

DEVELOPMENT OF INTERNATIONAL STANDARDS

At the present time, the U.S. participates in the two major international standards bodies, ISO and IEC, through the American National Standards Institute and the U.S. National Committee of IEC, which is affiliated with ANSI. The degree of participation and the positions taken in the technical work are determined by Advisory Groups established for each committee and subcommittee of the international bodies. These Advisory Groups are usually existing committees of U.S. standards-making organizations. The decisions arrived at by the Advisory Groups are presented to the international committees in writing and are supported by delegations to the international committee meetings.

While there is some governmental participation in both the Advisory Groups and the delegations to meetings, it is manufacturers who provide the major commitment and most of the leadership in U.S. international standards activities. It is vitally important for branches of government to become more viable in forming U.S. positions. For example, if a GATT Code of Conduct is approved, it will probably require agencies like the CPSC, OSHA, EPA and FEA to use international standards and acceptance procedures or defend their reasons for not doing so. It is obvious that such agencies need to have a strong role in the U.S. Advisory Groups that present the U.S. positions. This will require new policies by many agencies and a greater commitment of

manpower and travel and other expenses to assure the Agencies can carry out the authorities and responsibilities for which they were created.

THE USE OF INTERNATIONAL STANDARDS IN THE UNITED STATES

Throughout this presentation, I have been talking about the growing acceptance of international standards, but I have not given much of a picture on the use of international standards in the United States. The fact is, I don't know the picture very well, and I don't think any one else does either. As past President of the U. S. National Committee of IEC, I set up studies to determine the extent to which IEC standards were used in the United States, but the technical experts simply could not take enough time from their regular jobs to make proper analyses. We did learn that most products made to U.S. standards will meet the international standards; but we also learned that many U.S. standards are sufficiently different from, or more demanding than, the international ones. This means that other countries may often have to make special products for sale in our markets even though they meet the international requirements. A GATT Code of Conduct, a change in our NATO procurement policy, adoption of metric system, and other such actions may make it difficult for us to continue our present practices. Since a high percentage of our standards are for voluntary use, the problem is even more complicated. What is needed is a thorough study of international standards in comparison with United States standards to see how different we are and the extent to which we can justify such differences. It seems to me that this can be done only by a federal agency or under a federal contract to some private organization.

THE APPLICATION OF NEW TECHNOLOGY IN STANDARDS

Our voluntary standards system in the United States is a heterogeneous one with many organizations participating in it. The organizations that have good standards development programs, up-date their standards regularly to take into account new technological developments, to the extent that they are able to do so with the usual procedures that require a "consensus" of all affected parties. It must be recognized that it is often difficult to make changes even when there is a large majority in favor of the changes because the majority falls short of that considered for a consensus.

Another problem with the present system in the United States is "national acceptance" of a standard once it has been up-dated with the necessary consensus for approval. This is especially true when voluntary standards are adopted into federal, state, or local government regulations or purchase specifications, which often are more difficult or

more time-consuming to update. Even within the voluntary system, there are delays by the national approval body, ANSI, because of challenges by minority positions or simply by procedural delays.

The technical committees of the major standards bodies are broad-based, highly competent technically and well informed about new scientific advances that need to be taken into account, but even the experts disagree on the application of new technology. New requirements in standards often have to be the best considered judgment of the committee members backed up, in many cases, by limited experience data, i.e., compromises.

It is usually these kind of technical committees that become our Advisory Groups for international standards committees. This is generally helpful to both the national and international standardization because it provides a cross-fertilization of knowledge with experts in other countries and broadens the technical experience base. On the other hand, international standardization tends to proceed more slowly because of the wide differences in the needs of industrial and developing countries and the fundamental approaches to defining and prescribing the requirements. Some help is provided by the many international professional organizations which hold regular meetings and seminars to discuss technical developments. Many of these make suggestions to the standards bodies as to how to proceed with the standards-writing. A typical example is CIGRE, which has become a technical forum for the advancement of IEC requirements in the power field.

The federal involvement in these activities is mixed. In some cases, for example the UN programs under the WHO, ILO, and ITU, the U.S. government provides the leadership and considerable financial support for U.S. participation. In other cases, there appears to be little government interest. A review of the whole structure is overdue.

FINANCING U.S. PARTICIPATION IN INTERNATIONAL STANDARDS WORK

I pointed out earlier that the harmonization in Europe, the developments in GATT and NATO, and similar activities in other organizations has caused a tremendous growth in the work of international standards bodies. There are more committees that meet more frequently, with larger agendas and a corresponding increase in cost. The situation is especially critical in ISO and IEC, which are private organizations financed through dues of the member bodies. The member bodies in ISO are the national standards institutes and in IEC are National Committess, specially organized for particiption in IEC work, but generally a part of or affiliated with the national standards institutes. In most countries, the member bodies of ISO and IEC receive

full or partial support of their national governments and in many cases are actually agencies of the national government. The U.S. members of ISO and IEC are the only, or among a few, who receive no direct national government support. It is now becoming very difficult for the U.S. bodies to pay the dues required for membership in ISO and IEC and at the same time to provide all of the extra costs that are necessary to support effective U.S. participation efforts.

