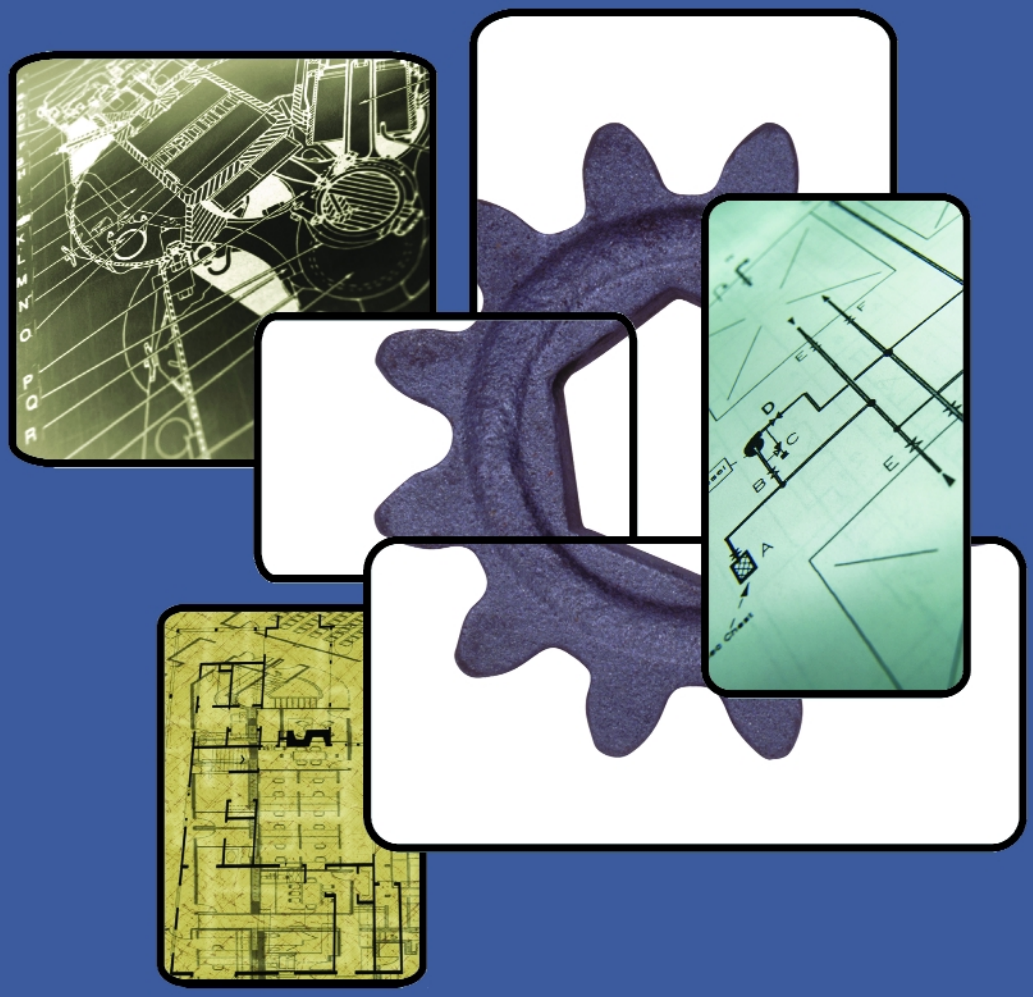
Defense Standardization Program

Case Study



Conversion of MIL-STD-100 to a Non-Government Standard

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Standardization Case Study

This study addresses the development of a non-government standard to replace MIL-STD-100, *Engineering Drawing Practices*, a standard for the preparation and delivery of drawings. Development of a fully acceptable replacement standard required interaction among the Military Services, non-government standards bodies, industry, and other government agencies.

