AMC Confronts Challenges, Barriers to Developing Commonsense, Cost-Effective Performance Specifications

"Roadshows" Provide Forum for Direct Interaction with Technical Teams Who Write, Review, Use Specifications

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> *The difficulty lies, not in the new ideas, but in escaping from the old ones...*
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> *– John Maynard Keynes (1883-1946)*
> *British Economist*

To accelerate significant changes in Department of Defense (DoD) business practices and processes, former Secretary of Defense, Dr. William Perry, institutionalized several Acquisition Reform initiatives across DoD since 1994. One of his policies, Specifications and Standards, instituted a dramatic cultural change for technical management within DoD.

Performance Specifications in AMC

To publicize and promote Dr. Perry's initiatives, along with changes in legislation and acquisition practices and policies, the U.S. Army Acquisition Corps, working with the Army Materiel Command (AMC), devised a unique, annual event [platform] called the Army Acquisition "Roadshow."

Basically, the Army's senior acquisition leaders and executives took the position that they could not reform the acquisition system by proclamations and memoranda alone. Rather, they believed that a series of "traveling" workshops and symposia that took the information directly to the Army Acquisition Workforce, was a better way to promote acquisition streamlining.

Many of the previous Roadshows placed heavy emphasis on Military Specifications (MILSPEC) and Military Standards (MILSTD) reform. This year, the emphasis will be on the total Army acquisition community. Roadshow VII – "Reducing Total Ownership Costs" – addresses the latest working-level

FIGURE 1. Performance and Detail Specifications

Performance Specification
- User needs
- Criteria for verifying compliance
- Functional requirements
- Operating environment
- Interface and interchangeablility characteristics
- Form, fit, and function

Detail Specification
- Design requirements
- Materials to be used
- How a requirement is achieved
- How an item is fabricated or constructed

A Specification that Contains both Performance and Detail Requirements is Still Considered a Detail Spec

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implications of current Acquisition Reform topics.

A Need for Practical Information

Feedback from Army Roadshow IV in fall 1994 revealed a need for in-depth, practical information, directly related to DoD's Performance Based Specifications policy. To meet this need, we developed and conducted separate AMC Performance Specifications Seminars from March 1995 through December 1996, directly interacting with technical teams who write, review, and use MILSPECs.

The U.S. Air Force, meanwhile, conducted a parallel effort in 1996 and 1997. Other seminars were conducted or are still ongoing for the Navy, Marine Corps, National Security Agency, and several companies in the defense industry.

This effort had two basic objectives: to show preparing activities how to write Performance Specifications; and to survey field activities to help us understand their concerns and perceived barriers to developing and using Performance Specifications. In this article, we share some of the more important conclusions and viewpoints from the people on the front lines of change.

Initial Effort

Our initial effort, starting in spring of 1995, concentrated on converting existing Component Specifications into Performance Specifications to impact the procurement process as quickly as possible. The result was a two-day seminar, directly addressing the question, "How do I convert our current Detail Specifications into Performance Specifications?"

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To accomplish this objective, we built a structured, methodical process. This included a case study, demonstrating the technique on a real Specification. Over the last three years, the seminar evolved into one-, two- and three-day versions with options to address Specifications used for components, programs, and test agency needs. We also built eight Army case studies, using real Specifications, to demonstrate converting Detail Specifications into Performance Specifications.

Over 3,000 technical personnel in the Army, Air Force, Navy, and support contractor community have already attended the seminars. As expected, we found some concerns about changing the way we do business.

Implications of Cultural Change

The Performance Specifications policy requires cultural change in the technical community. Instead of developing, approving, and maintaining designs, government engineers must develop clear, performance-oriented technical requirements and corresponding verifications. As you might imagine, we found some resistance, based on fear of the unknown, or perceptions that the government could acquire inferior products unless we always control the design process.

Moving Away From Detailed MILSPECs and Process-Oriented MILSTDs

One aspect of this cultural change is less reliance on an extensive set of Military Specifications (MILSPEC) and Military Standards (MILSTD) that only allow limited processes and designs. Instead, we will use non-government standards, program-specific requirements and corresponding verifications, or tailored portions of the remaining MILSPECs and MILSTDs.

The "one size fits all" approach for all types of products and systems is on the way out. This cultural change re-focuses government engineering efforts from design-oriented work toward empowerment to evaluate different types of solutions to our requirements.

FIGURE 2. Rules of Thumb for Writing Specifications (Requirements)

Does the requirement clearly state "What we need"?

Does the requirement directly relate to the user's need?

More length = More risk of being a Detail requirement!

Does the requirement allow for different solutions?

With the potential of multiple solutions to the same MILSPEC, we must determine the best approach during contract source selection. This has a significant impact on Army technical personnel. Instead of specializing on single designs and unique tests, we are flexible enough to recognize a wide variety of relevant technologies and test methods. We must also understand the risks associated with each contractor's solution, for the specific types of products and systems we manage.

Modernization Through Performance Specifications

The U.S. Army's leaders recognize that Performance Specifications offer a way to infuse current technology to improve capability and reliability. To achieve Modernization Through Spares during reprocurement activities on existing systems, we must relinquish design oversight, maintain critical interface control, and allow industry to determine the solutions. Our challenge is to clearly describe technical requirements and provide sufficient verification to assure products meet the users' needs.