CONCLUSIONS

It is apparent, at least to me, that international standards are, more and more, going to impact on all parts of our U.S. standardization systems-the government regulatory and procurement practices as well as the development and use of voluntary standards. I don't believe this fact is appreciated fully yet by either the government sector or the private sector.

I believe the time has come for a formalized federal-private body to provide an overview of our national standards policies and activities. Frank LaQue has suggested that perhaps we need a Standards Council of the United States to serve this purpose. In his view the Council could be a very small quasi-government body organized somewhat like the NAS. He would use the Interagency Committee on Standards for the government input into the Council and ANSI for the private input. The idea has some merit and deserves consideration.

The title of this presentation asks the questions - Should We Internationalize our National Standards" Maybe the real question is not "should we do this" but "how can we do it successfully." I hope this committee will give some thought to the problem.

APPENDIX H

U.S. PARTICIPATION IN INTERNATIONAL STANDARDS WORK

By: W.A. McAdams, General Electric Co., Vice-President, ASTM.

The two main organizations for developing international standards are the International Electrotechnical Commission (IEC) and the International Organization for Standardization (ISO). IEC prepares standards in the electrical and electronic fields; ISO in all other fields. Fcllowing is a brief summary of their technical activities.

Technical Work IEC and ISO

	IEC	ISO
Countries participating	42	75
Technical Committees	72	150
Subcommittees	105	495
Standards published	1200	2500
Pages included	38000	32000
Meetings of Committees and Subcommittees per year	125	400
New Standards per year	160	500

ISO and IEC both have headquarters in Geneva, in the same building, and maintain close liaison with each other to avoid duplication of work. Jurisdictional disputes are usually settled amicably by the officers and Secretary Generals of the two bodies.

History and Organization

The IEC was formed in 1906 as a result of a resolution passed at the International Electrotechnical Congress held during the Louisiana Purchase Exposition at St. Louis in 1904. From the beginning, its members have been National Committees, one for each country, organized especially for participation in the IEC. These National Committees have various roles and status within their countries, but each is broadly representative of all interests in the electrical and electronic fields- producers, users, academia, branches of government, testing and approval bodies and independent experts. Most are affiliated or operate under the National Bureau of Standards or the National Standards Institute of

their countries but some are special government agencies or independent bodies. All but a few are totally or partially subsidized by their governments. One important characteristic of the IEC and its National Committees is that the leaders of both are themselves highly regarded engineering or scientific people in electrotechnical fields.

The ISO was founded at a special meeting in London in 1946. The members are the national bodies considered to be the "most representative of standardization" in their countries. More than 70% are government agencies or organizations chartered under national laws. Most of the others have close links with governmental bodies and practically all are fully or partly subsidized by their governments. In some cases, the government funding is proportional to the financial support provided by the private sector and is for assistance to both the national and international standards programs. Often the governmental support includes specific appropriations for dues to the international bodies. In some cases, the appropriations to the national standards bodies include funds for the dues to both ISO and IEC even where the National Committees for IEC may not be a formally established entity of the national standards body.

The leaders of ISO policy and decision making are, for the most part, the administrative heads of the national standards bodies rather than leaders or professional experts in ISO technical fields.

From an organizational standpoint, the main difference between IEC and ISO is the management and operation of the Technical Committees and their work.

The IEC, has a technical policy board, called the Committee of Action, which determines priorities, establishes and discharges committees, and regularly reviews the progress and usefulness of each committee and its work. The ISO has no equivalent technical policy body. Its technical work is managed by the ISO Council which handles all the business of the organization. As a result, the Technical Committees of ISO have much less supervision than in IEC.

The most important differences between IEC and ISO are in the actual operation of the committees. In both organizations, the Secretariat of the committee is responsible for the administration and progress of the committee work. In IEC each committee (and subcommittee) has a permanent Chairman who assists the Secretariat. In ISO, the committees have not had permanent Chairmen, but have elected a Chairman at each meeting. ISO is now changing to the IEC arrangement.

In IEC all National Committees are considered to be members of all Technical Committees. All documents developed in a committee and all comments from members are circulated through the Central Office. This assures that all National Committees will review all documentation on all IEC Committee work. It also enables the Central Office to set standard formats for preparing documents and comments. This clarifies positions, improves the meeting discussions and simplifies final drafting and publication. The process greatly increases the Central Office costs, but National Committees are convinced that it is a more efficient and more equitable system than having the Committee Secretariats be responsible for the distribution of Committee papers.

In ISO the Committee Secretariat is responsible for translating and circulating all drafts, comments from members and other documents. The Central Office does not have the resources to operate as IEC does. Most members of ISO would like to change to the IEC system to obtain better control and efficiency, but the high estimates of costs to adopt the system have discouraged the change.

IEC and ISO Budgets

The IEC and ISO work has been expanding rapidly, especially over the last 10 years. This has, of course, required larger staffs and higher budgets. The following table shows the United States dues to both organizations for 1966, 1970, and 1976.