The replacement of MIL-STD-100 demonstrates the complex process that is necessary to realize the goals of acquisition reform. The greatest obstacle was the natural human aversion to change, requiring persuasion and compromise to reach a broad consensus. This conversion from a military standard to a commercial standard illustrates important lessons in building a partnership between the military and industry to find a mutually satisfactory solution.

Background

MIL-STD-100, first published in 1965, was for decades the cornerstone document the Department of Defense (DoD) used to create millions of technical engineering drawings. Large segments of industry used it as well. Compliance with MIL-STD-100 was required when commercial or contractor drawings were not an option. In addition, program offices with major end items that had to be supported through the DoD logistics system required drawing preparation in accordance with MIL-STD-100.

MIL-STD-100 required delivery of original drawings, in either hard copy or digital data. It also designated a DoD activity, identified on the drawing as the original design activity, which had change control authority over the drawing contents.

The Problem

For years, some decision makers in DoD and industry recognized problems with mandating compliance with detailed military specifications and standards. Compliance with MIL-STD-100 was viewed by many in industry as very costly and unnecessary. The advent of acquisition reform in the mid-1990s increased attention and concern on the way DoD set acquisition

requirements. All detailed standards came under scrutiny. Numerous studies—notably the *Report of the Industry Review Panel on Specifications and Standards* and *The DoD Regulatory Cost Premium: A Quantitative Assessment*—identified MIL-STD-100 among those labeled as excessively costly and beyond basic commercial practices.

In February 1995, the Defense Standardization Improvement Council (DSIC), after a review of MIL-STD-100, directed conversion of the military standard to a non-government standard. The DSIC called for the conversion and subsequent cancellation of the military standard to be completed within 2 years.

The content of MIL-STD-100 was detailed and rigid. It required drawings to provide virtually complete information on the design and production of items, leaving nothing unexplained. It contained many unique DoD requirements. Although MIL-STD-100 provided consistent contractual application and ensured proper interface with cataloging and logistics needs, in many places, it was incompatible with commercial practices. Because DoD did not accept commercial drawings for commercial parts used in military items, contractors were forced to develop new military drawings, even if the design of the parts was proprietary.

"According to industry, contractors devote, on average, about 50 to 100 percent more time to the preparation of a military drawing than that required for a comparable commercial drawing."
The DoD Regulatory Cost Premium: A Quantitative Assessment

Although the standard was cumbersome, over the years it had produced good results. Further, because the use of MIL-STD-100 was so extensive, its application involved virtually all weapons development programs. The defense establishment and its manufacturers and parts suppliers were deeply entangled with the intricacies of MIL-STD-100. However, the real challenge was deeper. Delivery of drawings by some means other than invoking MIL-STD-100 would require a change of mindset.

Organizational Approach

Three years before the DSIC directive, in February 1992, the DoD Industry Drawing Practices Group (DRPRG) was formed as an early response to the problems associated with MIL-STD-100. The DRPRG was the result of an initiative undertaken by the Quality Engineering

Directorate at the Armament Research, Development, and Engineering Center, Picatinny Arsenal, New Jersey.

DRPRG quickly concluded that the logical approach was to convert MIL-STD-100 to a non-government standard. In March 1992, DRPRG began a search for a non-government standards body that could—and would be willing to—sponsor the conversion. The Drawing Practices Committee (Y14) of the American Society of Mechanical Engineers (ASME) agreed to sponsor the task. Subsequently, DRPRG was chartered as a subcommittee of the Drawing Practices Committee. In August 1992, the subcommittee became ASME Y14/SC100. The framework for the conversion was now in place.

Table 1 summarizes the scope of work the committee undertook.

Identify and document engineering drawing practices.
Document the interrelationship of various drawing practices.
Identify subject areas related to engineering drawing practices that might need non-government standards.
Summarize government-peculiar requirements and associated practices.
Develop appendices for the government-peculiar requirements.

