The Impact of Acquisition Reform on Department of Defense Specifications and Standards for Materials and Processes: Report of the Workshop on Technical Strategies for Adoption of Commercial Materials and Processing Standards in Defense Procurement, October 11-12, 2000, Washington, D.C.

Committee for the Workshop on Technical Strategies for Adoption of Commercial Standards in Defense Procurement, National Research Council

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THE IMPACT OF ACQUISITION REFORM ON DEPARTMENT OF DEFENSE SPECIFICATIONS AND STANDARDS FOR MATERIALS AND PROCESSES

Report of the
Workshop on Technical Strategies for Adoption of Commercial Materials and Processing Standards in Defense Procurement

October 11-12, 2000
Washington, D.C.

Committee for the Workshop on Technical Strategies
for Adoption of Commercial Standards in Defense Procurement
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Acknowledgments

This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the National Research Council's (NRC) Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process. We wish to thank the following individuals for their review of this report:

Kathleen Kono, American Society for Testing and Materials,
Robert Schafrik, General Electric Aircraft Engines, and
Trudie Williams, Defense Standardization Program.

Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the viewpoints expressed, nor did they see the final draft of the report before its release. The review of this report was overseen by James Mattice of Universal Technology Corporation. Appointed by the National Research Council, he was responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the authoring committee and the institution.

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Executive Summary

At the request of the U.S. Department of Defense (DoD), through its Defense Science and Technology Reliance Group Sub-area for Materials and Processes, a committee was formed by the National Materials Advisory Board (NMAB) to organize and conduct a workshop on technical strategies for the adoption of commercial standards in defense procurement. The interest in and concern about this subject emerged as a result of developments in the area of materials and processing specifications and standards following the issuance of the Policy Memorandum by Secretary of Defense William Perry on June 29, 1994, "Specifications & Standards—A New Way of Doing Business." The full text of that memorandum is given in Appendix A. While the intent of the Perry memorandum was to reduce system acquisition costs and complexity, implementation of the policy had some mixed and perhaps unintended consequences in the area of specifications and standards for materials and processes over the ensuing years.

The task of this workshop, which was held October 11-12, 2000, in Washington, D.C., was to examine the effects of the implementation of that policy memorandum to date. The problems that had been introduced were to be defined and actions were to be discussed that would allow taking better advantage of the opportunities available. It was not the committee's assignment to develop independent conclusions or recommendations based on the workshop activities. Rather, it was tasked with organizing and conducting the workshop and then preparing a report. By the same token, the workshop participants did not develop consensus conclusions or recommendations. Accordingly, this report highlights the important points of the presentations and resulting discussions, with emphasis on the observations, subjects of consensus and/or disagreement, and suggestions made by the participants in the workshop.

There were six sessions during the 2 days of the workshop. The 20 speakers who were invited to present their views on this subject had been carefully chosen to represent a broad base of organizations critical to this area. Included were representatives of the DoD, the military services, other government agencies—the National Aeronautics and Space Administration (NASA) and the Federal Aviation Administration (FAA)—airframe and engine original equipment manufacturers (OEMs), materials suppliers, the nongovernment standards bodies (NGSBs) involved in the preparation and publication of the industry standards now being emphasized by the DoD, and selected individual consultants.

During the course of the workshop, a number of very interesting and pertinent observations were made. One concern was brought up by a large number of participants—that support for NGSBs and participation in their work by technical personnel are being noticeably reduced. The representatives of DoD agencies indicated that they had not been allocated sufficient funding by their organizations to allow their technical personnel to be involved with the various NGSB committees to ensure that DoD interests are represented. Industry support is also decreasing as a result of inadequate funding and the loss of the skilled and experienced personnel who would otherwise be expected to participate on the appropriate committees. The lack of technical support is further complicated by the fact that the cancellation of military specifications

(MilSpecs) and their replacement by industry consensus or commercial specifications are greatly increasing the workload of NGSBs. This increased workload will be compounded as time goes on, since the specifications must be continuously updated on a 5-year basis. In addition, for the necessary materials procurement documents to be made available in a timely manner, the time required to generate new and updated NGSB documents must be significantly reduced. It was pointed out that the acquisition reform initiative did not mandate that all military specifications be canceled, as some individuals in the DoD had mistakenly thought.

Other observers said that some segments of industry had had little or no advanced warning of the cancellation of important military specifications and that they have not had sufficient information on DoD conversion plans. There were concerns expressed about the potential risks involved in changing detail specifications to performance specifications. With the loss of experienced technical personnel in both industry and the DoD, such a change can be risky for both performance and reliability. The conversion of military and federal specifications to industry consensus documents on a word-for-word basis has been causing some confusion on the part of buyers and suppliers. Some OEMs even questioned the value of canceling military specifications at all since they are so widely used in industry. They expressed concern that the cost of providing and maintaining the documents would be transferred to industry.

Another concern that was brought up frequently was that the DoD was not continuing to provide long-term support for military handbooks such as *Metallic Materials and Elements for Aerospace Vehicle Structures* (more commonly referred to as MIL-HDBK-5) and the *Composite Materials Handbook—MIL 17* (MIL-HDBK-17), which are sources of reliable and statistically valid data on metals and composites. Without those documents, there is concern as to the validity of mechanical property data used in specifications for those materials.

In light of the problems that arose as a result of the many actions taken in recent years, industry and the DoD might benefit from several changes, including providing adequate funding directly to the organizations responsible for supporting the NGSB activities. The workshop produced several common themes, identified a key barrier to the military use of commercial materials and process specifications, and identified keys to the rapid insertion of commercial technology.

The common themes across all sessions of the workshop were as follows:

- While the military can and does make use of many commercial items, certain military-unique items exist and will continue to require military-unique specifications that are best prepared and coordinated within military organizations of the DoD.
- Although contractors are scrambling to recover, the recent wholesale cancellation of military specifications has strained configuration control and increased product performance risk throughout the military supply chain. The additional cost to cope with this transition will continue over the next generation of contracts and products.
- Suitable NGSBs exist to meet the commercial needs of military products, but DoD member participation in these bodies is required to ensure that the resulting specifications meet military needs.

- The workload of these NGSBs has increased as a result of cancelled military specifications, but the participation of users and the DoD in nongovernment standards (NGSs) is decreasing and poses the risk that these "shared" specifications will not be adequately maintained to meet military-unique needs.
- Retirements and career decisions have led to an erosion of materials and process expertise within industry and the DoD at a time when increased efforts are necessary to continue the transition to performance specifications and NGSs envisioned by the acquisition reform movement.
- The foundations of national materials and processes reliability (MIL-HDBK-5 and MIL-HDBK-17) are in danger of losing their independence and credibility if these documents are no longer funded and maintained under government cognizance.
- The apparent lack of a DoD master plan and DoD master coordinator for the military materials and processes specification development strategy is causing confusion and delay during the acquisition reform transition.

The key barrier to military use of commercial materials and process specifications appears to be a lack of DoD participation in NGSBs, which poses a significant risk that specifications may not meet military needs.

Two keys to rapid insertion of commercial technology into DoD were identified:

- First, neutral (government) control of the fundamental materials databases (MIL-HDBK-5 for metals and MIL-HDBK-17 for composites) must be retained to allow rapid dissemination of reliable data. These handbooks foster the widespread use of new, commercially developed materials. Lack of such a common materials database will cause each contractor to develop its own data over a longer period of time (if ever) and delay the impact of using such materials by several generations of product design.
- Second, strong DoD materials and processes expertise is required to conclude the transition to NGSs and performance-based specifications and to leverage the benefits into real cost savings, but technical expertise and discipline are eroding. This expertise is essential to skillfully craft performance-based specifications, provide strong DoD participation in NGSBs developing the specifications, and manage the complex assessments to ensure that DoD program needs are satisfied by the commercial technologies.

This report summarizes the comments and suggestions made by each of the speakers, the results of the discussion sessions, and the common themes repeated throughout the workshop. It contains the original Perry memorandum (Appendix A), the workshop agenda (Appendix B), a list of participants (Appendix C), biographical sketches of the committee members (Appendix D), and a list of acronyms and abbreviations (Appendix E).

1

Introduction

BACKGROUND

In 1994, then-Secretary of Defense William Perry issued a policy memorandum directing the Secretaries of the military departments in the Department of Defense (DoD) to take concerted action to increase access to commercial state-of-the-art technology and adopt business processes characteristic of world-class suppliers. In addition to affecting many aspects of the DoD's procurement activities, the memorandum had a major impact on specifications and standards. The memorandum was interpreted by many as a directive that would

- Rescind military-unique standards and specifications.
- Establish performance-based specifications for new acquisitions and for system upgrades and modifications.
- Adopt commercial or industry specifications when necessary.
- Make the cultural changes that would encourage manufacturers to move toward the performance-based model.

In many areas of procurement, the results of this policy have been positive and will, it is hoped, help to reduce the complexity and costs of the DoD purchase of major weapon systems and their many support requirements. Many other aspects of the move away from military and federal specifications to commercial or industry documents have also been positive. However, in one particular area—specifications and standards for materials and processes—the changes introduced since 1994 have, as a result of various interpretations of Secretary Perry's specifications and standards directive, caused some concerns, which in turn led to the formation of this committee.

Even before the introduction of the 1994 Specifications and Standards activity, there was considerable interest on the part of the DoD and the U.S. Congress in considering the status and posture of commercial materials and process specifications and standards in defense procurement. The military specifications (MilSpecs) have been recognized as being of paramount importance and, in fact, critical for the economic design and procurement of DoD systems. Senate bills (e.g., S.3555, Voluntary Standards and Certification Act of 1976) and Office of Management and Budget circulars over the years have considered the many and complex ramifications of government use of the voluntary consensus standards system. A voluntary consensus standard is a standard developed or adopted by voluntary consensus bodies, both domestic and international. These standards require that owners of relevant intellectual property agree to make that intellectual property available on a nondiscriminatory, royalty-free, or reasonable-royalty

basis to all interested parties. These activities are represented by the efforts of the nongovernment standards bodies (NGSBs) in generating materials and process specifications and standards. A nongovernment standard (NGS) is a national or international standardization document developed by a private sector association, organization, or technical society that plans, develops, establishes, or coordinates standards, specifications, handbooks, or related documents. In fact, a detailed study by a previous National Materials Advisory Board (NMAB) committee in 1975 considered the total output of the NGSB activities at that time and the role NGSBs should play in DoD procurement. That committee's final report, "Materials and Process Specifications and Standards," NMAB-330, was published in 1977. One of its main conclusions stands out clearly today: The DoD should take advantage of the voluntary consensus standards system.

This shows that the issue of the DoD adopting commercial and industry specifications and standards for the materials and processes area is not new. As a result of the concerns previously mentioned and the historical interest in this topic, NMAB was informally asked by the DoD Materials Panel of the Joint Reliance Group to conduct a workshop that would explore the issues currently associated with the DoD's adoption of commercial materials and process specifications and standards. The key issues raised in the workshop are presented in this report.