U.S. Dues to IEC and ISO

	IEC	ISO
1966	$ 24,250	$ 20,000
1970	55,000	46,000
1976	178,500	200,000

The dues to both organizations are paid by the American National Standards Institute and, as would be expected, the increases are of considerable concern to the ANSI Board of Directors and the ANSI membership. In actual fact, most of the increases have been due to the high Swiss inflation and the lower value of the dollar in comparison with the Swiss franc. Had there been a normal inflation of 3 to 5% and no dollar devaluation, the U.S. dues to IEC and ISO for 1976 would probably be under $60,000 each.

The dues to IEC and ISO are only a small part of the costs for participation in the work of the two organizations. The major portion of the costs are for the time and domestic travel of the several hundred advisory

groups in preparing the U.S. positions for the international committees. The expense is absorbed almost entirely by the employers of the individuals involved. The next highest cost is for delegate travel to international meetings. This expense is borne by the employers or by the various trade and professional organizations. The total cost of these two items is estimated to be in the order of $5 million annually. The U.S. National Committee of IEC has had little trouble in obtaining this kind of support and ANSI has been quite successful in obtaining similar support for most of the important sectors of the ISO.

It has been much more difficult to obtain support for the basic participation costs; i.e., the dues to ISO and IEC, the general staff support for coordinating U.S. inputs into the two bodies, and the operation of ISO and IEC Technical Committee (TC) secretariats. Following are the estimated 1976 costs of these activities.

1976 General Participation Costs for IEC and ISO

	IEC	ISO
Operation of TC Secretariats	$275,000*	$330,000
Staff Support for U.S. Advisory Groups	80,000*	120,000
General Coordination and Policy Administration	60,000	90,000
Dues	180,000	200,000
Total	$595,000	$740,000

All the costs shown in the table except those marked * are borne by ANSI. The items marked * are borne by the members or member organizations of the U.S. National Committee of IEC. The net budget costs to ANSI then are

IEC	ISO
$240,000	$740,000

At present ANSI has an income of about $1,300,000 from dues of member companies and organizations and a small surplus of about $100,000 from sale of publications. Its only other source of income is through special project funding. Special project funding for ANSI international

standards work has never been attempted and there is little enthusiasm for starting to do it now.

With an international standards budget about 70% of its total available income, it is obvious that ANSI can no longer finance continued participation in IEC and ISO work unless it finds new sources of income in the private sector or receives a subsidy from government as practically all other members of IEC and ISO do now.

ANSI Relationship with the U.S. National Committee of IEC

The U.S. National Committee of IEC (USNC) was formed in 1907. It has remained an independent organization since that time. In 1932, when the American Standards Association (ASA) (the predecessor of ANSI) was formed, the USNC became affiliated with ASA when ASA formally recognized its bylaws. That affiliation continued over the years. On January 2, 1973 ANSI and the USNC signed a new affiliations agreement under which the USNC retained its autonomy but agreed to have its bylaws, procedures, and policy and financial decisions approved by the ANSI Board of Directors, working through the ANSI International Standards Council. Under the agreement, ANSI agreed to pay the IEC dues and to provide administrative support for operation of the USNC. In return, the USNC continued to take responsibility for funding all IEC Committee Secretariats it undertook and funding the IEC meetings to be held in the United States. The USNC also agreed to work with ANSI in obtaining industry support for ANSI.

Recently, because of its large international standards budget, ANSI has decided to withdraw from the affiliation with USNC. A joint committee is being established to determine the future relationship between the two organizations. In the meantime, the USNC is taking steps to operate separately from ANSI. If a full separation is carried out, many of the ANSI member companies and organizations interested in IEC work will be asked to pay dues directly to the USNC. Most of these companies and organizations believe the dues they pay now to ANSI should cover the part of IEC expenses which ANSI now pays, especially since ANSI continues to pay an even larger proportion of the ISO expenses. The mattter will probably be settled by late summer.

Summary

The United States through ANSI and the U.S. National Committee of IEC has developed an excellent participation record in IEC and ISO especially during the last 8 to 10 years.

Cooperation between ANSI and the USNC has been excellent throughout the history of both organizations and can be expected to continue.

The only serious problem in the U.S. participation effort is the financial one. ANSI is not able to obtain adequate funding from the private sector to provide full support for the work in the future.

A recent example of ANSI participation in international standards affairs is the following:

The American National Standards Institute (ANSI) has recently designated the Standards Information and Analysis Section of NBS as the U.S. member of the International ISO Standards Information Network (ISONET). In addition, Dr. Lawrence D. Eicher, Chief of the Standards Information and Analysis Section, has been designated as the U.S. member to the ISONET management board.

As the national member of ISONET, NBS shall act as a reference point for other ISONET members for information on standards, technical specifications and related matters in their own country. The Information Centre of the ISO Central Secretariat shall act as a reference point for information on standards, technical specifications and related matters of an international nature.

