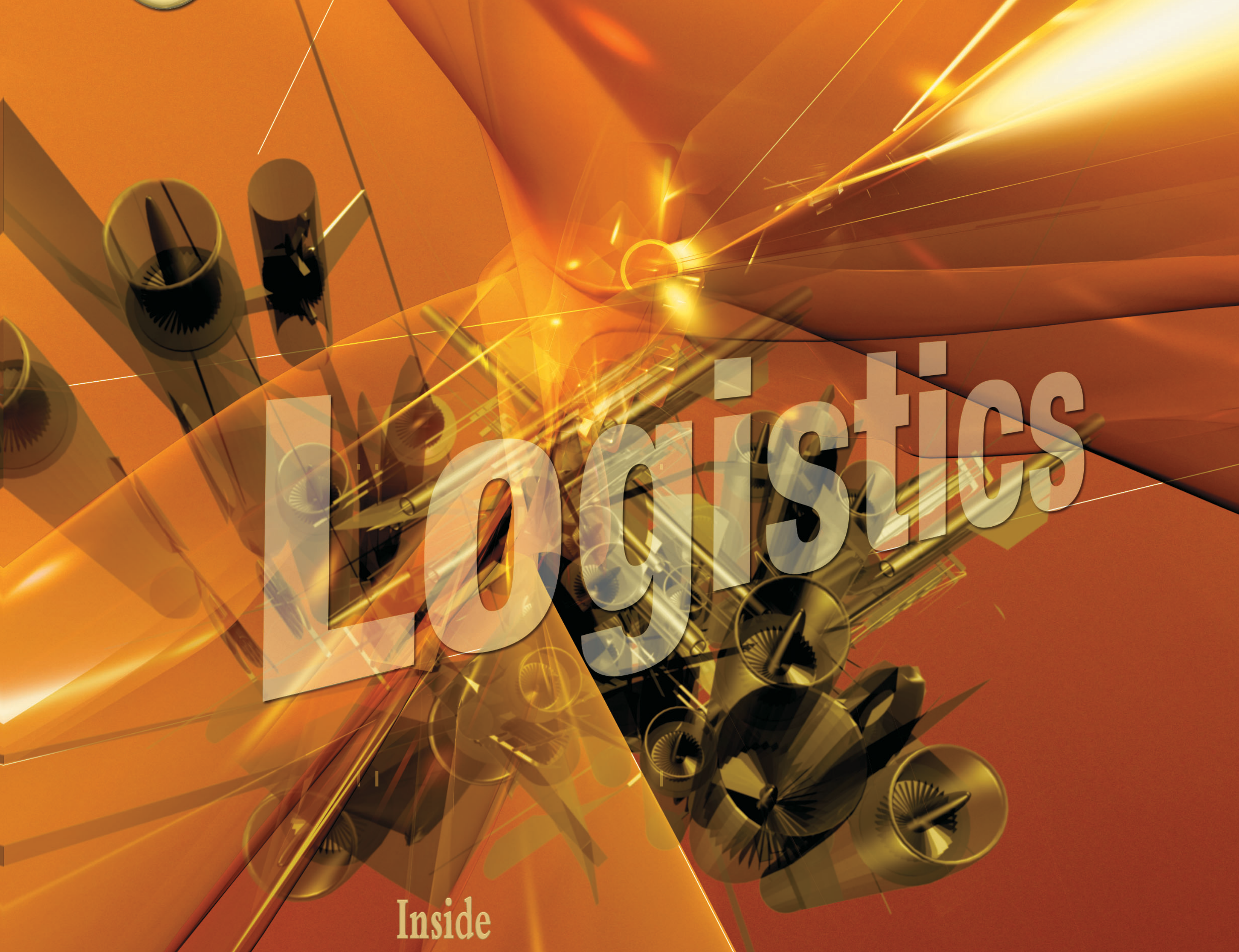
Defense Standardization Program

Journal

April/June 2004



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In the last issue of the *Defense Standardization Program Journal*, I welcomed the Army Standardization Executive to this column to introduce the first-ever issue devoted to the standardization work of a single military department. Soon I will welcome the Navy Standardization Executive when he is given the same opportunity. But for this issue, it is my pleasure to turn over my column to my boss, Mr. Lou Kratz, the Defense Standardization Executive and Assistant Deputy Under Secretary of Defense for Logistics Plans and Programs. The Defense Standardization Program is not an end unto itself—it is an integral part of a much larger whole. In his introduction, Mr. Kratz helps to draw the larger picture and show how standardization is woven throughout.