OBJECTIVE AND TASKS

The objective of the workshop was to examine in detail the issues associated with adopting commercial materials and process specifications for DoD procurement. The participants were asked to identify approaches that would ensure compliance with DoD requirements while satisfying the intent of acquisition reform directives. The Committee for the Workshop on Technical Strategies for Adoption of Commercial Standards in Defense Procurement was formed to plan and conduct a workshop that would identify barriers to the implementation of commercial materials and processing specifications and standards for military systems. The committee, through the workshop, was to explore ways to take advantage of the rapid development of commercial technology in a more efficient and less costly manner. The specific tasks of the workshop included the following:

- Discussion of military services' requirements and the status of acquisition reform,
- Identification of applicable commercial standards and specifications, including appropriate NGSs,
- Identification of barriers to the adoption of commercial standards, and
- Discussion of the role of the DoD in supporting the preparation, evaluation, and implementation of commercial materials and processing standards and specifications.

It was not the committee's assignment to develop independent conclusions or recommendations based on workshop activities. Rather, the committee was tasked with organizing and conducting the workshop and then preparing a report. This report

highlights the important points of the presentations and resulting discussions, with emphasis on the observations, recommendations, subjects of consensus and/or disagreement, and suggestions made by the participants in the workshop.

COMMITTEE FORMATION AND ACTIVITIES

The committee was formed in January 2000 as a result of invitations to participate sent from the NMAB. It was intended that the committee would represent a cross section of the technical community involved in the preparation and use of materials and process specifications and standards for DoD applications. Included were representatives of original equipment manufacturers (OEMs), their subcontractors, materials suppliers, and independent consultants with significant experience in materials and processes and their applications.

The first meeting of the committee was held on April 3, 2000, in Washington, D.C. In addition to members of the NMAB staff, several technical representatives of DoD agencies—including the Defense Standardization Program Office, the Office of Defense Directorate of Research and Engineering, the Office of the Deputy Under Secretary of Defense, the United States Air Force, the United States Army, and the United States Navy—attended and participated in the discussions. After introductory comments, the workshop theme, objectives, and topics to be covered were discussed. A preliminary agenda was established, and the group then considered in some detail who would be asked to speak on these topics. At the conclusion of the meeting, individual committee members were asked to contact the potential speakers. Since this was the only meeting scheduled for the committee prior to the workshop, members were also assigned to serve as session chairs and session scribes; the latter would accurately record the comments and observations made during the workshop. The date of October 11-12, 2000, was agreed upon for the workshop, allowing the committee ample time to contact and confirm the speakers.

The decision was made to hold the workshop in the Washington, D.C., area, with NMAB staff to select the exact location and make the necessary arrangements. Since no more meetings of the committee were scheduled, all subsequent activities—inviting and confirming speakers and other participants—were to be handled by e-mail and telephone. NMAB staff sent formal invitations to the speakers asking them to participate.

The remainder of this report presents the details of the workshop, including summaries of the major points made by the speakers in their presentations and detailed descriptions of the questions asked after the presentations, as prepared by the session scribes. Also included are descriptions of the panel discussions held at the conclusion of each session, with the presenters serving as panel members. It was the committee's goal to accurately record the results of the workshop without editorial comment.

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Workshop Session 1: Past, Present, and Future of Specifications and Standards

The first session was designed to create a foundation of understanding among workshop attendees regarding the history and focus of evolving government actions to use commercial standards in defense procurement. The four session presentations, followed by the speakers' panel discussion, provided an overview perspective on a number of topics:

- Historical involvement of DoD and NMAB in specifications and standards focused on materials and processes,
- Original intent of laws passed regarding the ongoing Defense Standardization Program (DSP),
- The military aviation sector's real-world reaction to acquisition reform,
- Recent specifications and standards symposium sponsored by NDIA's Technical Information Division, and
- Current perception of the status and adequacy of ongoing initiatives and processes.

PAST DOD AND NMAB INVOLVEMENT WITH MATERIALS AND PROCESS SPECIFICATIONS AND STANDARDS

Jerome Persh, consultant to Zimmerman Associates, Inc., and the Institute for Defense Analyses, is a former staff specialist for materials and structures at the Office of Defense Directorate of Research and Engineering for Advanced Technology. He provided a historical overview of the involvement of DoD and NMAB in specifications and standards focused on materials and processes, tracing some 50 years of related NMAB activities. Emphasis was placed on the value of the continued leadership and guidance role that should be played by the NMAB in this subject area and the continued relevance of the conclusions contained in the 1977 NRC/NMAB report *Materials and Process Specifications and Standards*, NMAB-330, on similar workshop themes.

Mr. Persh began with a chronology of NMAB-related activities over the last 50 years and emphasized that the NMAB's role is still an important one. A review of the 1975 NMAB study led by Nathan Promisel (NMAB-330, mentioned above) showed that while it is the only existing study on the subject, it is still very relevant. The lessons to be learned remain the same, indicating that very little has changed since its publication. The main points of NMAB-330 were as follows:

- Costs need to be reduced. One should design to unit production cost rather than exclusively to performance.

- More effective use of standards, including commercial standards, is necessary.
- Industry standards should be used but converted carefully.
- Specifications and standards for materials and processing are a complex arena.
- Contractors should be more responsible for field maintainability and reliability.

However, in today's changing environment, a new paradigm may be needed. Globalization and international impact today are reasons to refocus. The message of NMAB-330, the need to "work toward a unified system of specifications and standards," is still valid today. The current workshop is an important start, but it might be advisable to revisit or even update the 1975 study. The workshop may be a good prelude to a full National Academy of Sciences study, since the issues are currently not well focused.

Mr. Persh closed by suggesting that, following this workshop, the DoD should sponsor a comprehensive NMAB study, including a full update of NMAB-330. There remains a need to provide national visibility and to focus on the use of specifications and standards.

DEFENSE STANDARDIZATION PROGRAM, MILSPEC REFORM, AND NONGOVERNMENT STANDARDS

Stephen Lowell, of the DSP Office, presented an overview of the original intent of laws passed regarding the ongoing DSP; the status of DSP objectives; the adequacy of communications and understanding throughout DoD and between DoD and industry; and the adequacy of DoD support for and interaction with commercial standards development organizations (SDOs). The SDOs cited or discussed at the workshop were the American Society for Testing and Materials (ASTM), the Society of Automotive Engineers (SAE), and the Performance Review Institute.

The use of nongovernment standards (NGSs) dates back to 1952 DoD policy, and the DSP is required by law. Mr. Lowell pointed out that the objective is an integrated, single, DoD-wide program with the highest practical standardization; however, the message of the Perry memorandum was misinterpreted as intending to get rid of all MilSpecs.

The key MilSpec reform policies are to give preference to performance specifications over detail specifications and to require waivers to cite detailed military specifications and standards. A DoD-wide program should be centrally managed but decentrally executed. One solution is through centralized, online data, but the heart of the process is consensus. He stressed that the law had been misunderstood; the intent was always to use NGSs where practical.

Mr. Lowell also pointed out the following:

- The DSP stated that government participation in NGSs was needed; however, no funds were provided.
- MilSpec reform policy was a real change. Now the use of MilSpecs must be justified.
- Currently, waivers are needed to require detailed military specifications and standards as a solicitation requirement.

- MilSpec reform actions are 98 percent complete; NGS actions are 70 percent complete.
- More opportunities exist to reduce acquisition costs, but time and funds are not available.

The DSP policies and laws are being successfully implemented but often are not well communicated or well understood. Government participation in NGSBs and involvement in NGS processes is constrained by time and funding. The adequacy of government support is suspect. However, in the context of current to near-term activities, some accomplishments of note have occurred:

- MilSpec reform as originally defined is nearing completion.
- The first ever U.S. national standards strategy was approved in September 2000.
- The DoD 5000 Series on acquisition policies is being extensively revised.

ISSUES AFFECTING THE DOD

Gary Adams, of the Aeronautical Systems Center at Wright-Patterson Air Force Base, provided an overview of the military (fixed-wing) aviation sector's real-world reaction to acquisition reform, emphasizing that the sector's first responsibility is to meet safety and mission requirements and to adequately serve its ultimate consumers: the pilots and operators.

Mr. Adams began with a top-down aviation sector view of how the real world uses specifications and standards. He stressed that the aviation sector must take a responsibility focus by certifying that aircraft are safe to fly and mission capable. The aviation sector has "enough control to meet responsibilities," and all other issues are secondary. However, it is also necessary to know that lower-level processes are suitable and to understand the basis for certification.

The Air Force Research Laboratory is an essential partner and the keeper of MIL handbooks. It is also a primary source of expertise necessary for pursuing the corporate mission.

Since the primary objective is to assess and manage risk, the strategy should have three priorities, according to Mr. Adams: joint service specification guides, interoperability, and affordability. The focus should be on the products that are purchased: for example, "buy equipment not titanium." The Army, Navy, and Air Force are working together in the aviation sector.

The use of NGSs is the "best choice within existing constraints," he said. This requires an unbiased process, where the ultimate consumer is of primary concern, not the buyers or sellers. Mr. Adams recommended that the aviation sector adopt bodies of standards rather than individual standards, but noted that there must be confidence in the process used to develop the standards. The downside is that the DoD and military services are not funding government participation in NGSBs; the discretionary budget is zero.

In summary, Mr. Adams believed the aviation sector is doing its job. Its focus is on its responsibilities to the pilots and operators. Emphasis is on alignment with

standards bodies, not standards. If standards are adequate for industry, then one must assume they are adequate for the government. Resources are not aligned with the stated policy to support NGS organizations; the DoD needs to align resources with stated policy or vice versa. A performance specification for NGSBs may need to be written.

OVERVIEW OF THE SPECIFICATIONS AND STANDARDS SYMPOSIUM SPONSORED BY THE NDIA'S TECHNICAL INFORMATION DIVISION

Timothy Guilliams, of the Boeing Company, provided an overview of the recent Specifications and Standards Symposium sponsored by the National Defense Industrial Association's (NDIA) Technical Information Division. This symposium, held in Baltimore, Maryland, on August 16-17, 2000, sponsored a variety of panel discussions relevant to the NMAB workshop:

- MilSpec reform, status and lessons learned,
- Future directions for specifications and standards in the DoD,
- The impact of MilSpec reform on industry, and
- DoD qualification program assessments.

The symposium overview reinforced many themes of the present workshop and is directly relevant to the workshop. The full proceedings of the symposium are available from the NDIA and on its Web site at <http://www.ndia.org/committees/techinfo>.