APPENDIX I

FEDERAL INTERAGENCY COMMITTEE ON STANDARDS POLICY, PURPOSE, FUNCTION, MEMBERSHIP[1]

Purpose.

The purpose of the Committee is to facilitate the effective participation by the federal government in domestic and international standards activities and to promote the development of uniform policies among agencies participating in these activities. The establishment and application of appropriate standards for the characteristics or performance of goods and processes can contribute significantly to national and international prosperity, economic growth, and public health and safety. A well-considered federal standards policy reflecting the public interest can expedite the development and adoption of standards which will stimulate competition, promote innovation, and protect the public safety and welfare. Additionally, a well-implemented federal national standards policy would promote national defense objectives, reduce costs, and expand domestic as well as international trade. Growing national and international awareness of the importance of standards activities prompts the establishment of the Interagency Committee on Standards Policy to identify the broad roles and appropriate interactions of agencies of the government in these matters wihout interfering with the prerogatives of any agency in exercising its authority. The objective of the Committee shall be to promote effective and consistent standards policies of interagency concern in furtherance of United States domestic and foreign goals and, to this end, to foster cooperative participation by the federal government and U.S. industry and other private organizations in standards activities, including the related activities of product testing, compliance and certification programs.

Functions.

1. The Committee shall gather, analyze and maintain as appropriate current information about standards and related regulations, rules, and product testing, compliance and certification policies and activities:

(a) conducted within or established by various federal agencies;

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[1] Communication from Department of Commerce.

(b) conducted by private domestic and foreign national standards bodies and regional and international private and intergovernmental organizations involved in such programs;

(c) and the relationships of such programs among agencies of the federal government, industry, and the various national, regional and international organizations involved in such programs.

2. On the basis of such information, it shall make recommendations to federal agencies and to private organizations when appropriate with respect to:

(a) strengthening coordination of the policies and activities of such programs among the federal agencies;

(b) reducing duplication of efforts within the federal government and the U.S. private sector, and among regional and international organizations, both private and governmental, involved in such programs;

(c) promoting uniformity of policies consistent with statutory obligations within the federal government in regard to interactions with non-Federal government organizations involved in such programs;

(d) assessing and improving the adequacy of such programs;

(e) ensuring effective representation of United States interests, both federal and private, at significant regional and international conferences related to such programs;

(f) identifying American, foreign national, regional and international standards and related programs which act as unwarranted barriers to trade and recommending remedial actions;

(g) proposing and promoting international standards and related activities with a view of increasing trade and economic integration and development, and otherwise furthering United States foreign policy objectives.

Membership.

1. Together with the Department of Commerce, the following agencies shall constitute the initial membership of the Committee:

Department of State

Department of the Treasury

Department of Defense

Department of Justice

Department of the Interior

Department of Agriculture

Department of Labor

Department of Health, Education and Welfare

Department of Housing and Urban Development

Department of Transportation

U.S. Postal Service

Small Business Administration

Consumer Product Safety Commission

Environmental Protection Agency

Energy Research and Development Administration

Nuclear Regulatory Commission

Federal Communications Commission

Federal Trade Commission

General Services Administration

National Aeronautics and Space Administration

Federal Energy Administration

Office of Management and Budget

Office of the Special Representative for Trade Negotiations

Council on Environmental Quality

The formation of this Committee in itself has underlined the importance of standards. Its influence, while diffuse, has focused attention on the general problems involved in standards within the federal government.

APPENDIX J

FEDERAL STANDARDS ACTIVITIES OTHER THAN DoD

1. NATIONAL BUREAU OF STANDARDS

The National Bureau of Standards (NBS) is the repository of and maintains the fundamental physical standards in the U.S. It is at the forefront of research in improving the accuracy and in disseminating the use of these standards.

NBS maintains the Index of U.S. Voluntary Standards[1] which, together with its foreign standards listing, is the largest compendium of standards available anywhere. Access to the listings is available on a quick and easy basis. The NBS Standards Information Service maintains a reference collection of more than 240,000 U.S., foreign national, and international standards and provides information on the availability and source of standards.

NBS has the facilities and organization to initiate and develop standards using the full consensus procedure where none exist and where a real need for a standard has been demonstrated. While it encourages the non-government voluntary system to develop and maintain standards, NBS has the potential for generating standards if the non-government voluntary system does not act, but it currently does little in this regard.

The National Bureau of Standards through its personnel with memberships on many committees in the voluntary system has an important and salutary influence on the quality of standards produced. This is due not only to participation in meetings but also to support work done in the NBS laboratories. Competence of the NBS people covers a wide section of the economy and their influence is many times the proportion of their participation.

It would be inappropriate to list all of the activities of the NBS in this discussion, but its educational and training activities in the field of standards of measurement and in providing model codes for state and local governments should be mentioned. Such model codes are the documents which determine how referenced standards are used and applied.

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[1] NBS SP-329.

NBS also provides technical support for the National Conference of States on Building Codes and Standards in its continuing efforts to overcome the debilitating economic and regulatory problems caused by the great fragmentation of codes as used by cities and local jurisdictions. State governors are well aware of the problems of codes and standards and standards that would be generated if this Conference did not exist. Unfortunately top management in government and industry have not in a like manner recognized the opportunities of improved specifications and standards which are the crux of the whole procurement process.