Gregory E. Saunders
Director, Defense Standardization Program Office

Message from Lou Kratz

Defense Standardization Executive and Assistant Deputy Under Secretary of Defense (Logistics Plans and Programs)

Logistics Is the Foundation of Combat Power
—Joint Doctrine Capstone and Keystone Primer (Joint Pub 4.0)

As logistics is the recognized foundation of combat power, so too the Defense Standardization Program (DSP) is the bedrock of logistics effectiveness and interoperability. Allied operations in Afghanistan and Iraq proved the invaluable contribution that the DSP makes to allied interoperability. This issue summarizes ongoing efforts by the DSP to continue to evolve defense standardization to meet the requirements of our national security strategy and our warfighters.

The Challenge

The Quadrennial Defense Review (QDR) clearly documented logistics transformation objectives to support our emerging national security strategy:

- Rapidly project and sustain combat power to distant theaters with minimal footprint
- Implement performance-based logistics to improve weapon system readiness and compress supply chains
- Achieve industry standards for logistics cycle times.

Attainment of those objectives is dependent upon a coherent standardization program that is focused on interoperability and future process requirements. To provide this focus, the Under Secretary of Defense for Acquisition, Technology and Logistics (AT&L) directed

Lou Kratz

the Defense Standardization Executive to develop a Joint Materiel Standards Roadmap. This roadmap was intended to prioritize defense standardization activities on near-term operational requirements for joint and allied interoperability and enabling future logistics processes. The DSP aggressively developed and implemented the roadmap in FY03 and, later this year, will launch the Program Manager's Tool (PMT), a web-accessible guide to applying key roadmap requirements. A few highlights that directly support the QDR direction are summarized below.

Reducing Footprint

The most significant drivers of the deployed logistics footprint are maintenance and supply operations in support of weapon systems and the footprint associated with munitions safety handling and storage. To address the logistics footprint, defense standards efforts in FY03 included the following:

- Adoption of commercial item designators for true commercial items, thus simplifying the ordering process
- Endorsement of AECMA Standard 1000D for technical manuals, thus increasing interoperability with our European allies and finally issuing a consistent DoD standard for interactive electronic technical manuals
- Development and implementation of NATO standards for the design of safe and suitable munitions and explosives (including "insensitive munitions") to reduce the allied footprint, streamline materiel handling, and ultimately reduce the hazard classification
- Renewed emphasis on parts standardization through revised supportability policy to reduce duplicate parts and streamline materiel delivery processes.

These efforts were in addition to maintenance of the international and NATO standards that enabled allied interoperability in Iraq and Afghanistan.

Implementing Performance-Based Logistics

DoD's migration to performance-based logistics as our preferred weapon system sustainment strategy often involves increased reliance on industry for critical technical support areas, such as sustaining engineering, obsolescence management, configuration management, and data management. This increased reliance on industry necessitates the development of consistent industry standards for configuration management and data management. Previously, a strong industry-government team developed and promulgated GEIA-649, an industry standard for configuration management. Building upon that success, the Government Electronics Industry Association, the military departments, and the Office of the Secretary of Defense supported the development of GEIA-859, industry standard for life-cycle data management, and the EIA-836 data dictionary. The data dictionary is in the final vetting process now, with a projected completion in FY04. This effort will ensure rigorous configuration and data management practices across DoD and our industrial partners, resulting in accurate and timely product information by unique end item.

Achieving Industry Standards

One of the biggest differences between commercial and DoD supply chains is that leading commercial firms can see, manage, and control all the materiel in their pipelines. After years of assessing, considering, and pilot testing various supply chain visibility technologies, DoD moved out rapidly in FY03 in two distinct but complementary areas. First, at the direction of the Acting Under Secretary of Defense (AT&L), Mr. Michael Wynne, DoD implemented universal identification of materiel built upon ISO standard 15434. Today, all inbound materiel must be marked with a unique item identification (UID), and we are assessing application of UID markings to legacy materiel. This technology provides DoD with unique identification of spare parts (particularly high-dollar spare parts), which directly assists maintenance planning, supply planning, asset tracking, and obsolescence management.