PANEL DISCUSSION

The four speakers assembled for a question-and-answer session with the audience at the end of the session's formal presentations. The following provides a general overview of the more topical questions along with a general description of speaker and audience responses to the questions. This part of the report should be considered qualitative and subjective in that many opinions, comments, and perceptions have been, by necessity, folded into it. The major issues covered during the Session 1 panel discussion follow.

Discussion question 1. It seems from the presentations that for the most part everything is going well. Is this is an accurate perception? Where are the "horror stories"? In practice, companies will probably use the "easiest nongovernment standards specification" available, so errors may occur (e.g., bolt integrity may suffer). Do we have a problem? What is really happening?

Integrated responses of panel and audience. Discipline may erode as a result of the initial use of NGSs. It was observed that MilSpec use has historically resulted in a disciplined, uniform process. If the use of MilSpecs is skipped over to save costs, the process may become dependent on the knowledge, expertise, and integrity of individual users, which increases program risk and variability. Further, historically, there has been a natural tension between program managers (responsible for cost and schedule) and the

engineering communities (responsible for "doing the job right"). Eliminating MilSpec leverage might disadvantage the engineering community vis-à-vis the program office, so that reliability and integrity could suffer. It was stated that the Air Force, to offset any loss of discipline, instituted two new policies intended to focus on operational safety and airworthiness criteria. The intent is to assure that technical discipline is present in the process and to allow engineers to prove that the technical responsibilities are being met. A related issue was raised—the need to create a culture of trust in the process between industry and government and program office and engineers. For the most part, the Army, Navy, and Air Force (i.e., the aviation sector) were said to be succeeding in this; there were no comments on other sectors.

Discussion question 2. What are the key challenges that must be met to move the process forward?

Integrated responses of panel and audience. Resources and perception are the key challenges. The messages sent by policy makers are different from the messages received at the working and implementation levels. We need to find the right number of specifications to maintain quality and will need to maintain some MilSpecs, which in some cases are the de facto industry standards. Government organizations lack budgets that would allow them to adequately participate in nongovernment SDOs. Government support was always intended and is needed to ensure that requirements are consistently met and prioritized. Further, there exists an underlying concern that the NGS system may not be working as well as we perceive, which is compounded by the fact that current government budgets are ad hoc and inadequate for support. We may be building the commercial standardization system on a seriously flawed existing system. The problem is complex and not solely due to funding issues. We may need new, fresh ideas and a new paradigm. The NMAB could serve as a catalyst for planning and focusing issues and policy-making discussions.

Discussion question 3. Are we really getting the job done, and how do we get funding?

Integrated responses of panel and audience. The consensus is that we are getting the job done at the product level, but a growing concern centers on our understanding of the lower-level processes and process assurances. For instance, are the material qualifications and design allowables still adequate? Additionally, significant cost reductions may still be possible at the lower levels. Unfortunately, neither adequacy studies nor pursuit of cost reductions are possible within the government-supported funding that currently exists. Historically, customers were able to supply funding for the lower-level processes due to MilSpec-related activities. Today, while it is recognized that standardization is a valuable corporate mission, funding sources are at the program level. No central pool exists, there is no sharing, and funding is not easily obtained.

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Workshop Session 2: Company, Commercial, and Military Specifications

The second session heard from four speakers representing NGSBs and the user community. They spoke on the workings of their organizations and the availability of NGSs that may meet military needs.

VIEW FROM THE AMERICAN SOCIETY FOR TESTING AND MATERIALS

Kathleen Kono, of the ASTM, presented an overview of the ASTM organization and specification system, reviewed some recent collaborations to meet military needs, and identified challenges affecting the coordination between ASTM and its military-oriented users. ASTM is a large, strong, stable NGSB that produces consensus-based specifications. Its three principles of consensus are openness, balance, and due process. A formal 5-year review process ensures technical accuracy. The ASTM annual budget of $29 million goes into the maintenance of 11,000 standards. Most of its funding is from the sale of standards. The sales, which are generated by 25 percent of its committees, support the remainder of the committees. Of the 32,000 members, only 22,000 actively participate. However, electronic forums and balloting are making inroads, increasing participation.

The ASTM has a long history of collaboration to meet military needs, and the DoD has adopted approximately 2,800 ASTM standards. However, declining DoD participation (33 percent decrease over the last 4 years) is a cause for concern. Management fails to encourage members to participate, and there is a lack of funding for members to attend meetings. The current number of DoD participants is 345, down from 513 in 1996. ASTM believes that DoD attendance at meetings and active participation on committees are key to meeting military needs because they

- Reduce resources required to develop and sustain military standards,
- Foster commercial and military integration,
- Ensure that standards meet DoD needs,
- Keep DoD up to date with commercial technology and industry experts, and
- Allow DoD staff to interact with peers, the number one reason why people participate in ASTM.

In summary, ASTM is capable of meeting military needs for NGSs, but government participation is vital to ensure that specifications and test methods address the appropriate requirements.

SOCIETY OF AUTOMOTIVE ENGINEERS AEROSPACE MATERIALS SPECIFICATION SYSTEM

Gary Pollak, of the Aerospace Materials Division of the SAE International, described the Aerospace Materials Specification organization and specification system.

SAE is a large, strong, stable NGSB, producing consensus-based specifications. There are about 2,600 documents in the Aerospace Materials Specification (AMS) domain, which has a long history of cooperation to meet military needs. It has a formal 5-year review process to ensure technical accuracy, and user members have authority to make changes and grant final approval. Properties are based on MIL-HDBK-5 qualification, and downgrades are forbidden. To shorten cycle time, AMS is also beginning to use electronic committee communications. Thus far, over 1,100 MilSpecs have been converted to SAE, and the projected total is about 1,500. A significant revision workload lies ahead to sustain converted MilSpecs, some of which are over 20 years old.

Participation by DoD members is sparse, and participation by user members from original equipment manufacturers is on the decline. SAE believes that attendance at member meetings and participation in committees is key to ensuring strong, relevant specifications. SAE wants adequate government participation and is concerned that MIL-HDBK-5 and MIL-HDBK-17 (national archives of metals and composites technical data) might not be sustained due to acquisition reform and the declining DoD standards budget.

Overall, the SAE/AMS system is capable of meeting military needs for NGSs. The continued participation of user members and an increase in government involvement appears necessary to meet the workload resulting from cancelled MilSpecs.

ISSUES RELATED TO QUALIFIED PRODUCT LISTS

Arshad Hafeez, of the Performance Review Institute (PRI), spoke of the need to maintain qualified product lists (QPLs) associated with specifications for military applications. He shared the progress of the institute's work with industry and the DoD to create a new document system to fill the vacuum resulting from cancelled military specifications and their associated qualified product lists.

QPLs have been used to control products for military-unique applications. Currently, there are 3,035 QPLs in the DoD Index of Specifications and Standards, of which 809 are aerospace-related. A void in control has resulted from the cancellation of QPL-containing military specifications. PRI has created a new QPL program to meet these military-unique needs. A strong QPL management council is in place and a successful QPL pilot program is under way. Fifteen PRI QPLs have been published so far, and PRI and industry partners are continuing to grow PRI's QPL program to cover additional commodities.

In summary, the PRI QPL system shows promise of filling the vacuum created by cancelled MilSpecs that contain QPLs. Continued user and government support is required to sustain this new program.

AEROSPACE INDUSTRIES ASSOCIATION EARLY WARNING PROJECT GROUP

Dennis Evans, of Pratt & Whitney, is chair of the Aerospace Industries Association Early Warning Project Group (EWPG). He presented an overview of the issues that had led to creation of the EWPG and identified future considerations related to these issues.

Industry was using many military and federal specifications as de facto global standards. About 5,000 DoD specifications and standards are of interest to the aerospace industry. OEMs and their supply chain had no advance notice of military specification cancellations, and the wording of cancellation notices was confusing to the supply chain. Questions arose concerning technical equivalency for newly referenced specifications, and there was a loss of configuration control.

The EWPG was established as an ad hoc defensive mechanism for notification and action planning for the aerospace industry. Other transportation systems (ships, ground vehicles, and so on) did not develop an EWPG.

NGS committee actions are pending so that the future of word-for-word converted military specifications can first be determined. This would result in a significant workload ahead for NGSBs. It is vital that MIL-HDBK-5 and MIL-HDBK-17 remain as national archives for technical data. In short, the activities of the EWPG illustrate the profound impact that the military and its standards produce across industry, in this case, the aerospace industry. A significant workload remains for industry to complete the transition to NGSs.

PANEL DISCUSSION

As with Session 1, the speakers assembled for a general question-and-answer session with the audience at the end of the session's formal presentations. The following items provide an overview of the major issues covered during discussion:

- Specifications are a cost of doing business. They are a utility that is often invisible to users.
- Strong, consensus-based NGSBs exist to respond to military needs.
- Competent analysis is required to ensure that NGSs are technically suitable for each specific need.
- Transition plans are dealing (albeit inefficiently) with existing design and procurement issues.
- New specifications can be readily developed if supporting data can be provided and analyzed.
- Industry-member NGSB participation and support are declining while the workload to manage the 5-year review of converted military specifications is increasing. A future problem is predicted.
- Military and government member participation and support in NGSs are declining; future problems are anticipated.
- The primary national materials data archives (MIL-HDBK-5 and MIL-HDBK-17) are in danger.

- Lack of central DoD leadership to direct and fund military standards causes significant variation as each preparing activity establishes its own strategy and execution.
- The government approach, which pulls specifications and standards funding from current programs, is a short-term approach that cannot be relied upon to support long-term materials development needs.

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Workshop Session 3: Implementation Issues—Government Agencies' Perspectives

The speakers at Session 3 focused on the implementation of commercial specifications or standards in place of those previously issued by the government and on barriers to their implementation. The organizations offering their experiences were the Langley Research Center of the National Aeronautics and Space Administration (NASA), the Federal Aviation Administration (FAA), and the Air Force Space and Missiles Systems Center.

NASA IMPLEMENTATION OF COMMERCIAL SPECIFICATIONS

Mark Shuart, of the NASA Langley Research Center, spoke of NASA Langley's efforts in developing composite materials and their associated standards. Its development focus is to formulate new materials, characterize new materials and material forms, and to demonstrate and validate new concepts. He spoke extensively on the development of test methods and the program objectives of the NASA Technical Standards Program.

Standards are an outgrowth of research and technology work and the need for new materials and forms. NASA recognized its need to lead the development of standards. The approach was proactive interaction of NASA with industry and universities to develop and verify test methods for new materials. There are multiple examples of NASA cooperation with industry in development of methods and standards. Testing is initiated at NASA then continues with round robin testing.

It is necessary to negotiate cost sharing with industry. However, cost sharing can limit the dissemination of information, as some data are proprietary.

The NASA Technical Standards Program coordinates standards for agency programs and projects. Its objectives are as follows:

- Develop and maintain an integrated NASA Preferred Technical Standards System.
- Improve interoperability within NASA and with industry and universities both nationally and internationally.
- Document experiences and lessons learned.
- Sponsor the development of technical standards and products of particular use to NASA.
- Promote increased use of and support for national and international consensus standards.
- Enhance awareness of standardization in NASA.