2. DEPARTMENT OF LABOR

The Department of Labor is required to enforce the Williams-Steiger Occupational Safety and Health Act of 1970 (OSHA). For our purposes, it is also convenient to consider here the National Institutes of Occupational Safety and Health (NIOSH) which, although part of the Department of Health, Education, and Welfare, supplies the technical backup for the Labor Department

NIOSH develops criteria documents or drafts which may form the basis for standard writing by the Department of Labor. They have set themselves a time span of 8 to 12 months for the development process. So far, they have concentrated on criteria relating to the health aspects of their mission rather than to the safety area. They have developed an internal procedure for developing the background for value and regulatory standards. A comprehensive worldwide literature search is interpreted by NIOSH personnel, and is then exposed to external experts for review. Representatives from industry, medicine, public health, and so on, are involved in this process. The modified criteria are then exposed to an open review by the National Academy of Sciences, professional societies, and various other federal agencies. The completed document is then forwarded to the Department of Labor for further action.

In the health area, NIOSH has in-house technical resources of a fairly basic type and is expanding its activities in the safety field. The Occupational Safety and Health Administration (OSHA) has used consultants to supplement its skills, as in examining the economic implications of the draft asbestos fiber standard.

The Occupational Safety and Health Act requires the Department of Labor to use the voluntary standards system, if feasible. During the first two years of its charter, it was empowered to take existing national consensus standards and convert them directly into regulations without further comment. Now that the two-year period has elapsed, it can take existing voluntary standards, expose them to a review

and comment procedure through the Federal Register, and then promulgate them as regulations.

When a standard does not pre-exist, OSHA prepares a draft, has it reviewed externally by a panel of experts, offers it for public review, and then turns it into a regulation. The law also makes provision for the voluntary bodies to request standards development through advisory committees.

OSHA is using ANSI (American National Standards Institute), both as a coordinator and as a resource for developing standards through the sponsorship of organizations like National Standards Committees (NSC). It views ANSI as offering some advantages in that the labor unions are represented on some of their standards-writing groups. OSHA is also planning to use consultants to pull together sets of existing standards into comprehensive manuals for specific types of small businesses. OSHA activities are increasing and the need for standards is substantial. There are significant labor and consumer overtones in the OSHA standards development process.

3. CONSUMER PRODUCT SAFETY COMMISSION

The Consumer Product Safety Act (December, 1972) empowers a five-member commission to regulate a very broad range of products which the consumer uses or is associated with. The former chairman, Richard O. Simpson, and the present chairman, S. John Byington, have actively supported the voluntary standards system, both in the national and international scene. The Act was the culmination of some years of activity by the National Commission on Product Safety. The Act requires that if a need is established, the Commission is to use voluntary consensus standards if these are applicable. If not, then a "notice of need" in the Federal Register will provide an opportunity for any voluntary standards-writing body to offer to develop standards. A 120-day period is allowed for the preparation of a standard, with a provision for extensions, should The Commission so determine. It should be noted that the law requires "opportunities for interested parties to participate"; it does not specify that a consensus process be used. The Commission expects that consensus process will be achieved through the Federal Register public review and comment procedures. The draft must be accompanied by accident analyses, test data and technical-backup documentation, and quality control plans. The powers of the Commission are very broad. The intention of the Act was to provide a means for regulating all products connected with the consumer that were not already subject to regulation under existing legislation. The law further provides that the flammable fabrics activity of the Department of Commerce, some duties of the Federal Trade Commission, and

the Bureau of Product Safety, Food and Drug Administration, be incorporated into the new agency. The agency is also empowered to provide financial assistance for standards development if the need is justified and provides for the commissioners to establish procedures for the development of standards.

The type of standards needed are both materials and methods, and regulatory. For example, in the flammability area, it is necessary to develop a standard test before it is possible to set a regulatory standard. Such tests are difficult and controversial, and the setting of pass-fail criteria must take into account the cost-benefit consideration. It should also be noted that the safety of consumer products is of interest to the General Services Administration and the Department of Labor since many consumer-type products are also used by federal government agencies and by industry.

4. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE (HEW)

At the moment, HEW has very limited powers in regulating medical devices of substantial interest to the DoD medical services. However, a bill now before the House, HR 6073 (the Staggers bill), would give the agency broad powers over everything from a tongue depressor to a sophisticated piece of electronic equipment. This bill would require the use of the voluntary standards organizations; it may be passed within one to two years, particularly since hospital authorities are highly critical of the current confusion and lack of standards in this field.

The bill provides for standards relating to the composition, construction, identification, and performance of devices, and requires that testing, measuring characteristics, installation, maintenance, and operation and use, be also standardized. As in the Consumer Product Safety Act, the federal agency can contribute to the cost of standards writing. Generally sophisticated materials and methods-type standards are involved, although defining hazard levels will involve risk-benefit decisions similar to regulatory standards.