Second, considering the results of operations in Central Command, Mr. Wynne also directed that DoD accelerate application of active and passive radio frequency identification (RFID), again built to commercial and international standards. In FY03, DoD developed initial policy guidance on active and passive RFID application. An interesting note is that DoD is leading the commercial sector in passive RFID implementation. In fact, we are working closely with Wal-Mart to ensure that we implement consistent, international standards.

The Way Ahead

FY03 was a banner year for DoD standardization efforts, and I congratulate you all on your commitment and progress. Your efforts are paying off on the battlefield today and will continue to pay off as we move to the future, due to your foresight and dedication. The remainder of this edition of the *DSP Journal* provides some additional examples of recent standardization successes and contributions. I invite you to review those articles to gain a better sense of your contribution to our national security.

THE UNDER SECRETARY OF DEFENSE

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WASHINGTON, DC 20301-3010

ACQUISITION,
TECHNOLOGY
AND LOGISTICS

FEB 21 2004

MEMORANDUM FOR MEMBERS OF THE DEFENSE LOGISTICS BOARD
OFFICE OF FORCE TRANSFORMATION

SUBJECT: Logistics Transformation Roadmap

Focused Logistics is the Department's Joint Functional Concept for comprehensive, integrated logistics capabilities necessary to support future warfighting capabilities and Joint Operational Concepts. The Concept includes sufficient capacity in the deployment and sustainment pipeline, appropriate control over the pipeline from end to end, and a high degree of certainty to the supported joint force commander that forces, equipment, sustainment, and support will arrive where needed and on time. Additionally, this covers redeployment and reconstitution of units and material. Successful implementation of this broad concept requires a number of specific enabling strategies.

One of those strategies must be a coherent approach to implement a distributed and adaptive logistics capability. This strategy will be referred to as the Logistics Transformation Roadmap, in support of Focused Logistics.

The Deputy Under Secretary of Defense (Logistics and Materiel Readiness) will convene a Flag Officer/General Officer group of key stakeholders, including representatives from the requirements, logistics, materiel, and warfighter communities. The roadmap will provide a coherent way forward, including milestones and resources, that encompasses the Force-Centric Logistics Enterprise, ongoing Distribution Process Owner efforts, Sense and Respond Logistics, and Joint Theater Logistics Management. The product of this group will be a Transformation Roadmap for integrating logistics from point-of-effect to source of supply/services, across Services and Defense Agencies. A draft approach should be available in early June, 2004.

I will review the draft approach in coordination with CJCS, Commander USJFCOM, Commander USTRANSCOM, and the Office of Force Transformation.

To assist with this critical undertaking, I ask for your active participation and support. My point of contact for this effort is Mr. Lou Kratz, ADUSD (Logistics Plans & Programs); available by phone at 703-614-6082 or via e-mail at Louis.Kratz@osd.mil.

Michael W. Wynne
Defense Logistics Executive
Acting

Performance-Based Logistics
The New Standard for Acquisition

By Anthony Trovato

In a few short years, performance-based logistics (PBL)—the de facto DoD standard for acquisition and support services—has evolved substantially. When it first emerged, PBL initially was seen to focus on contractor logistics support. Most of industry perceived PBL as being an effort to shorten the logistics tail by releasing the military from its rigid support infrastructure and, instead, having the contractor achieve the same results through a more flexible, commercial-like support structure. Now, industry and DoD alike view PBL as being a comprehensive design-based activity—one that addresses the interrelationships of design and support requirements, as illustrated in Figure 1.

FIGURE 1. True Performance-Based Logistics Is Founded in the Engineering Design Activities Based on the Final Users' Requirements and Environment

Impact on New System Acquisition

The impact of PBL is just now being felt in the acquisition of new systems (both equipment and software) in which meeting user requirements for supportability is considered as important as meeting the performance requirements. To put it another way, the need for improvements in reliability and maintainability is challenging the dynamics of the design process. A prime example of this is the Future Combat Vehicle; the requirements for reliability are challenging industry to reach new goals, and the requirements for minimum maintenance and onboard support are fully integrated into the vehicle design.