NASA Langley has contributed to standards as part of its materials and structures technology development and has developed standard test methods to evaluate composites. Research at NASA Langley continues to support ASTM and MIL-HDBK-17 efforts for composite materials standards.

In closing, Dr. Shuart emphasized that the agency needs to ensure continued involvement in the development of standards and needs to promote its participation in technical societies.

FEDERAL AVIATION ADMINISTRATION PERSPECTIVE

Larry Ilcewicz, of the FAA, spoke on the following topics: FAA certification and delegation for commercial products; general outlook on the barriers; recommended solutions for composites used in aviation products; an evolving national plan for composite certification initiatives; and some progress in base material control and shared databases.

He said that the good old recipes are understood, reliable, and proven to yield repeatable, safe, and durable products. Desired new recipes will have all the benefits of the good old recipes, plus cost and performance advantages. Such improvements will require a joint effort of industry, government agencies, and national organizations, which will be more efficient and smarter in developing the new recipes.

The FAA certification process includes type certification, with extensive FAA oversight, and production certification, where the manufacturer controls production with less FAA oversight. Each aircraft must have an airworthiness certificate, and the certification steps are basically the same for MilSpecs, commercial, or "own specs." The FAA recognizes there will be interim problems until new specifications are developed. Dr. Ilcewicz suggested the FAA form Partnerships in Safety with individual designees and company delegations to assist FAA aircraft certifications.

Although MilSpecs were benchmarks for safety, national standardization leads to more efficient product certification. The conversion to commercial specifications will, however, have some interim lack of standardization and may inadvertently omit some shared technical information that came from the DoD. Among the indirect effects of DoD acquisition reform on the FAA is less training and experience available to those who must produce specifications, and it becomes clear that SDOs must have a conduit to industry-government-university research initiatives.

The greatest barrier to the adoption of commercial materials and processing standards will be the time that is needed. Somewhere between forced standardization and a commercial consensus process is a middle ground that should yield specifications acceptable to an efficient industry. Industry, government agencies, and national organizations need to work together to accomplish this. Dr. Ilcewicz suggested that SDOs need to reconsider the technical processes and business structure of their organizations in order to address how the technical resources to create specifications can be supported; the proprietary material and process issues; how to retain valuable research information in the commercial specifications; and feedback from applications using the specifications. Government agencies and technical resources must remain major stakeholders to gain technical benefits. Dr. Ilcewicz also listed educational issues as a

major barrier to the acceptance of commercial specifications. The associated documentation and the training of a workforce for new standards is not a trivial task and relates to limited resources skilled in particular materials technologies.

Dr. Ilcewicz's recommendations were as follows:

- Promote integrated development among industry, government, and university research.
- Promote close collaboration between international and national standards organizations, industry, and government.
- Create composite certification initiatives by:
  - Working with industry, government, and academia to ensure safe deployment of technologies,
  - Sharing databases, and
  - Fostering FAA/NASA/DoD partnerships with industry.

SPACE SYSTEMS PERSPECTIVE

Dave Davis, of the U.S. Air Force Space and Missile Systems Center at Los Angeles Air Force Base, elaborated on the systems-level acquisition methodology for the center and on technical challenges and issues.

The goal of acquisition reform is to derive a best practice by capitalizing on commercial practices and competitive supplier designs and processes and by consistently applying them across the DoD. The focus is performance-based, so the government should continue to assess capabilities, approve contractors' proposals of production, and manage risks.

Mr. Davis also reviewed the center's implementation of a performance-based business environment. Recent contracts have used performance-based business environment methodology and made minimal use of MilSpecs and standards; performance requirements have been documented. Contractor processes and applications are included as part of the proposal. In the area of specifications and standards, there is a recognized need for industry standards, substantial conversion of MilSpecs, and government support for NGSBs. Critical process assessment tools would also be useful if the government can assess all responses to a common set of evaluation standards.

He identified several technical challenges and issues:

- The industrial base has undergone significant change and is continuing to change.
- Proposal costs are out of sync with the costs associated with actual processes.
- Technical processes often are just streamlined, not reengineered.

Industrial base concerns include the following:

- Many manufacturers have left the military market in recent years, resulting in decreased availability of devices that meet MilSpecs.
- There is a decreased availability of product, leading to concerns about the future supply.

- Other issues are: advanced technology funding; product life cycle vs. acquisition schedules; and the financial viability of suppliers.

In summary, the current practice of system-level acquisition facilitates the application of commercial materials and processes. Also, the space community must be selective, since not all commercial specifications get the job done. There remain numerous technical challenges, including a better understanding of the products and supply base.

PANEL DISCUSSION

The speakers assembled for a general question-and-answer session with the audience at the end of the formal presentations. The following items provide a general overview of the major issues covered during the panel discussion:

- Government needs to work closely with NGSBs.
- Government engineers must understand processes.
- Companies that could not compete using MilSpec requirements can supply to performance-based requirements.
- Test methods vary between supplier companies.
- The risk is twofold: the loss of controlling or defining specifications and the loss of an experienced personnel base in government and industry.

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Workshop Session 4: Implementation Issues—DoD Agencies' Perspectives

Session 4 was a continuation of Session 3. The speakers focused on the implementation of commercial specifications or standards in place of those previously issued by the government and on barriers to their employment. The organizations offering their experiences were the Air Force Aeronautical Systems Center at Wright-Patterson Air Force Base, the Naval Air Systems Command, the U.S. Army Aviation and Missile Command at Redstone Arsenal, and the U.S. Army Tank-automotive and Armaments Command (TACOM).

AIR FORCE IMPLEMENTATION OF COMMERCIAL SPECIFICATIONS

R. Scott Kuhnen, of the Aeronautical Systems Center at Wright-Patterson Air Force Base, presented a history of the center's experience with implementing commercial materials and processing standards. He pointed out that people had mistaken the message about the use of commercial standards; the DoD did not plan to cancel all MilSpecs. *Equal Partners*, issued in 1985, recommended more use of voluntary standards and DoD participation in voluntary standards organizations.

Currently, MIL standards and specifications are in transition. Some have been cancelled or inactivated. About 8,000 have been transferred to the Defense Logistics Agency and many have been replaced with voluntary standards. Air Force reform actions are 95 percent complete. However,

- NGS actions are only 33 percent complete.
- This is too slow.
- The Air Force has less control over NGS actions.

Sixty-seven members of the Air Force are involved in 193 NGS committees. The funding for Air Force participation in NGS activities went to zero in FY 2000 from $332,000 in FY 1996. Air Force technical expertise is eroding as a result of three factors:

- Retirements,
- Little or no incentive for Air Force engineers to work on standards, and
- A 10-year hiring freeze.

In the past, DoD specifications were an important way to incorporate lessons learned, and they impose discipline on the development process. The contract statement of work should simply read, "Meet the specifications."

NAVY IMPLEMENTATION OF COMMERCIAL SPECIFICATIONS

Bob Prine, of the Naval Air Systems Command, presented a history of the Navy's experience with implementation of commercial materials and processing standards in the aeronautical area.

He stressed that, for a successful development program, government engineers need expertise beyond simply monitoring the results of a test program, and that commercial specifications should be used where possible. The number of institutionally funded Navy aeronautical personnel, the engineers who develop specifications, has declined from 1,100 to 350.

The commercial aircraft industry uses many MilSpecs. Over the last 6 years, the total number of specifications used has decreased significantly, and the percentage of commercial specifications has increased:

- In 1994, of 4,491 total specifications, 82 percent were military.
- In 2000, of 2,664 total specifications, 46 percent were military.

The DoD policy on specifications and standards has given rise to many misunderstandings concerning conversion. There is a preference for, rather than a requirement for, performance specifications and commercial standards. Many unique military specifications remain, and MilSpecs often are commercial practice.

However, nongovernmental standards are not a free ride; consensus takes time. Commercial specifications can result in achieving the "lowest common denominator." Mr. Prine also emphasized that government and industry share responsibility, since all stakeholders should do their fair share of the work.

Navy participation in NGS activities is now performed on an ad hoc basis. A strategy is needed to establish a schedule and funding levels and to define the requirements for the maintenance of specifications and standards. Priority should be given to the most important standards and the impact of not developing them. Senior-level government and industry need to endorse the strategy, and resourcing must be a corporate responsibility.

ARMY AIR SYSTEMS IMPLEMENTATION OF COMMERCIAL SPECIFICATIONS

Kirit Bhansali, of the U.S. Army Aviation and Missile Command at Redstone Arsenal, presented a history of Army experience with implementation of commercial materials and processing standards in the aeronautical area.

He discussed the Defense Competitive Procurement Act, which requires the parts be procured from alternative sources in addition to prime contractors. This requires frozen processes for flight safety. However, processes such as grinding, shot peening, and cleaning have a critical effect on metal fatigue. The equivalence of military and commercial specifications often is not known. For example, the Aerospace Materials Specification allows for removal of material after shot peening, but the MilSpec does not. Alternative sources often do not have a technical staff to evaluate the differences between military and commercial specifications, so quality control is maintained by Defense

Contract Management Agency personnel who may or may not be knowledgeable about materials and processes.

Dr. Bhansali also noted that performance specifications can be too broad. It is not possible to anticipate all requirements, and performance-based testing is very expensive. For example, the steel heat treatment MilSpec was cancelled. Now, someone must review the NGS replacement and verify its equivalence.

The implementation of changes in specification policy was very fast, and there is potential for problems later on. Converting to NGSs means that there will have to be more knowledgeable people to interpret commercial specifications and to verify their suitability for military use. This is particularly important for parts that are critical to flight safety.

ARMY LAND SYSTEMS IMPLEMENTATION OF COMMERCIAL SPECIFICATIONS

Marta Tomkiw, of the U.S. Army TACOM, presented a history of TACOM experience with implementation of commercial materials and processing standards.

Before 1996 there were 5,000 TACOM specifications. There are 1,500 today:

- 21 percent are NGSs,
- 16 percent are commercial, and
- 8 percent are performance-based.

TACOM purchases many commodities but finds it hard to maintain technical competence because of a shrinking labor force. This leads to greater reliance on suppliers. For example, the M1 Abrams main battle tank uses 60 percent commercial design standards. Industrial "upscreen" alternatives are integrated daily, and new statements of work use performance-based requirements. Today the procedures are 100 percent electronic.

The Army designs for extreme conditions that require unique military specifications, so participation in NGSBs is critical. TACOM cannot afford to convert existing technical data packages to performance specifications. It is hard to keep abreast of new technology because current employees are overworked and experts are leaving the Army.