Table 1 ***Scope of the Y14.100 Effort***

Core subcommittee membership was comprised of representatives from the Military Services, other government agencies (e.g., U.S. Postal Service, National Security Agency), DoD contractors, and industry groups. The subcommittee formed working groups to write conversion procedures.

The process also involved close cooperation and coordination with 16 subject-related subcommittees of ASME and interface with the Institute of Electrical and Electronic Engineers (IEEE), the Society of Automotive Engineers (SAE), and the American Society of Testing and Materials (ASTM).

Because so many organizations had strong vested interests in the standard, the subcommittee decided to keep membership open. Anyone who used MIL-STD-100, or was affected by it, was welcome to serve on the conversion committee. Opening the meetings to all interested parties stimulated participation with as many as 60 members attending some meetings.

As is true for many other processes, the development of standards succeeds best through consensus building. Reaching consensus on complex issues is lengthy and sensitive, adding further complexity. The consensus process requires that all parties be actively engaged in the issue. The committee's open membership approach encouraged its members to be active. Working group members discussed the issues surrounding a problem and pooled their collective knowledge and experience. The ideas and feelings of all the members then were integrated into a group solution. Rewriting concluded only when each member of the group supported the solution.

The investment of time spent in building consensus paid off during the comment resolution phase. Because the most interested members actively participated in writing the new standard, follow-up coordination was easier and less time consuming than is often characteristic of projects of such magnitude.

Conversion Phases

The 2-year schedule that the DSIC had stipulated for the conversion of MIL-STD-100 to a non-government standard was too optimistic. A consensus process involving many diverse interests is difficult and time consuming. The MIL-STD-100 conversion required an additional year. The newly rewritten non-government standard was approved and adopted in February 1998.

The conversion required two phases. The initial phase resulted in the creation of two documents:

- ASME Y14.100M, *Engineering Drawing Practices*, a non-government standard that replaced approximately 70 percent of MIL-STD-100.

- A new version of the DoD document, MIL-STD-100G, *Department of Defense Standard Practice for Engineering Drawing*, that detailed engineering drawing practices with no commercial equivalent.

The two standards were to be used in combination. Contractual and logistics issues would dictate how they were used (e.g., if a manufacturer provided the total support for an item, then the detailed parts identification information required in MIL-STD-100G might not be necessary).

The second phase, initiated in November 1998, is scheduled for completion in 2001. In this phase, the two standards are being combined into one document. The resulting standard will be ASME Y14.100-2001, *Engineering Drawing Practices*. Unique DoD practices (those that remained in MIL-STD-100G) will convert to a set of non-mandatory appendices to the non-government standard. These practices will remain available as needed.

Development of standards succeeds best through consensus building.

Investments and Payoffs

The Costs of Conversion

The primary cost to convert from MIL-STD-100 to a non-government standard is time, an investment made by DRPRG and SC100 members. Composing text, conducting draft reviews, and attending meetings are lengthy and iterative processes. The collective government and industry personnel time spent on conversion is estimated to equal at least 3 man-years.

The Deferred Benefits of Conversion

The benefits of the conversion are long range. Benefits from the new ASME standard will accrue from its application to new procurements. Existing programs may not benefit because converting existing drawings is unnecessary, and the cost of drawing conversion would be prohibitive. Because ASME Y14.100 benefits accrue primarily to new programs, the commitment of time and effort is an investment made now to reduce the cost and complexity of acquiring future systems. The realization of those

savings will be determined by how new program teams apply the standard.

Programs that accept commercial drawings may realize the greatest savings. Programs that invoke the military-unique appendices will incur increased costs reminiscent of those associated with MIL-STD-100. The conversion offers choices and flexibility to better tailor drawing solutions to meet program requirements.

DoD Conversion Benefits

The shared interests and concerns of government and industry are addressed by participation in the consensus process.