The early emphasis on an engineering design that improves reliability and maintainability provides the basis for future reductions in support and operations costs through changes in spares distribution and reductions in personnel training costs. The increased emphasis on performance, coupled with the elimination of most of the prescriptive standards and specifications once cited in statements of work, has shifted the focus to the use of commercial standards and industry-identified best commercial practices. This shift has been unsettling in some communities and has caused a strain on some smaller businesses that now must implement, on their own, what formerly had been mandated. Some parallel initiatives—such as the move toward the use of commercial off-the-shelf (COTS) products—have accelerated the acceptance of those best practices.

Not clear yet is the impact on mission availability when an item of equipment fails so rarely that the skills necessary to repair that item have been forgotten or diminished through lack of use. Parallel improvements in equipment design will be necessary to provide onboard diagnostics and repair instructions to overcome these challenges. For a common office example, one can look at the office copier. When a paper jam occurs, the machine's troubleshooting and diagnostic display guides the user sequentially through the opening of panels, removal of the paper, and return to operations. If the user cannot correct the problem, the display has the user place a service call for a factory-trained technician. Often, the technician can solve the problem over the telephone. As a result, on-site repair visits are rare, significantly decreasing copier downtime (increasing copier availability) and reducing maintenance costs. Similar onboard diagnostic and prognostic prompts and processes will be necessary for the emerging highly sophisticated equipment systems as availability and performance requirements increase in future acquisitions.

Gains in performance can be achieved only if they are the result of a formal standardized process of analysis and design improvements. Industry provides best practices for planning the analysis process, conducting the analysis, and documenting the results. Acquisition agency concurrence at each step is required for success. Proven standard analysis techniques, formulas, and interrelationships are required if the results are to be predictable and repeatable. Industry standards and best practices are based on solid academic foundations in engineering and mathematics.

The other side of the acquisition coin concerns the ability of the contractor and the government to record and exchange data. Some standards have been developed, but they are open to interpretation. Moreover, contractors and government agencies have considerable flexibility in the selection of tools. Further definition and process standardization are necessary to ensure full compatibility between the information-generation activities and the information users. Standards are needed not only for the development phase but throughout the life cycle of the system, with full emphasis on the "as maintained" system configuration and the complete maintenance history of the systems and repair parts.

Such standards need to be fully embraced throughout industry and all branches of DoD.

From a supportability standpoint, the "logistics" in PBL can be thought of as the optimal mix of organic government resources and the resources of the contractor or original equipment manufacturer (OEM) and other third-party vendors, all organized to provide cost-effective support for the deployed system.

Barriers and Enablers

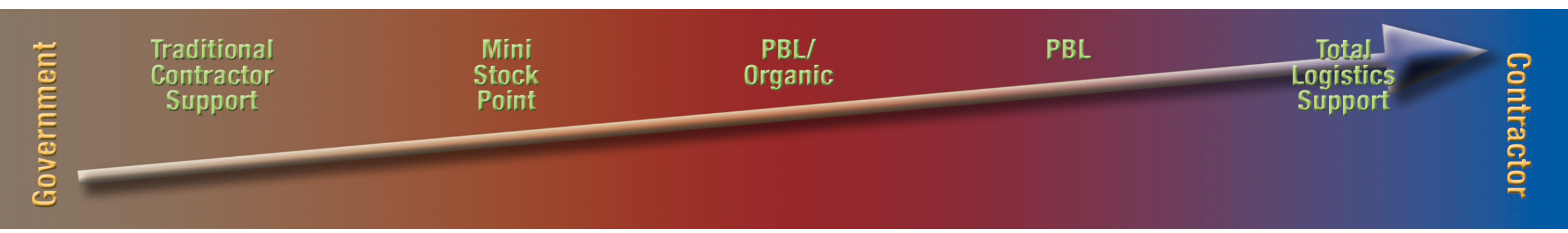
Federal laws and other congressional mandates have been seen by some as barriers to the implementation of a PBL process. The lack of multiyear funding and contracts for continued involvement in support activities is seen as a barrier to achieving a fully optimized mix of services from all parties necessary to implement PBL objectives. Likewise, requirements for a 50/50 workload split between industry and government depots present a challenge to suppliers when little work is actually performed at the depot level. It is particularly daunting for COTS products, because most OEMs do not provide information or training on depot-level repairs for such products; instead, they retain all repair tasks at their own facilities. This situation is further complicated by the use of third-party vendors, OEM licensed or not, to make repairs. But to be truly successful in implementing a long-range and cost-effective PBL solution, these existing "standard ways of doing business" will have to be changed to provide the basis for success.