FIGURE 3. Rules of Thumb for Writing Specifications (Verification)

Will the current product pass these tests?

Are we open to alternative tests?

Did we provide several options for costly or time-consuming verifications?

Did we focus on the important criteria, oriented to verifying performance, not the design?

Did we tailor extracted tests to get the most economical verification possible?

Did we *minimize* risk, not ***eliminate*** all risk?

Building Performance Based Requirements

Many Component-level Specifications contain a mix of performance and detail requirements, defining "how to" achieve the capability. As we transition to pure Performance Specifications, addressing the needs shown in Figure 1, industry now has an opportunity to provide alternative solutions.

One added benefit is that a well-written Performance Specification removes inconsistencies that can occur between detail designs and performance requirements in the same document — a condition known as a "Defective Specification."

The user-oriented approach to writing performance requirements is more direct than designing a solution to satisfy our needs. However, more interaction with users and support agencies will be required to develop the best Performance Specifications. Our Rules of Thumb in Figure 2 can help select good performance requirements.

Avoid These Potential Problems

We found several pitfalls to building good Performance Specifications in our Specification conversion work, and during discussions in the Performance Specifications Seminars. The two most important ones follow:

Pitfall No. 1 — The Unobtainable Requirement. Performance Specifications concentrate on needs, not solutions. One danger is that it becomes very easy to write statements that are technically un-

PERFORMANCE SPECIFICATIONS WEB SITES

For additional reference information about Performance Specifications, visit the following Web sites on the Internet:

OSD Standardization Office
http://www.acq.osd.mil/dsp/

Specifications and Standards Search
http://www.dtic.mil/stinet/htgi/dodiss/

Army Specifications and Standards
http://www.amc.army.mil/amc/rda/milspec/All.html

Navy Specifications and Standards
http://www.acq-ref.navy.mil/thrust_ss.html

Air Force Specifications and Standards
http://www.afmc.wpafb.af.mil/HQ-AFMC/EN/enp/enpiweb/specs.htm

Open Systems Joint Task Force
http://www.acq.osd.mil/osjtf/

BRTRC Institute
http://www.institute.brtrc.com/

obtainable, or extremely costly to achieve. If we are in a development program, this may be desirable. If we intend to use the Specification for production, this pitfall can create real problems. The following example of an undesirable performance requirement illustrates our point:

The computer's crystal oscillator shall function at temperatures of –150° C.

In reality, this requirement was achieved during production, but the manufacturing process only gave a 17-percent yield, causing fielding delays and high procurement and support costs. In its real operating environment, the crystal was only exposed to a temperature range found in aircraft cockpits. If we specified the environment to only –120° C, the production yield jumps to over 90 percent.

As it turned out, this temperature requirement migrated into aircraft hardware from the National Aeronautics and Space Administration's lunar lander program. It provided a very durable solution for the aircraft, with significant safety margin, but had extreme impacts on program cost and schedule.

Our recommendation to resolve this type of problem is to suggest that each author and Specification reviewer analyze critically every word and phrase in the Specification. When combined with market awareness of compatible types of technology, this approach helps minimize the unobtainable requirement problem.

Pitfall No. 2 — Not Maintaining Backward Compatibility. When converting existing Component-level Specifications, we usually need the documents for contracting action as soon as feasible. Since many of these Specifications are used for reprocurement of spare parts, delays could have drastic impacts on force readiness.

One tendency we found when converting Specifications is to state "wants" or inadvertent upgrades. Sometimes, authors try to revise requirements to incorporate capabilities found in the latest technology when updating older, detailed Specifications. The danger lies in demanding high-tech type requirements that have no proven production capability. If a Specification has this problem, we cannot procure products until all development, design, qualification, and first-article testing are completed. Our recommendation to minimize this danger is maintain backward compatibility.

Performance Specifications concentrate on needs, not solutions. One danger is that it becomes very easy to write statements that are technically unobtainable, or extremely costly to achieve.

The successful test of backward compatibility is when current products, now built to Detail Specifications, are the first acceptable candidates with a converted Performance Specification. Once we use a newly converted Specification, competitive market pressures can facilitate design evolution and incorporate increased capability. When new products have been proven, the Performance Specification can then incorporate increased performance levels.

Writing Clear Verifications

Building a clear set of requirements is important, but the heart of a Performance Specification is Section 4, Verification. A contract requires the manufacturer to deliver items that meet requirements. This means that each product must be capable of passing every examination, analysis, test, or demonstration listed in Section 4.

The measure of success — whether the product meets the user's needs — is directly related to the quality of verifications we write. We found that building this section is the most difficult part of developing good Performance Specifications. Figure 3 shows some of our suggested tips to help write good verifications.

Cultural Change Related to Verifications

Knowledge of the types and methods of verification used in industry is crucial to developing good verifications. With the change in reliance from design solutions and mandatory MILSPECs and MILSTDs, a different approach to verification is now necessary. The new outlook requires market awareness to research, develop, and write good verifications.

Some Conclusions

We conclude that the technical requirements process continues to evolve within the Army, and over the last three-and-a-half years, a great deal of progress occurred. Cultural change in the technical community requires a different outlook to writing requirements and verifications, but the new paradigm offers real benefits. To make this a lasting, beneficial effort, authors and reviewers should emphasize critical analysis of their Specifications and strive to maintain backward compatibility with current products when converting existing Specification.