PANEL DISCUSSION

The speakers assembled for a question-and-answer session with the audience at the end of the formal presentations. Many of the major issues covered during the Session 3 panel discussions were brought up again. However, some additional points emerged during the Session 4 panel discussion:

- Performance specifications for reprocurement may be implemented by DoD.
- Performance specifications require more knowledgeable DoD personnel to assure a reliable product.

- Since DoD is procuring fewer new systems, fewer engineers than in the past are required to develop new specifications.

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Workshop Session 5: Implementation Issues—Original Equipment Manufacturers' Perspectives

Session 5 focused on the issues affecting the implementation of commercial standards in defense procurement from the perspective of OEMs.

ADOPTING COMMERCIAL MATERIALS AND PROCESSING STANDARDS IN DEFENSE PROCUREMENT AT GE AIRCRAFT ENGINES

Robert Schafrik, of General Electric (GE) Aircraft Engines, spoke of the benefits of and barriers and challenges to implementing commercial specifications for DoD applications. He pointed out that since commercial technology is often available immediately, its use could significantly shorten overall system development time and thus give the military an advantage by allowing a needed system to be fielded quickly. The DoD emphasis on using commercial specifications requires a commercial mind-set in which DoD relies to a greater extent on the commercial marketplace and their contractors' engineering capabilities. A direct implication is that only available technology can be specified, so performance may have to be traded off somewhat to realize cost and schedule targets. Commercial specifications are derived from experience, so their use allows DoD to leverage a wide application and experience base, further reducing its technology risk.

A constraint to DoD use of commercial specifications is that DoD systems typically have an operational lifetime greater than 25 years, while commercial specifications typically are updated periodically, such as every 5 years. However, DoD cannot afford to employ niche materials and processes since the narrow application base will render this strategy increasingly costly. In those instances in which use of niche materials is essential to DoD, there may be a role for the Title III program to broaden the application base to the commercial uses.

Many OEMs operate in the global marketplace, where the industry standard may be an international standard. There is a need for easier, quicker acceptance of international standards in DoD applications.

In the past, DoD prepared and controlled military specifications. But the situation has now changed, since commercial standards are prepared and controlled by commercial entities. It is imperative that DoD, in the course of adopting commercial standards, not insist on complex modification to the commercial specification to address a special DoD requirement.

Standard development organizations (SDOs) must support industries' need to reduce product development times. For example, the engine development cycle for GE

Aircraft Engines is currently 24 months, with a goal of 18 months. This rapid product development cycle is in contrast to the lengthy, multiyear times typically required to develop consensus NGSs. Dr. Schafrik issued the following challenge: Establish a goal to reduce NGS development time to 6 months (1 year maximum).

He pointed out that an area of concern expressed by several engineers who had briefed the NRC/NMAB Committee on Aging of U.S. Air Force Aircraft (*Aging of U.S. Air Force Aircraft: Final Report*, NMAB-488-2, published by the National Academy Press in 1997) was that many acquisition programs, in the rush to comply with the intent of acquisition reform guidelines, did not include the needed MilSpecs in their procurement packages, and no commercial specifications existed to take their place. For example, corrosion control plans were not required. The consequence was that maintenance personnel across the Services were handed a difficult, expensive task when the equipment was fielded; this result clearly was not the intent of acquisition reform. A better approach to institutionalizing commercial specifications within DoD is clearly necessary.

Word-for-word conversion of military documents was a reasonable approach given the circumstances and timeline imposed on the DoD organizations by acquisition reform. But obviously, trading a rigid MilSpec for a rigid commercial specification falls short of achieving the potential advantages of commercial specifications. These converted documents are now coming due for revision during the normal SDO review cycle. The revisions will probably generate a substantial workload for such organizations. Dr. Schafrik said he was concerned that they will be hard pressed to deal with this workload without improving productivity (e.g., increased use of e-mails and meetings conducted via the Internet) and striving to reduce the time for the revision process.

GE Aircraft Engines has made good use of the single process initiative (SPI) block changes to simplify contract requirements and implement commercial technology. However, review and approval of block changes is often lengthy, sometimes stretching beyond 1 year. Speeding up the approval (or disapproval) process could facilitate the introduction of commercial technology for DoD applications.

Preparing and adopting commercial specifications truly represents a partnership between industry and the DoD; "we all sink or swim together." Contractors must understand and manage the contract details to remove unnecessary requirements and support commercialization opportunities.

Dr. Schafrik pointed out that, in the past, the DoD's Manufacturing Technology (ManTech) program within the three Services was a leader in developing commercial specifications for new materials and processes. He also said that a current Air Force ManTech program, the Engine Supplier Base Initiative—Casting Sector, was an excellent example of what could be achieved with industry working together under government oversight to develop specifications common for the entire industry sector. For instance, each OEM had developed nondestructive testing (NDT) specifications based on corporate best practices, requiring the investment casting suppliers to support a number of different NDT procedures, all aimed at achieving the same goal. As a result of the Engine Supplier Base Initiative, common NDT specifications were agreed to by the OEMs, reducing the cost and cycle time for NDT operations within the supply chain. Without the ManTech program, this change probably would not have happened since the impact to any one program is not significant enough for the change to have been made.

As did other speakers, Dr. Schafrik noted that the attrition of experienced engineers owing to retirement, among other things, is a serious concern for which a preventative strategy is needed. He thought that one benefit of companies sending people to SDO meetings was that less-experienced engineers could gain knowledge and perspective by participating with others who are active and experienced in the same technology area.

BOEING IMPLEMENTATION OF COMMERCIAL SPECIFICATIONS

Keith Porter, of the Boeing Company, spoke of five areas that are barriers to the implementation of commercial standards by industry. He stressed the need to reduce confusion associated with transition to commercial standards, and the need to maintain configuration control and technical integrity of products.

First, notices canceling government specifications and standards are misinterpreted by industry as a technical supersession by NGSs. The DoD has stated that the actual intent of cancellation notices is to direct DoD (not industry) personnel to the new standard for future contracts. Boeing has reacted with a policy (directed internally as well as externally to suppliers, customers, and subcontractors) that calls for using cancelled government specifications until Boeing Engineering has identified a suitable replacement.

Replacement standards referenced by the cancellation notices may not be technically equivalent. Configuration management must be maintained. Boeing's selection of materials and processing specifications will, in all cases, be based on technical suitability and the business case. Existing contracts may require use of canceled government standards. These call-outs remain binding until contract modification is approved. There is a need to develop design allowables for commercial materials not currently used by the aerospace industry.

Second, there are problems with conversion to NGSs. Industry has not been adequately informed of the DoD's conversion plans. The Aerospace Industries Association EWPG has helped, but there are still awareness problems. A new feature in DoD's Acquisition Streamlining and Standardization Information System database is expected to help raise awareness sometime next year. Industry has SDO preferences based on subject matter. Not all SDOs are equal; some have more focus on users, some on manufacturers. Companies do not have the resources to support all SDOs.

Non-word-for-word conversions are expensive and do not add value. Companies do not have the resources to review changes to all converted government standards at once. Thus, the burden of document maintenance is shifted to industry. Companies need to increase their support of SDOs. In addition, some converted MilSpecs have been inactivated, not canceled. The result is confusion and a proliferation of specifications (contrary to standardization).

Third, the industry's transition to NGSs must be controlled and methodical. Product design integrity must be maintained. Drawings and supersession lists must be updated. SPIs must be requested and approved. Decisions must be made about reprocurements.

Fourth, a means of dealing with qualification and qualified products lists (QPLs) must be established. Many MilSpecs with QPLs are being converted to NGSs. The current situation is often very confusing. Mr. Porter showed an example of a MilSpec

with a QPL that has been converted to an NGS. Over the course of about 3 years, many irregularities developed, including multiple QPLs for the same standard, multiple versions of the standard, and missing or conflicting pointers between documents.

There is an urgent need for a qualification system adequate to support these converted standards. Mr. Porter stated that Boeing is looking toward industry-managed qualification to fill this void.

Fifth, the use of NGSs increases cost to specification users. Military specifications are free. Users must purchase copies of NGSs. Large companies, such as Boeing, can mitigate these costs through negotiations with SDOs. There is a greater impact on small businesses and individuals.

COMMERCIAL SPECIFICATIONS AT LOCKHEED MARTIN: IMPLEMENTATION ISSUES AND A PROPOSED PLAN FOR NATIONAL STANDARDS

Cecil Schneider, of Lockheed Martin Aeronautics Company, focused on standards for composite materials fabrication. He spoke on the application of commercial specifications and a proposed plan for development of national standards for composites. The value of investing in standardization was emphasized.

Lockheed Martin is almost completely using company specifications for composite materials (or tri-company specifications on the F-22 program). For test methods, commercial standards are used, and for design data, MIL-HDBK-17 is used where data exist.

A major problem with NGSs is timeliness. Industry does not have 4 or 5 years to build a consensus NGS set of materials specifications when developing a new product. Therefore, companies will continue to use company specifications. Lack of a suitable, approved commercial specification when a program is initiated will always result in the use of company specifications.

A plan was worked on in the early 1990s for standardization of composite materials by an ad hoc committee and developed into the Aeronautics Materials and Manufacturing Technology Standardization Plan. However, the plan has not been implemented owing to the lack of funding.

Design allowables are required to conduct detailed design. One common specification for design allowable data is needed. The development of design allowables data is time consuming and expensive and depends on multiple data sources such as material specification, process specification, test method, design and quality criteria, and analysis methods. Mr. Schneider presented an example of design-allowable data for the same material, which had been developed by four different programs and documented in over 25 specifications. Most of the data were not comparable. This is an extremely expensive and duplicative process compared with starting with a single common specification.

Lack of standardization impedes the use of advanced materials on aircraft and other new applications. While commercial-grade materials demand has increased, no reinvestment capital is being generated. An integrated effort is needed to focus both industry and government support and funding. Material specifications, test methods,

analysis methods, process specifications, and design and quality criteria all impact design allowables. All must be included in an integrated plan.

PANEL DISCUSSION

The speakers assembled for a question-and-answer session with the audience at the end of the formal presentations. The following provides a general overview of the major topics covered during the panel discussion.

The panel was asked, "How does the government decide which MilSpecs to transfer, and to which SDOs?" The answer was that the government contacted SDOs early on. OEMs did not know until it had already been done. The EWPG was formed to provide early warning to industry when key military or government standards were about to be canceled and to facilitate the orderly transition to industry standards consistent with Secretary Perry's directive. The group included SDOs, government preparing activities, and industry. At this point, the work of the EWPG is almost done.

The panel was asked about the benefits of the government's transition from military standards to commercial standards. The panel agreed that eliminating the military standards that control business processes (i.e., the "110 cost driver documents") had been a major benefit. OEMs saw no benefit to throwing out material and processing specifications; that has resulted in increased costs to them.

The aircraft propulsion industry uses company specifications for most—in terms of quantity—material used, although company specifications account for only about 20 percent of the total number of specifications used. Because company specifications are used, not industry specifications, different engine manufacturers buy the same material to different company specifications.