All is not bleak in the PBL implementation arena. In some areas, OEMs and the government are embracing the PBL concept and finding ways to implement program goals.

Support Base for Existing Systems

Integrating PBL tenets and processes into the management of already fielded systems, and achieving

FIGURE 2. Optimizing the Mix of Government, OEM, and Third-Party Vendors



Government-owned inventory	Government-owned inventory	Government-owned inventory	Contractor-owned inventory	Contractor manages inventory levels, maintenance philosophy
Contractor repairs, returns	Contractor receives, stocks, issues	Contractor receives, stocks, issues	Contractor determines stockage levels	Contractor meets performance specs for each function
Government determines requirements	Government determines requirements	Government determines requirements	Contractor must meet performance metrics	Contractor paid for performance
Billing by DD 250 by repair	Traditional contractor pricing	Traditional billing	Traditional billing	Technology insertions
Traditional customer billing	Traditional customer billing	Organic depot has configuration management	Reliability improvements	Contractor has configuration management
		Organic depot performs limited repair	Technology insertions	
		Warranty management and tracking	Contractor has configuration management	

the corresponding reduction in the logistics footprint to improve the "tooth-to-tail ratio" is, in many ways, a more daunting challenge than applying PBL concepts to new systems. Little agreement is seen, on the surface, in the application of PBL within or between the individual military services. Just look to their websites and note the differences. However, if the vision of PBL is expressed—as portrayed in Figure 2—as the optimal mix of organic, contractor, and vendor personnel and services necessary to provide cost-effective support, the levels of differences are no longer seen as a lack of agreement. Rather, they are fair expressions of the need for the right combination under different circumstances.

Remember, the existing systems were procured under a different set of rules and standards. In many cases those systems were not designed using an integrated approach—an approach that is necessary for the fully optimized integration of support resources. Acquisition of these systems was tailored to meet what was believed to be best achievable design goals in a specification. Although based on a set of government-mandated "standards," there was little real standardization across industry. Manufacturers used their own processes, with oversight by the government. There was minimal industry-wide sharing or consensus on the tools or approach in the final support solution set. Many times the approach was to "build it and throw it over the fence for the users to support."

Contractor vs. Government Focus

One thing that must be addressed in the evolution of the PBL initiative is that the objectives of the contractor and those of the government are not fully harmonized. Contractors have, as a basic objective, the operation of a business for profit. They are responsible to their shareholders for the bottom line. On the other hand, the government's primary objective is the maintenance of force readiness in support of both the national military strategy and the security of the nation. During system development, these seemingly divergent objectives are, in fact, complementary. The desired objectives in design are achievable by a contractor within the constraints of the funding available. It is during post-deployment support that the conflicts in objectives can result. Failure on the part of the contractor may result in management changes or, in the worst case, in the failure of the firm, as expressed in bankruptcy. However, failure to achieve full PBL support can have disastrous impacts on the readiness of our military forces, the safety of the war fighter, and the survival of the nation itself. These objectives combine to provide a significant management challenge for the government in structuring a PBL architecture that meets the war fighter's needs, maintains readiness posture for the forces, provides a cost-effective solution, and does not impose an undue burden on the contractor.

Summary

The full promise of a carefully structured PBL initiative can be achieved only through a thorough understanding of the integrated roles of all parties—government, manufacturers, and vendors—who are integrated into a final solution set. This final solution set must be fully supported by both industry and government performance standards that provide mutual understanding and integrated goals necessary to achieving the full benefits of PBL in the deployed forces.

About the Author

Anthony Trovato, CPL (Certified Professional Logistician), is the Immediate Past President of SOLE—The International Society of Logistics—having served three terms in that office. Currently a senior integrated logistics support manager at Raytheon Technical Services Company, he is responsible for design for supportability and support system development and operations on a diverse set of programs throughout the world.

Transforming Parts Management

By Ron Froman

Performance-based logistics contracts emphasize systems supportability and sustainment.