The responsibility for maintaining the drawing practice standard has shifted to ASME. The shared interests and concerns of both government and industry will be addressed by actively participating in the non-government standard consensus process. Document maintenance and subject-matter expertise for all but DoD-unique requirements is now the responsibility of ASME, lowering the DoD document maintenance burden. DoD still has a responsibility to participate in SC100 meetings and to defend DoD interests in the standard.

DoD needs to participate in ASME Y14.100 activities because some practices contained in this document are specifically applicable to, and in direct support of, DoD interests. For example, the DoD logistics system requires that drawings identify items in a manner unique to DoD. These identification numbers provide definitive identification of an item's configuration and the requirements it is designed to meet, allowing DoD to know that it is obtaining safe, suitable and effective parts. To ensure that the unique DoD practices contained in the Y14.100 appendices are not changed or abandoned, the government must be an active participant in maintaining the standard.

Perhaps the most significant benefit is less tangible. The *mindset* of the acquisition community is changing. The rigid government control of drawing processes under MIL-STD-100 demanded inflexibility. Following approval of ASME Y14.100, the default condition for delivery of drawings is commercial drawings produced under non-government stan-

dards in the contractor's format. However, the standard retains the ability to apply tighter requirements when circumstances demand.

Current Status

ASME and associated industry supporters are responsible for additional documentation addressing drawing preparation. While Y14.100 is the basic drawing practices standard, three other standards also apply:

- ASME Y14.24, *Types and Application of Engineering Drawings*
- ASME Y14.34M, *Associated Lists*
- ASME Y14.35M, *Revision of Engineering Drawings and Associated Documents.*

The combined application of these standards is driven by contractual and logistics intent.

Conversion requires a partnership between the military and industry to find a mutually satisfactory solution.

Lessons Learned

The conversion of MIL-STD-100 involved hundreds of people and a total investment of more than 3 man-years of labor. They struggled through a long and difficult process to reach consensus regarding one of the most complex standards ever to undergo conversion. Their success depended on active involvement, commitment, and hard work. Their path uncovered several important lessons for future conversion teams. The lessons they learned have broad application.

The following is a summary of the lessons learned during the conversion of MIL-STD-100 to a non-government standard:

1. **Define the Scope of the Task.** The preliminary examination of MIL-STD-100 revealed the complexity of the conversion. Acknowledging the complexity, dividing the task into phases, and allowing time to change the mindset provided an invaluable platform for accomplishing the task. A quick solution is not necessarily the best solution.

2. **Seek the Best People for the Job.** A large conversion effort requires dedicated, tenacious people with a strong interest in seeing the task done. Such people required tremendous energy, tact, perseverance, and good will.

3. **Collaborate with Industry.** Conversion of a military standard to a non-government standard requires compromise. It means harmonizing industry practices with military needs. Reaching consensus early on key requirements and objectives can reduce the time required to resolve conflicts later in the conversion process.

4. **Draw on Industry Expertise.** Industry can provide a wealth of expertise on new technology, best practices, and practicality. Collaboration and cooperation uncover opportunities for cost and time savings.

5. **Develop Working Relationships**. The collegial relationships formed between government and industry personnel through interaction at symposia, non-government standards committees, conferences, and other professional meetings help facilitate the intense interaction and close cooperation required for consensus.

6. **Invest Time to Reach Consensus.** Many organizations had a strong interest in MIL-STD-100 and its conversion. Developing and maintaining consensus on issues required sensitivity and patience throughout the lengthy process. The natural desire to complete a task quickly competed with the need to listen to all the concerns, address each of them in turn, then work through them line by line.

7. **Commit Sufficient Resources.** The conversion of a complex military standard to an equally complex non-government standard takes time and commitment. Significant resource and expertise are essential. An early commitment to “go the distance” is absolutely necessary.

8. **Plan Ahead.** After a complex conversion is complete, the government still must actively maintain involvement to protect and address DoD-unique interests. Adequate staff support for active non-government standard involvement, while minimal compared to that required by military document maintenance, must be planned and budgeted.

Making Systems Work Together

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