Standards practices and test methods developed by such organizations as the College of American Pathologists and the American Association of Clinical Chemists play an important role in clinical laboratories. However, the practices and accuracies of some clinical laboratories have been criticized by the medical profession, and the National Committee on Clinical Laboratory Standards was formed in order to develop standards for the accreditation of such laboratories.

5. NUCLEAR REGULATORY COMMISSION (NRC)

Emphasis has shifted at NRC from value and regulatory standards to the M&M type. This reflects the emergence of reactor design and operation from experimental stage to a more routine operation. The rapid development of M&M standards, says NRC would speed up the process for bringing nuclear power plants on-stream through the simplified approval of the plans. ANSI is used by the regulatory branch of NRC as the coordinator for voluntary standards activity, and ANSI has undertaken a program for standards development through appropriate organizations. The NRC regards the American Society of Mechanical Engineers (ASME), American Society for Testing and Materials (ASTM), and the American Nuclear Society (ANS) as important resources. ASME has played a dominant role in the Boiler and Pressure Vessel Code. The voluntary standards emerging from the system will be subjected to internal review at NRC and will then follow one of two courses: they may be exposed to public hearing and comment and issued as a regulation; or, they may be adopted without the public comment process as an "acceptable method". A modest grant has been given to ANSI to assist them in administering the program.

6. GENERAL SERVICES ADMINISTRATION (GSA)

The Federal Property and Administration Services Act of 1949, Section 206(b) requires each federal agency to utilize standard purchase specifications ". . .except as the Administrator of the GSA, taking into consideration efficiency, economy, and other interests of the government, shall otherwise provide". This same Act gives the Administrator of the GSA the authority "to prescribe standard purchase specifications".

Under the authority of this Act, the Federal Supply Service of the GSA, by delegation, administers the Federal Standardization Program to develop and maintain a wide range of specifications and standards to describe the technical requirements for materials, products and services procured by federal agencies. As of September 1976 approximately 6200 federal specifications and standards were listed in the Index of Federal Specifications and Standards. Over half of these federal specifications and standards are actually maintained by other federal agencies under the Assigned Agency Plan administered by the FSS-GSA. (See below for DoD)

Federal Procurement Regulation 1-1.305 defines several categories of specifications which can be used by federal agencies. These are the Federal Specifications and Standards, the Interim Federal Specifications and Standards, the Military Specifications and Standards and Departmental Specifications. Federal specifications and standards are

normally issued in lieu of the other documents identified when two or more federal agencies are involved and at least one is a civil agency. Federal specifications and standards are mandatory for use by all federal agencies; whereas Interim Federal and Departmental specifications and standards, while encouraged, are usually optional or limited. Federal Property Management Regulaticns (41 CFR 101-29) cover the mandatory provisions of federal specifications and standards.

Federal Qualified Products Lists are also developed and maintained, in association with a federal specification, under the Federal Standardization Program for selected items meeting established criteria. The Administrator of the GSA has the authority to levy charges to cover the costs of testing on suppliers applying for qualification. Testing costs may be borne by the government when deemed in its best interest.

There is significant collaboration by federal agencies with the GSA in the development, coordination and maintenance of federal specifications and standards with the greatest collaboration between the DoD and GSA. The DoD currently (as of September 1976) has been assigned the responsibility to be the preparing activity for approximately 3600 federal specifications and standards.

7. DEPARTMENT OF TRANSPORTATION (DoT)

Standards development at DoT is moving from value standards through regulatory standards toward the Materials and Methods type. DoT believes, however, that their in-house procedures, developed for cost benefit analyses, have pioneered in this difficult field, and provide skills that cannot readily be obtained elsewhere. DoT regards voluntary standards as basically unsuited for conversion to regulations. Thus, the DoT approach is to look in-house for their "software" and to the trade associations for technical expertise. DoT standards have a direct bearing on industry support of Department of Defense needs in aircraft, over-the-road vehicles, rail vehicles, and freight handling.

8. ENVIRONMENTAL PROTECTION AGENCY (EPA)

Greater collaboration with private sector organizations is being sought. The Director of Standards and Regulations Coordination, Office of Planning and Evaluation, explicitly states that the Agency seeks to solicit collaboration from the voluntary system for their substantial in-house technical capabilities. This is an instance in which Materials and Methods standards may be the key to assessing levels of contaminants for purposes of regulatory standards. Standard test methods in the water area are almost universally based on "Standard Methods for the Examination

of Water and Waste Water" (SM), now in its thirteenth edition. The test methods are used by federal, state, and local agencies. This work is the result of a continuing cooperative effort among the American Public Health Association, the American Water Works Association, and the Water Pollution Control Federation, plus significant inputs from members of EPA (formerly Public Health Service).

Federal effluent "guidelines" and economic impact statements are being generated through substantial use of consultants. The agency (hence, the consultants) is under great pressure to meet deadlines required by law. The interaction between state agencies and federal authorities is complex.

In addition to air and water, EPA has responsibility for the Noise Control Act of 1972, under which it is required to submit noise emission standards for products distributed in commerce.