At the spring 2003 Parts Standardization and Management Committee (PSMC) meeting in St. Louis, MO, the mood was initially somber, primarily because of concerns about the relevance of parts management (PM) processes to modern DoD programs. The future of some PM organizations within the Defense Logistics Agency was in question. Certain PM processes and tools that had been developed in the 1980s and early 1990s were becoming increasingly ineffective for use on new programs. As one example, a representative from the Defense Supply Center, Columbus, OH, noted that the content of the government-furnished baseline for electronic part selection was not being kept current and that it was no longer being used by the overwhelming majority of contractors.

The Challenge

In his presentation to the general session, the director of the Defense Standardization Program Office (DSPO) stated that we could no longer afford to continue to adapt past practices to future program needs and that the government and industry trend is moving away from buying and managing parts to buying systems and capabilities. He issued a challenge: he asked the PSMC to consider how PM processes could be reengineered to meet the needs of the future.

Initially, the attendees found this request difficult to assimilate. However, as we sat through the remainder of the PSMC general session presentations, it became apparent that most of the presenters and attendees, whether government or industry, were already involved in new and innovative parts management and standardization activities and programs. In most cases, the activities and programs were not formally mandated (at least not to the extent implemented). However, they were in place or were being developed; they were producing meaningful part selection and standardization results, as well as cost savings for programs and stakeholders.

The F/A-18 Hornet is an example of the successful use of performance-based contracts.

As the meeting progressed, it became increasingly evident that effective parts management could and should be an important contributor to the support of the Future Logistics Enterprise initiative, launched by the Deputy Under Secretary of Defense for Logistics and Materiel Readiness in response to the 2001 Quadrennial Defense Review. One of six elements integral to the Future Logistics Enterprise initiative—Total Life Cycle System Management—places increased emphasis on performance-based weapon system sustainment. Thus, new PM processes are needed that will span part selection through sustainment.

Parts Management Transformation Subcommittee

In response to the DSPO director's challenge, the PSMC established a Parts Management Transformation (PMT) subcommittee; it also developed a mission statement and four major objective focus areas for the PMT subcommittee. The mission statement is to "develop a Parts Management process that will support weapon system readiness and reduce the overall logistics footprint through Total Life Cycle Systems Management." The four focus areas to be addressed by the PMT subcommittee are as follows:

- Understand environmental factors
- Develop objectives
- Identify enabling processes, technology, and infrastructure to support implementation
- Identify performance measurement metrics.

Logistics footprint and mission reliability are two key parameters of PBL contracts.

© The Boeing Company

Understanding Environmental Factors

The PMT subcommittee addressed the first focus area, identifying the environmental factors influencing PM needs, at the October 2003 PSMC meeting.

One of the most prominent factors influencing programs today is the use of performance-based logistics (PBL) contracts. Among the many examples of PBL contracts are the Joint Strike Fighter, the

F/A-18 Hornet, and Future Combat Systems. The PBL contracts emphasize systems supportability and sustainment by establishing supportability-related key performance parameters such as logistics footprint and mission reliability. New PM processes must take an expanded view that balances engineering selection processes and technical needs with logistics sustainment concerns. New PM processes must also address the increased need for interoperability and network-centric products in a global environment.

The logistics footprint can be reduced not just by having fewer, more standardized parts, but also by reducing the underlying support infrastructure and transport needs.

The spiral development processes being applied on new programs also present challenges to effective parts management. In particular, the design content and capabilities of a system may evolve over time; as a result, the first products developed on a program may contain significantly different part content than those developed later.

The United States no longer has the luxury of planning for a cold war "static" battlefield environment. With today's worldwide threats of terrorism and rogue elements, increasingly rapid and lean force deployments will be required, underscoring the need for a reduced logistics footprint on our weapon systems and our in-theater capabilities. The logistics footprint can be reduced not just by having fewer, more standardized parts, but also by reducing the underlying support infrastructure and transport needs.

Another factor influencing the efficacy of PM programs is that increasingly, both government and industry are being asked to accomplish more, with fewer resources—both personnel and funds. Thus, the old MIL-STD-965 parts control program model of having multiple groups of commodity-specific specialists reviewing individual part selections can no longer effectively be maintained. We must develop more innovative and automated means of selecting, standardizing, and sustaining component parts. Tremendous advances have been made in information technology software products that can enable efficient, transformed PM processes. When MIL-STD-965 was cancelled, Internet technology was still in its infancy, and software tools such as product data managers and collaborative environment workflow managers did not exist. These products and many others have yet to be applied to their full potential in parts management and standardization practices.