OEMs are making use of SPIs to obtain DoD acceptance of commercial practices.

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Workshop Session 6: Implementation Issues—Supplier and Manufacturer Perspectives

Session 6 featured two speakers on issues of concern to suppliers and manufacturers.

MATERIAL SUPPLIER PERSPECTIVE

Milton Milner, of Alcoa, presented a summary of issues important to suppliers.

Military-unique materials (armor, for example) belong in military specifications. The cancellation notices attached to military specifications are confusing, leading to delays and increased cost. Converted word-for-word specifications are confusing buyers and suppliers. Redundant specifications for the same material are inefficient and should be collapsed. For example, the following documents are equivalent:

- QQ-A-200,
- AMS-QQ-A-200,
- ASTM B221,
- AMS 4026, and
- Company-unique specifications.

In the end, the transition to fewer commercial and industrial specifications will be good for suppliers. MIL-HDBK-5 must be retained as a national data archive because it is crucial for the ability of suppliers and manufacturers to develop and maintain NGSs that are suitable for military needs.

Suppliers like Alcoa bear the brunt of the confusion related to the cancellation of MilSpecs but are in favor of the long-term transition to fewer standards across industry.

MANUFACTURER PERSPECTIVE

Randy Kanaby, of Rolls-Royce Allison, spoke of the key issues affecting the relationship of manufacturers, their supply chain, and their customers.

Military specifications (hundreds or more) are referenced throughout most manufacturers' documentation systems, and even as references inside company-unique specifications. Issues of concern that arise because of their cancellation include the following:

- Cost,
- Compliance,
- Configuration control,
- Technical equivalence, and
- Environmental impact.

Costly work lies ahead to ensure proper transitions in-house, at subtier contractors, and by NGSBs. It will take a generation of designs to sort out. The disadvantage is that no value is added, as programs do not see an immediate benefit.

Mr. Kanaby stated that the problems are manageable, but significant, and at a cost. Acquisition reform has presented an opportunity for international harmonization of specifications, but there appears to be little interest and no action. Manufacturers see MilSpecs referenced throughout their internal and external documentation for product design and manufacturing.

PANEL DISCUSSION

As did the speakers at the earlier sessions, the speakers at Session 5 assembled for a general question-and-answer session with the audience at the end of the formal presentations. The major issues covered at the panel discussion were as follows:

Canceling military specifications has caused significant confusion and cost to industry.

- Plans are in place to cope with these issues related to legacy (existing) designs.
- Suitable NGSBs exist to serve industry and military needs.
- New materials and process specifications can be created through NGSBs for most needs, and company specifications can be used for nonstandard needs.

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Workshop Summary

In many areas of procurement, the results of the acquisition reform policy have been positive and, the participants believed, have helped to reduce the complexity and costs of the DoD purchase of major weapon systems and their many support requirements. Many outcomes of the move away from military and federal specifications to commercial or industry documents have also been positive.

The workshop revealed several common themes, identified a key barrier to the military use of commercial materials and process specifications, and identified two keys to the rapid insertion of commercial technology.

COMMON THEMES

The following themes were common across all sessions of the workshop:

- While the military can and does make use of many commercial items, certain military-unique items will continue to require military-unique specifications that are best prepared and coordinated within military organizations of the DoD.
- Although contractors are scrambling to recover, the recent wholesale cancellation of military specifications has strained configuration control and increased product performance risk throughout the military supply chain. The additional cost to cope with this transition will continue over the next generation of contracts and products.
- Suitable NGSBs exist to meet the commercial needs of military products, but DoD member participation in these bodies is required to ensure that the resulting specifications meet military needs.
- The workload of these NGSBs has increased as a result of cancelled military specifications, but user member and DoD member participation in NGSs is decreasing, posing the risk that these "shared" specifications may not be adequately maintained to meet future military-unique needs.
- Retirements and career decisions have led to an erosion of materials and processes expertise within industry and the DoD at a time when increased efforts are necessary to continue the transition to performance specifications and NGS envisioned by the acquisition reform movement.
- The foundations of reliability for national materials and processes (MIL-HDBK-5 and -17) are in danger of losing their independence and credibility if they are no longer funded and maintained under government cognizance.

- The lack of an apparent DoD master plan and master coordinator over the military materials and processes specification development strategy is causing confusion and delays during the transition to acquisition reform.

Two keys to the rapid insertion of commercial technology were identified. First, neutral (government) control of the fundamental materials databases (MIL-HDBK-5 for metals and MIL-HDBK-17 for composites) must be retained to allow rapid dissemination of reliable data. Second, just as technical expertise and discipline are eroding at DoD, strong expertise for materials and processes is required to conclude the transition to NGSs and performance-based specifications and leverage the benefits into real cost savings.

Appendix A

Perry Memorandum

THE SECRETARY OF DEFENSE
WASHINGTON, DC 20301-1000
29 Jun 94

MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS
CHAIRMAN OF THE JOINT CHIEFS OF STAFF
UNDER SECRETARIES OF DEFENSE
COMPTROLLER
ASSISTANT SECRETARY OF DEFENSE (COMMAND, CONTROL, COMMUNICATIONS, AND INTELLIGENCE)
GENERAL COUNSEL
INSPECTOR GENERAL
DIRECTOR OF OPERATIONAL TEST AND EVALUATION
DIRECTORS OF THE DEFENSE AGENCIES
COMMANDER-IN-CHIEF, U.S. SPECIAL OPERATIONS COMMAND

SUBJECT: Specifications & Standards - A New Way of Doing Business

To meet future needs, the Department of Defense must increase access to commercial state-of-the-art technology and must facilitate the adoption by its suppliers of business processes characteristic of world-class suppliers. In addition, integration of commercial and military development and manufacturing facilitates the development of dual-use processes and products and contributes to an expanded industrial base that is capable of meeting defense needs at lower costs.

I have repeatedly stated that moving to greater use of performance and commercial specifications and standards is one of the most important actions that DoD must take to ensure we are able to meet our military, economic, and policy objectives in the future. Moreover, the Vice President's National Performance Review recommends that agencies avoid government-unique requirements and rely more on the commercial marketplace.

To accomplish this objective, the Deputy Under Secretary of Defense (Acquisition Reform) chartered a Process Action Team to develop a strategy and a specific plan of action to decrease reliance, to the maximum extent practicable, on military specifications and standards. The Process Action Team report, "Blueprint for Change," identifies the tasks necessary to achieve this objective. I wholeheartedly accept the Team's report and approve the report's primary recommendation to use performance and commercial specifications and standards in lieu of military specifications and standards, unless no

practical alternative exists to meet the user's needs. I also accept the report of the Industry Review Panel on Specifications and Standards and direct the Under Secretary of Defense (Acquisition and Technology) to appropriately implement the Panel's recommendations.

I direct the addressees to take immediate action to implement the Team's recommendations and assign the Under Secretary of Defense (Acquisition and Technology) overall implementation responsibility. I direct the Under Secretary of Defense (Acquisition and Technology) to immediately arrange for reprogramming the funds needed in FY94 and FY95 to efficiently implement the recommendations. I direct the Secretaries of the Military Departments and the Directors of the Defense Agencies to program funding for FY96 and beyond in accordance with the Defense Planning Guidance.

Policy Changes

Listed below are a number of the most critical changes to current policy that are needed to implement the Process Action Team's recommendations. These changes are effective immediately. However, it is not my intent to disrupt on-going solicitations or contract negotiations. Therefore, the Component Acquisition Executive (as defined in Part 15 of DoD Instruction 5000.2), or a designee, may waive the implementation of these changes for on-going solicitations or contracts during the next 180 days following the date of this memorandum. The Under Secretary of Defense (Acquisition and Technology) shall implement these policy changes in DoD Instruction 5000.2, the Defense Federal Acquisition Regulation Supplement (DFARS), and any other instructions, manuals, regulations, or policy documents, as appropriate.

Military Specifications and Standards: Performance specifications shall be used when purchasing new systems, major modifications, upgrades to current systems, and non-developmental and commercial items, for programs in any acquisition category. If it is not practicable to use a performance specification, a non-government standard shall be used. Since there will be cases when military specifications are needed to define an exact design solution because there is no acceptable non-governmental standard or because the use of a performance specification or non-government standard is not cost effective, the use of military specifications and standards is authorized as a last resort, with an appropriate waiver.

Waivers for the use of military specifications and standards must be approved by the Milestone Decision Authority (as defined in Part 2 of DoD Instruction 5000.2). In the case of acquisition category ID programs, waivers may be granted by the Component Acquisition Executive, or a designee. The Director, Naval Nuclear Propulsion, shall determine the specifications and standards to be used for naval nuclear propulsion plants in accordance with Pub. L. 98-525 (42 U.S.C. §7158 note). Waivers for reprocurement of items already in the inventory are not required. Waivers may be made on a "class" or items basis for a period of time not to exceed two years.

Innovative Contract Management: The Under Secretary of Defense (Acquisition and Technology) shall develop, within 60 days of the date of this memorandum, Defense Federal Acquisition Regulation Supplement (DFARS) language to encourage contractors to propose non-government standards and industry-wide practices that meet the intent of the military specifications and standards. The Under Secretary will make this language effective 180 days after the date of this memorandum. This language will be developed for inclusion in both requests for proposal and in on-going contracts. These standards and practices shall be considered as alternatives to those military specifications and standards cited in all new contracts expected to have a value of $100,000 or more, and in existing contracts of $500,000 or more having a substantial contract effort remaining to be performed.

Pending completion of the language, I encourage the Secretaries of the Military Departments and the Directors of the Defense Agencies to exercise their existing authority to use solicitation and contract clause language such as the language proposed in the Process Action Team's report. Government contracting officers shall expedite the processing of proposed alternatives to military specifications and standards and are encouraged to use the Value Engineering no-cost settlement method (permitted by FAR 48.104-3) in existing contracts.

Program Use of Specifications and Standards: Use of specifications and standards listed in DoD Instruction 5000.2 is not mandatory for Program Managers. These specifications and standards are tools available to the Program Manager, who shall view them as guidance, as stated in Section 6-Q of DoD Instruction 5000.2.

Tiering of Specifications and Standards: During production, those system specifications, subsystem specifications and equipment/product specifications (through and including the first-tier reference in the equipment/product specifications) cited in the contract shall be mandatory for use. Lower tier references will be for guidance only, and will not be contractually binding unless they are directly cited in the contract. Specifications and standards listed on engineering drawings are to be considered as first-tier references. Approval of exceptions to this policy may only be made by the Head of the Departmental or Agency Standards Improvement Office and the Director, Naval Nuclear Propulsion, for specifications and drawings used in nuclear propulsion plants in accordance with Pub. L. 98-525 (42 U.S.C. §7158 Note).