It is clear that EPA activities will bear on the welfare of the industrial base for DoD production as well as on DoD activities directly since it is DoD policy to conform to EPA regulations except in national emergencies.

9. DEPARTMENT OF COMMERCE

9.1 FORMER REGULATORY ACTIVITIES. Standards needs in the Department of Commerce, associated with the Flammable Fabrics Act, have been transferred to the Consumer Product Safety Commission (CPSC). CPSC has established a working relationship with the National Bureau of Standards Fire Research Center for technical support. This center assists in preparing regulatory standards in such areas as carpets, mattresses, and sleepwear. Work on furniture flammability is also in process. Like other safety standards, flammability standards[1] have a large emotional content. The development of test procedures which can be extrapolated to real life is extremely difficult and the setting of acceptable safety levels has large non-technical inputs. Industry has generally adopted a "wait and see" attitude toward flammability regulations, so that when action is required, the time span is short and the activity is intense.

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[1] The reader's attention is directed to the work of the NMAB Committee on Fire Safety Aspects of Polymeric Materials.

In considering flammability, one must distinguish between the development of standard test methods and the development of flammability standards; the latter implies pass-fail criteria; the former does not.

9.2 NATIONAL BUREAU OF STANDARDS. While nominally under the Department of Commerce, the NBS has sufficient special interest that its flammability work as well as its other work was discussed separately earlier under 4.3.2.

10. VETERANS ADMINISTRATION (VA)

The Veterans Administration buys commercial type products and services through six industry divisions headquartered in the VA Marketing Center. These divisions are:

M1: Medical, dental, and scientific supplies;

M2: Medical equipment for operating rooms;

M3: Administrative/medical equipment (this is a "conglomerate" -- general supplies, hearing aids, prosthetic devices, etc.);

M4: Subsistence supplies;

M5: Drugs and chemicals; and

M6: Radiological and nuclear supplies.

Some 160 hospitals are supplied by these divisions. Each division does its own specification setting using federal specifications where applicable and other standards when federal specifications are not available.

The trend is for specifications to have performance statements; this will require a larger role to be played by certifying laboratories.

APPENDIX K

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

OFFICE OF FEDERAL
PROCUREMENT POLICY

November 30, 1976

TO THE HEADS OF EXECUTIVE DEPARTMENTS AND ESTABLISHMENTS

SUBJECT: Proposed OMB Circular on Federal Interaction with Commercial Standards-Setting Bodies

Enclosed is a proposed OMB Circular (Attachment A) establishing a uniform policy for all executive branch agencies in working with commercial (non-Federal) standards-setting bodies. The proposed Circular, requested by the Secretary of Commerce, results from the development and approval by the Interagency Committee on Standards Policy (ICSP) of certain principles for a uniform, Government-wide policy in this area. The ICSP, chaired by the Department of Commerce, has its membership drawn from 22 executive departments and agencies (see Attachment B).

Standard definitions, specifications, test methods, and performance requirements are essential elements of conducting business and discharging procurement and regulatory responsibilities both in the Federal and non-Federal sectors. Over the years, an effective system of voluntary consensus standards activities has developed in the non-Federal sector. In that system, a wide range of interests meld their expertise and compromise their differences with the result that many commercial standards (i.e., standards established by activities which are not conducted by the Federal Government) are solidly based and widely accepted. Although effective Federal Government coordination and cooperation with appropriate domestic and international standards organizations could result in significant public benefits, including stimulation of economic growth, competition, and innovation, coordinated Federal involvement has been lacking.

The proposed Circular incorporates the principles espoused by the ICSP as well as statements of purpose, definitions, and responsibilities enunciated by that body. Responsibilities for implementing this proposed Circular are assigned to the individual departments and agencies, and to the Department of Commerce which, though the ICSP, will act in a coordinating capacity. Placement of the coordinating role with the Department of Commerce reflects that Department's responsibilities for national standards of

measurement and standardized test methods as expressed in Title 15, United States Code.

Comments on the proposed Circular should be forwarded to this Office not later than December 31, 1976.

Hugh E. Witt
Administrator

Attachments

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

Attachment A

CIRCULAR NO. A-

TO THE HEADS OF EXECUTIVE DEPARTMENTS AND ESTABLISHMENTS

SUBJECT: Interaction with Commercial Standards-Setting Bodies

1. Purpose. This Circular establishes policy to be followed by executive branch agencies in working with commercial standards-setting bodies to develop, improve, and use standards for materials, products, systems, and services.

2. Background. The Federal Government purchases many products and services and regulates many activities which affect health, safety, and the national economy. To insure that such products possess appropriate quality characteristics, the Federal Government must depend upon reliable standards for product specification, quality control analysis, and performance testing. For example, the widely accepted standard for Portland cement (Federal Document SSC-1960-3) is used to guarantee consistent quality in this important construction material. Over the years, an effective system of voluntary consensus standards activities has developed under the leadership of the American Society for Testing and Materials, American Society of Mechanical Engineers, American National Standards Institute, and many others. In this voluntary system, a wide range of interests meld their expertise and compromise their differences, with the result that the standards produced are solidly based and widely accepted. Federal reliance on such standards, whenever practicable, will reduce the cost of developing standards and minimize confusion among those who deal with them.

3. Coverage. This Circular applies to all executive agency involvement in commercial standardization activities, both domestic and international.

DRAFT

4. Objectives. The objectives are to insure maximum practicable use of commercial standards by the Federal Government and active participation of the Federal Government in development of such standards.

5. Definitions. As used in this Circular:

a. Executive agency (hereinafter referred to as agency) means an executive department, a military department, and an independent establishment within the meaning of sections 101, 102 and 104(1) of Title 5, United States Code, and also a wholly owned Government corporation within the meaning of section 101 of the Government Corporation Control Act (31 U.S.C. 846).

b. Commercial standards-setting bodies are domestic and international standardization bodies, including nonprofit organizations, operating outside of the Federal Government or its agencies. They do not include the development and adoption of professional standards of conduct and standards of private companies; nor the United States' participation in international standardization activities pursuant to treaties.

c. Commercial standard means a prescribed set of rules, conditions, or requireerements established by commercial standards-setting bodies, as defined in 5b, concerning definition of terms; classification of components; specification of materials, performance, or operations; delineation of procedures; or measurement of quantity and quality in describing materials, products, systems, services, or practices.

d. Standardization and standards-setting activities mean the process of developing the rules, conditions, and requirements defined in 5c above.

e. Cooperative testing means testing by interested parties to establish such things as precision, accuracy, and reliability of standards.

6. Policy. It is the policy of the Federal Government to rely on commercial standards, both domestic and international, whenever feasible. The policy embodied in the five elements below is consistent with and in furtherance of the Federal Government's general policy of using commercial products whenever feasible and relying on

the private enterprise system to supply Government needs for products and services, as enunciated in OMB Circular No. A-76. Agencies will:

a. Participate in commercial standards-setting activities when such participation is in the public interest and is compatible with the agency's missions and authorities. Participation by agency personnel shall have the approval of appropriate officials and shall be consistent with the agency's regulations issued pursuant to paragraph 7a of this Circular, but of itself does not connote agency agreement with or endorsement of decisions reached. Such participation, where the agency's budget permits, may include:

(1) direct financial support, e.g., grants, sustaining memberships, and contracts;

(2) indirect or administrative support, e.g., travel cost, and document preparation; and

(3) technical support, e.g., cooperative testing for standards evaluation.

b. Encourage commercial standards-setting bodies with which they interact to observe rules and procedures that ensure prompt and full consideration of the views and interests of all who might be materially affected by their actions, and evaluate participation in these bodies in light of their adherence to such rules and procedures.

c. Use commercial standards in lieu of in-house standards when they will serve the agency's purpose and are consistent with applicable laws and regulations, and give such commercial standards preference in procurement actions unless use of such standards would result in higher cost to the Government.

d. Cite applicable commercial standards in Federal Register publications, regulatory orders, or related in-house documents.

e. Plan jointly with the commercial sector to ensure a coordinated effort in resolving priority standardization problems.

7. Responsibilities.

a. Each agency will, within six months of the date of this Circular, implement the policy principles in paragraph 6 to the extent compatible with its mission responsibilities. In taking this action, the agency should recognize the positive contribution of standardization and related activities, such as product and compliance testing and certification. It must, however, be recognized that these activities, if improperly conducted, could suppress free and fair competition; impede innovation and technical progress; exclude safer and less expensive products; or otherwise adversely affect trade, commerce, health, or safety. Full account shall be taken of applicable Federal laws, policies, and national objectives including, for example, laws and regulations relating to antitrust, national security, product safety, and conflict of interest.

b. The Department of Commerce shall be responsible for coordinating the implementation of said policy principles through an Interagency Committee on Standards Policy established to foster cooperative participation by the Federal Government and U.S. industry and other private organizations in standards activities, including the related activities of product testing, compliance, and certification programs. The Department of Commerce shall, through said interagency committee, periodically advise OMB concerning implementation of the policy principles set forth in this Circular.

8. Inquiries. For information concerning this Circular, contact the Office of Management and Budget, Office of Federal Procurement Policy, telephone number (202) 395-3336.

DIRECTOR

(No. A-)

DRAFT

Attachment B

INTERAGENCY COMMITTEE ON STANDARDS POLICY
as of July 21, 1976

Members

Department of Agriculture
Department of Commerce
Consumer Product Safety Commission
Department of Defense
Energy Research and Development Administration
Environmental Protection Agency
Federal Communications Commission
General Services Administration
Department of Health, Education, and Welfare
Department of Housing and Urban Development
Department of the Interior
Department of Justice
Department of Labor
National Aeronautics and Space Administration
Nuclear Regulatory Commission
Office of the Special Representative for Trade Negotiations
U.S. Postal Service
Small Business Administration
Department of State
Department of Transportation
Federal Trade Commission
Department of the Treasury

Observer

Office of Management and Budget