New Directions

Management and Manufacturing Specifications and Standards: Program Managers shall use management and manufacturing specifications and standards for guidance only. The Under Secretary of Defense (Acquisition and Technology) shall develop a plan for canceling these specifications and standards, inactivating them for new designs, transferring the specifications and standards to non-government standards, converting them to performance-based specifications, or justifying their retention as military specifications and standards. The plan shall begin with the ten management and manufacturing standards identified in the Report of the Industry Review Panel on

Specifications and Standards and shall require completion of the appropriate action, to the maximum extent practicable, within two years.

Configuration Control: To the extent practicable, the Government should maintain configuration control of the functional and performance requirements only, giving contractors responsibility for the detailed design.

Obsolete Specifications: The "Department of Defense Index of Specifications and Standards" and the "Acquisition Management System and Data Requirements Control List" contain outdated military specifications and standards and data requirements that should not be used for new development efforts. The Under Secretary of Defense (Acquisition and Technology) shall develop a procedure for identifying and removing these obsolete requirements.

Use of Non-Government Standards: I encourage the Under Secretary of Defense (Acquisition and Technology) to form partnerships with industry associations to develop non-government standards for replacement of military standards where practicable. The Under Secretary shall adopt and list in the "Department of Defense Index of Specifications and Standards" (DoDISS) non-government standards currently being used by DoD. The Under Secretary shall also establish teams to review the federal supply classes and standardization areas to identify candidates for conversion or replacement.

Reducing Oversight: I direct the Secretaries of the Military Departments and the Directors of the Defense Agencies to reduce direct Government oversight by substituting process controls and non-government standards in place of development and/or production testing and inspection and military-unique quality assurance systems.

Cultural Changes

Challenge Acquisition Requirements: Program Managers and acquisition decision makers at all levels shall challenge requirements because the problem of unique military systems does not begin with the standards. The problem is rooted in the requirements determination phase of the acquisition cycle.

Enhance Pollution Controls: The Secretaries of the Military Departments and the Directors of the Defense Agencies shall establish and execute an aggressive program to identify and reduce or eliminate toxic pollutants procured or generated through the use of specifications and standards.

Education and Training: The Under Secretary of Defense (Acquisition and Technology) shall ensure that training and education programs throughout the Department are revised to incorporate specifications and standards reform.

Program Reviews: Milestone Decision Authority (MDA) review of programs at all levels shall include consideration of the extent streamlining, both in the contract and in the oversight process, is being pursued. The MDA (i.e., the Component Acquisition

Executive or his/her designee, for all but ACAT 1D programs) will be responsible for ensuring that progress is being made with respect to programs under his/her cognizance.

Standards Improvement Executives: The Under Secretary, the Secretaries of the Military Departments, and the Director of the Defense Logistics Agency shall appoint Standards Improvement Executives within 30 days. The Standards Improvement Executives shall assume the responsibilities of the current Standardization Executives, support those carrying out acquisition reform, direct implementation of the military specifications and standards reform program, and participate on the Defense Standards Improvement Council. The Defense Standards Improvement Council shall be the primary coordinating body for the specification and standards program within the Department of Defense and shall report directly to the Assistant Secretary of Defense (Economic Security). The Council shall coordinate with the Deputy Under Secretary of Defense (Acquisition Reform) regarding specification and standards reform matters, and shall provide periodic progress reports to the Acquisition Reform Senior Steering Group, who will monitor overall implementation progress.

Management Commitment

This Process Action Team tackled one of the most difficult issues we will face in reforming the acquisition process. I would like to commend the team, composed of representatives from all of the Military Departments and appropriate Defense Agencies, and its leader, Mr. Darold Griffin, for a job well done. In addition, I would like to thank the Army, and in particular, Army Materiel Command, for its administrative support of the team.

The Process Action Team's report and the policies contained in this memorandum are not a total solution to the problems inherent in the use of military specifications and standards; however, they are a solid beginning that will increase the use of performance and commercial specifications and standards. Your leadership and good judgment will be critical to successful implementation of this reform. I encourage you and your leadership teams to be active participants in establishing the environment essential for implementing this cultural change.

This memorandum is intended only to improve the internal management of the Department of Defense and does not create any right or benefit, substantive or procedural, enforceable at law or equity by a party against the Department of Defense or its officers and employees.

<signed>

William J. Perry

Appendix B

Workshop Agenda

Wednesday, October 11, 2000

7:15 am *Registration and Continental Breakfast*

8:00 Welcome–*Tom Cooper, Universal Technology Corporation, Committee Chair*

Session 1: Past, Present, and Future of Specifications and Standards
Chair: Tom Cooper

8:15 Past DoD/NMAB Involvement with Materials/Processes Specifications and Standards–*Jerry Persh, Zimmerman Associates, Inc., and Institute for Defense Analyses*

8:45 Defense Standardization Program, MilSpec Reform, and Nongovernment Standards–*Steve Lowell, Defense Standardization Program Office*

9:15 Issues Affecting New DoD Programs–*Gary R. Adams, Aeronautical Systems Center, Wright-Patterson AFB*

9:45 *Break*

10:00 NDIA Specs and Standards Symposium Summary–*Tim Guilliams, Boeing*

10:30 Panel Discussion with the Speakers of Session 1

Session 2: Company, Commercial, and Military Specifications
Chair: Bob Steffen

11:00 Strategies for Adopting Commercial Standards in Defense Procurement: A View from ASTM–*Kitty Kono, ASTM, Washington, D.C.*

11:30 The SAE-AMS Specification System–*Gary Pollak, AMS Program Manager, Society of Automotive Engineers*

Noon *Lunch*

1:00 Issues Related to Qualified Product Lists–*Arshad Hafeez, Performance Review Institute*

1:30 AIA Early Warning Project Group–*Dennis Evans, Pratt & Whitney and Chairman of EWPG*

2:00 Panel Discussion with the Speakers of Session 2

2:30 *Break*

Session 3: Implementation Issues—Government Agencies' Perspective
Chair: Dale Moore

2:45 NASA Implementation of Commercial Specifications–*Mark Shuart, NASA Langley*

3:15 FAA Perspectives: Barriers and Recommendations for Adoption of Commercial Materials and Processing Standards–*Larry Ilcewicz, FAA NRS (Composites)*

3:45 Space Implementation–*Dave Davis, Directorate of Systems Acquisition, Space and Missiles Center, Los Angeles Air Force Station*

4:15 Panel Discussion with the Speakers of Session 3

4:45 *Break*

5:00 *Reception*

Thursday, October 12, 2000

7:30 am *Continental Breakfast*

Session 4: Implementation Issues—DoD Agencies' Perspective
Chair: Darold Griffin

8:00 Air Force Implementation of Commercial Specifications–*R. Scott Kuhnen, ASC/AFRL Engineering Standards Office, Wright-Patterson AFB*

8:30 Navy Implementation of Commercial Specifications–*Bob Prine, Naval Air Systems Command*

9:00 Acquisition Reform from an Army Airworthiness Perspective–*Kirit Bhansali, ARDEC, U.S. Army Aviation and Missile Command, Redstone Arsenal*

9:30 Army Land Systems Implementation of Commercial Specifications–*Marta Tomkiw, Interoperability Engineering and Standardization Team, Tank-automotive and Armaments Command (TACOM)*

10:00 *Break*

10:15 Panel Discussion with the Speakers of Session 4

Session 5: Implementation Issues—Original Equipment Manufacturers' Perspective
Chair: Samuel Garbo

10:45 Overview of OEM Implementation Issues–*Robert Schafrik, General Electric Aircraft Engines*

11:15 Boeing Implementation of Commercial Specifications–*Keith Porter, Boeing*

11:45 Commercial Specifications at Lockheed Martin: Implementation Issues and a Proposed Plan for National Standards–*Cecil Schneider, Lockheed Martin Aeronautics Company*

12:15 pm *Lunch*

1:00 Panel Discussion with the Speakers of Session 5

Session 6: Implementation Issues—Supplier and Manufacturer Perspective
Chair: Ernest Piisila

1:30 A Material Supplier's Perspective on the Implementation of Commercial Specifications–*Milt Milner, Alcoa, Inc.*

2:00 Implementation of Commercial Specifications: A Manufacturer's Perspective–*Randy Kanaby, Rolls-Royce Allison*

2:30 *Break*

2:45 Panel Discussion with the Speakers of Session 6

Session 7: Conclusion
Chair: Tom Cooper

3:15 Open Discussion

3:45 Concluding Remarks–*Tom Cooper, UTC, Planning Group Chair*

4:00 *Adjourn*

Appendix C

Workshop Speakers and Participants

Gary R. Adams, Aeronautical Systems Center ◙
Kirit J. Bhansali, U.S. Army Aviation and Missile Command ◙
Andrew Certo, Defense Standardization Program Office ♣
Thomas D. Cooper, Universal Technology Corporation ☼
Dave Davis, U.S. Air Force Space and Missile Systems Center, Los Angeles Air Force Base ◙
Dennis J. Evans, Pratt & Whitney ◙
Samuel P. Garbo, Sikorsky Aircraft Corporation ☼
Darold L. Griffin, Engineering and Management Executives, Inc. ☼
Timothy L. Guilliams, The Boeing Company ◙☼
Lee R. Gulley, Air Force Research Laboratory ♣
Arshad Hafeez, Performance Review Institute ◙
Larry Ilcewicz, Federal Aviation Administration ◙
Randy Kanaby, Rolls-Royce Corporation ◙
Kathleen (Kitty) Kono, American Society for Testing and Materials ◙
John J. Kopecky, Pratt & Whitney
R. Scott Kuhnen, Aeronautical Systems Center, Air Force Research Laboratory ◙
Stephen Lowell, Defense Standardization Program Office ◙
Milton W. Milner, Alcoa Technical Center ◙
Dale Moore, Naval Air Systems Command ♣
Jerry Persh, Institute for Defense Analyses ◙
Ernest M. Piisila, ALLVAC ☼
Gary W. Pollak, Society of Automotive Engineers ◙
Keith Porter, The Boeing Company ◙
Bob Prine, Naval Air Systems Command ◙
B. Walter Rosen, Material Sciences Corporation
Robert Schafrik, General Electric Aircraft Engines ◙
Cecil Schneider, Lockheed Martin Aeronautics Company ◙
Mark Shuart, NASA Langley Research Center ◙
Lewis Sloter, Department of Defense ♣
Robert Steffen, Raytheon Electronics Systems ☼
James Thompson, Department of Defense ♣
Marta N. Tomkiw, U.S. Army Tank-automotive and Armaments Command ◙
Frank Traceski, Department of Defense ♣
Matthew B. Williams, Aerospace Industries Association
Trudie Williams, Defense Standardization Program Office ♣
Carl H. Zweben, independent consultant ☼

Note: ☼ denotes committee member
◙ denotes speaker
♣ denotes government liaison

Appendix D

Biographical Sketches of Committee Members

THOMAS D. COOPER is senior program manager for Universal Technology Corporation in Dayton, Ohio. Before joining UTC in 1995, he retired from his position as chief, Systems Support Division, Materials Directorate, Wright Laboratory (now the Air Force Research Laboratory), at Wright-Patterson Air Force Base, Ohio, after 39 years with the U.S. Air Force, including 2 years as an Air Force officer. A registered professional engineer in Ohio, he specializes in all aspects of aerospace metallurgical engineering and the application of materials in operational aerospace systems, including nondestructive evaluation, failure analysis, specifications and standards, materials selection, and manufacturing. Mr. Cooper has had broad experience working in the areas of research, development, manufacturing, and application of new and advanced aerospace materials. He has also been deeply involved with the materials and processes aspects of aircraft and engine structural integrity programs.

Mr. Cooper's numerous honors and awards include the 1991 ASNT Mehl Honor Lecture, SAE's 1991 Franklin W. Kolk Air Transportation Progress Award, SAE's 1992 Arch T. Colwell Cooperative Engineering Gold Medal, the Air Force Systems Commands Certificate of Merit, and the Air Force Meritorious Civilian Award. He also represented the United States Air Force in international specification activities, including having served for many years as the U.S. delegate to NATO AC/82 Group of Experts on the Conversion of U.S. Aerospace Materials Specifications.

Mr. Cooper served for 8 years as chairman of the Aerospace Materials Division of the SAE, responsible for preparing the Aeronautical Materials Specifications. He also served on SAE's Performance Review Board and as a member of SAE's Performance Review Institute Registrar Advisory Panel. He is widely recognized throughout the aerospace community and is a fellow of both ASM International and the American Society for Nondestructive Testing. He is also a member of AIAA, Tau Beta Pi, Sigma Xi, the Dayton Engineers Club, and the Air Force Association and is an honorary member of SAE's Aerospace Materials Division.

SAMUEL P. GARBO has 29 years of experience in the aerospace industry advancing the development, application, qualification, or certification of advanced materials and structure in commercial and military aircraft. Mr. Garbo has significant expertise working with industry, government agencies, university, and professional societies to define standard practices for the characterization, qualification, and certification of advanced materials and aircraft structure in fixed-wing and rotorcraft applications. He has been with Sikorsky Aircraft Corporation (United Technologies) since 1983 and is currently director of technology engineering, directing the technology development and planning in areas of structures research, aeromechanics, and advanced manufacturing technologies. Prior to joining Sikorsky Aircraft, Mr. Garbo focused on composite materials, structural design, analysis, and research and development at McDonnell Aircraft. Mr. Garbo is on the Management Council for Sikorsky Aircraft; president of Composite Materials Characterization, Inc., an industry consortium; the

Sikorsky D 30 Committee Voting Member of ASTM; and a member of ASTM, AHS, AIAA, and Tau Beta Pi. Prior associations include the following: co-chair, Military Handbook 17 Guidelines Working Group; editorial board, *Journal of Composites Technology and Research* and *International Composites Journal*; Aerospace Materials and Manufacturing Technologies Subcommittee on Standardization; AIA Task Group for the Standardization of Composite Test Methods; and AIA Task Group for Standard Damage Tolerance Specification.

DAROLD L. GRIFFEN is president and CEO of Engineering & Management Executives, Inc., with broad executive responsibilities to grow the corporation and enhance stockholder values. EME provides executive engineering and management service in acquisition streamlining, business development; strategic business planning; customer relations; teaming, joint ventures and strategic alliance; continuous process controls; and manufacturing engineering and training. Prior to joining EME in 1994, Mr. Griffin had a long and impressive career with the U.S. Army Materiel Command (AMC), ending up as principal materiel developer and acquisition agent for the U.S. Army. His major responsibilities were development, engineering, and acquisition. He directed a highly successful initiative to reform military specifications and standards for the Secretary of Defense and Deputy Assistant Secretary of Defense (AR). Mr. Griffin also created and implemented acquisition reform strategies, policies, and field training of the acquisition community (research, development, procurement, and organic manufacturing). His professional affiliations include NDIA, AUSA, and the American Society of Metals. Mr. Griffin has expertise in the preparation of commercial and international standards and military acquisition.

TIMOTHY L. GUILLIAMS is a standards engineer with the Boeing Company. He writes, maintains, coordinates, and resolves issues relating to Boeing Company standards, specifically electrical material and process specifications. His expertise is in the preparation of commercial and military standards. Mr. Guilliams administers the Boeing company-wide engineering standards system with responsibility for the overall health of the standards system. He acts as lead or as part of a team in cross-functional and cross-divisional Boeing standardization initiatives. He also reviews external (government or industry) standards for their impact on Boeing. Since 1994, Mr. Guilliams has also been active in the Society of Automotive Engineers (SAE). He serves as chairman of Subcommittee SAE AE-8C2, Aerospace Electrical Terminating Devices, where he is responsible for managing the smooth operation of this standards-writing committee with biannual meetings and is actively concerned with the impacts of military standard and specification reform on industry. AE-8C2 is deeply concerned with impacts of the transfer of military specifications requiring qualification to industry standards developing organizations and is currently drafting recommended practices for the format of SAE standards that include qualification requirements. The chairmen of AE-8 committees participate in the AE-8 executive committee, Aerospace Electrical Distribution Systems, to guide AE-8 subcommittees in providing effective, integrated standardization programs in conjunction with other government and industry standardization activities.

ERNEST M. PIISILA is a quality assurance engineer at the Monroe, North Carolina, facility of ALLVAC with responsibilities as the ISO 9000 coordinator for four

ALLVAC production sites. He has expertise in materials and processing technologies and materials testing. Mr. Piisila currently manages the ALLVAC Quality Assurance administration for customer orders that are to supply government contracts, U.S. Navy nuclear orders, and commercial nuclear customers. He also reviews and interprets specifications as they pertain to material requirements and certification, with oversight of the Certifications Supervisor. He began his career with ALLVAC at the Latrobe, Pennsylvania, facility in 1974 as assistant chief chemist. By 1987, he had become assistant manager of quality assurance at that site, with direct responsibility for the material testing laboratories, specification review, process control procedures, and audits. From 1991 until his transfer to ALLVAC in Monroe, North Carolina, in 1994, he served as manager of quality assurance with responsibilities for all site quality assurance functions and the chemical and metallurgical laboratories. Mr. Piisila is a member of the American Society for Quality and the American Society for Materials (ASM).

NEVILLE PUGH has been at NIST since 1979. He was born and educated in Wales, receiving his B.S. (1956) and Ph.D. (1959) in metallurgy from the University of Wales at Cardiff. His expertise is in the preparation of commercial and international standards. Dr. Pugh's research career focused on fracture and the effects of corrosive environments on the fracture (stress corrosion cracking, hydrogen embrittlement, and liquid metal embrittlement) of a broad range of alloys, including those of copper, iron (stainless steels), aluminum, and titanium. His research was conducted primarily at the Australian Defense Standards Laboratories (1959-1963), Martin Marietta's Research Institute for Advanced Studies (1963-1970), and the Metallurgy Department at the University of Illinois at Urbana-Champaign (1970-1979), in addition to the Corrosion Group at NIST. He has published widely and has received NACE's Whitney Award for Corrosion Science (1984) and the Department of Commerce Silver Medal (1989). He is a fellow of both ASM International (1984) and NACE International (1995). In 1985, Dr. Pugh became chief of the Metallurgy Division, managing a group of 50-60 professionals; during that period, he was a member of the federal government's Senior Executive Service. Beginning in early 1998, Dr. Pugh shifted his interests from materials science and engineering to the standards area. He worked first at NIST's Office of International and Academic Affairs on a European Union-U.S. program on mutual acceptance of calibration certificates, focusing on problems encountered by the FAA and other U.S. regulatory agencies in establishing equivalence between the primary standards of NIST and those of the European Union national metrology laboratories. He is currently a member of the headquarters staff at NIST's Office of Standards Services, where he is involved with issues relating to the implementation of the 1995 Technology Transfer and Advancement Act and of the development of a national standards strategy.

ROBERT STEFFEN has been a process engineering metallurgist with Raytheon since 1980. His expertise is in specifications and standards. He is involved in fabrication shop, program design, quality engineering, and procurement activities. He was elected Distinguished Member of Technical Staff in 1998. Mr. Steffen plays a leadership role in Society of Automotive Engineers Aerospace Materials Specifications Committees as vice chair of the Aerospace Materials Division, chair of the Metals Group, and past chair of Nonferrous Alloys Committee D. He also participates on the RSC Castings/Forgings/Metals Stock Technology Team, RTIS Technical Recognition and

Award Program Team, RTIS Casting Quality Improvement Team, and Dallas Metal Fabrication COE Technical Ladder Process Team. Mr. Steffen is a member of ASM International and the American Foundrymen's Society.

CARL H. ZWEBEN, now an independent consultant on composites, was for many years advanced technology manager and division fellow at GE Astro Space, which was acquired by Lockheed Martin. His expertise is in systems design. At Lockheed Martin, Dr. Zweben was responsible for developing advance composites applications and technology. He served as manager of the GE Aerospace Composites Center of Excellence and as leader of the Lockheed Martin Space and Strategic Missiles Sector Composite Structures Center of Excellence Team. He also was responsible for management of all Astro Space structural, mechanical, and thermal technologies. Dr. Zweben has chaired design and mission success reviews, conducted marketing studies, and consulted on acquisitions and joint ventures for GE Corporate Headquarters. He is also an advisor to the Georgia Institute of Technology NSF (Electronic) Packaging Research Center, part-time research professor at Drexel University's Department of Materials Engineering, and adjunct professor at the University of Maine Department of Civil Engineering. He previously held positions at DuPont and the Jet Propulsion Laboratory. He holds degrees in civil engineering (structures) and applied mechanics from the Cooper Union, Columbia University, and Polytechnic University.

Appendix E

Acronyms

AMS	Aerospace Materials Specification
ASTM	American Society for Testing and Materials
DoD	Department of Defense
DSP	Defense Standardization Program
EWPG	Early Warning Project Group
FAA	Federal Aviation Administration
GE	General Electric
ManTech	(Department of Defense) Manufacturing Technology
MIL-HDBK	Military Handbook
MilSpec	military specification
NASA	National Aeronautics and Space Administration
NDIA	National Defense Industrial Association
NDT	nondestructive testing
NGS	nongovernment standard
NGSB	nongovernment standards body
NMAB	National Materials Advisory Board
NRC	National Research Council
OEM	original equipment manufacturer
PRI	Performance Review Institute
QPL	qualified product list
SAE	Society of Automotive Engineers
SDO	standards development organization
SPI	single process initiative
TACOM	(United States Army) Tank-automotive and Armaments Command