In 2004, a new DoD policy will be implemented that can have a profound influence on the management of parts and part-specific data. This is the unique identification (UID) policy, as enacted by revision L of MIL-STD-

130, *Identification Marking of U.S. Military Property*. The UID policy mandates the unique identification of certain parts and assemblies. The unique identification must physically reside on the part if possible, in the form of a two-dimensional data matrix, as described in ISO/IEC 16022, *Information Technology—International Symbology Specification—Data Matrix*. The data matrix must contain a globally unique and unambiguous identification, consisting of an issuing agency code, a serial number, and, depending on whether MIL-STD-130 UID construct one or two is selected, an original part number. The same data matrix technology used to mark parts with UIDs can also be used to encode, on the parts, a variety of other information such as maintenance actions. Although the current UID policy limits the items that must be marked to those meeting certain conditions, parts managers and implementers may want to evaluate the benefits of using UIDs to mark additional parts beyond those strictly required by the policy.

Data Matrix

Per ISO/IEC 16022

Quickly evolving technology, particularly in electronic part commodities, has pushed parts obsolescence susceptibility into prominence as one of the most important elements to be considered in the selection and use of solid-state parts. For mechanical parts, an ever-increasing emphasis is being placed on selecting parts for installation and maintenance efficiency. Assemblers on the line and maintainers in the field no longer should be saddled with parts that present them with frustrating challenges.

The increased availability of commercial off-the-shelf (COTS) items means that PM processes can serve as upfront "gatekeepers" to end-product cost reductions and long-term sustainment results by ensuring the proper match of COTS components to application requirements. Conversely, without the appropriate PM processes in place, misapplied COTS components and technologies can easily result in serious deficiencies in product performance and result in near-term sustainment problems.

Developing Objectives

The PMT subcommittee discussed the second focus area—develop objectives—at the PSMC general session, held April 20–22, 2004, in Orlando, FL. Topics included the following:

- Benchmarking world-class PM processes
- Developing/reviewing tools to facilitate PM processes
- Relating supply chain management "friendly" parts to PM processes

- Developing language for PM process definition
- Recommending the PM to-be state to DSPO
- Developing guidance for new PM processes.

Conclusion

As the PMT subcommittee has matured, we have grown increasingly confident that we are "on the right track." This was underscored by an October 23, 2003, DSPO memo that stated, "The PMP (Parts Management Program) is essential to restraining the growth of the logistics footprint, a major aim of the Future Logistics Enterprise….More importantly, the absence of centralized parts management would degrade the logistics support of the Department's ultimate customer, the warfighter." The memo further concluded, "We propose conducting a thorough review of the current PMP with the intention of reengineering it to make it more effective….We look forward to working with you to develop a plan for conducting the reengineering effort."

Anyone interested in attending the next PSMC meeting or learning more about the PSMC and the general meeting sessions should visit the PSMC website at http://www.dscc.dla.mil/psmc/.

About the Author

Ron Froman is the chair of PSMC's Parts Management Transformation subcommittee. He has more than 20 years of experience in component engineering and is the lead standards engineer at Boeing Integrated Defense Systems, St. Louis, MO, where he holds the title of Associate Technical Fellow. Mr. Froman is responsible for implementing parts management, standardization, and obsolescence management programs on the F/A-18, EA-18, F-15, and T-45 aircraft.

Reduce Program Costs Through Parts Management

By Parts Standardization and Management Committee

The goal of parts management is to improve operational readiness and reduce life-cycle costs by promoting the use of common, widely available, reliable parts and processes. This business case, written by parts management professionals, can help managers determine the value of having a comprehensive parts management program. The approach presented here is a conservative method for estimating the cost savings over a program's life cycle when a viable parts management program is used. Cost factors may vary depending on the organizational and operational structure of a given program or company. This method for estimating costs uses very conservative values for the factors it includes and does not include values for many nonrecurring and intangible cost factors. Therefore, although the method is a useful framework for estimating the value of a comprehensive parts management program, it is not a finite method for calculating actual program savings.

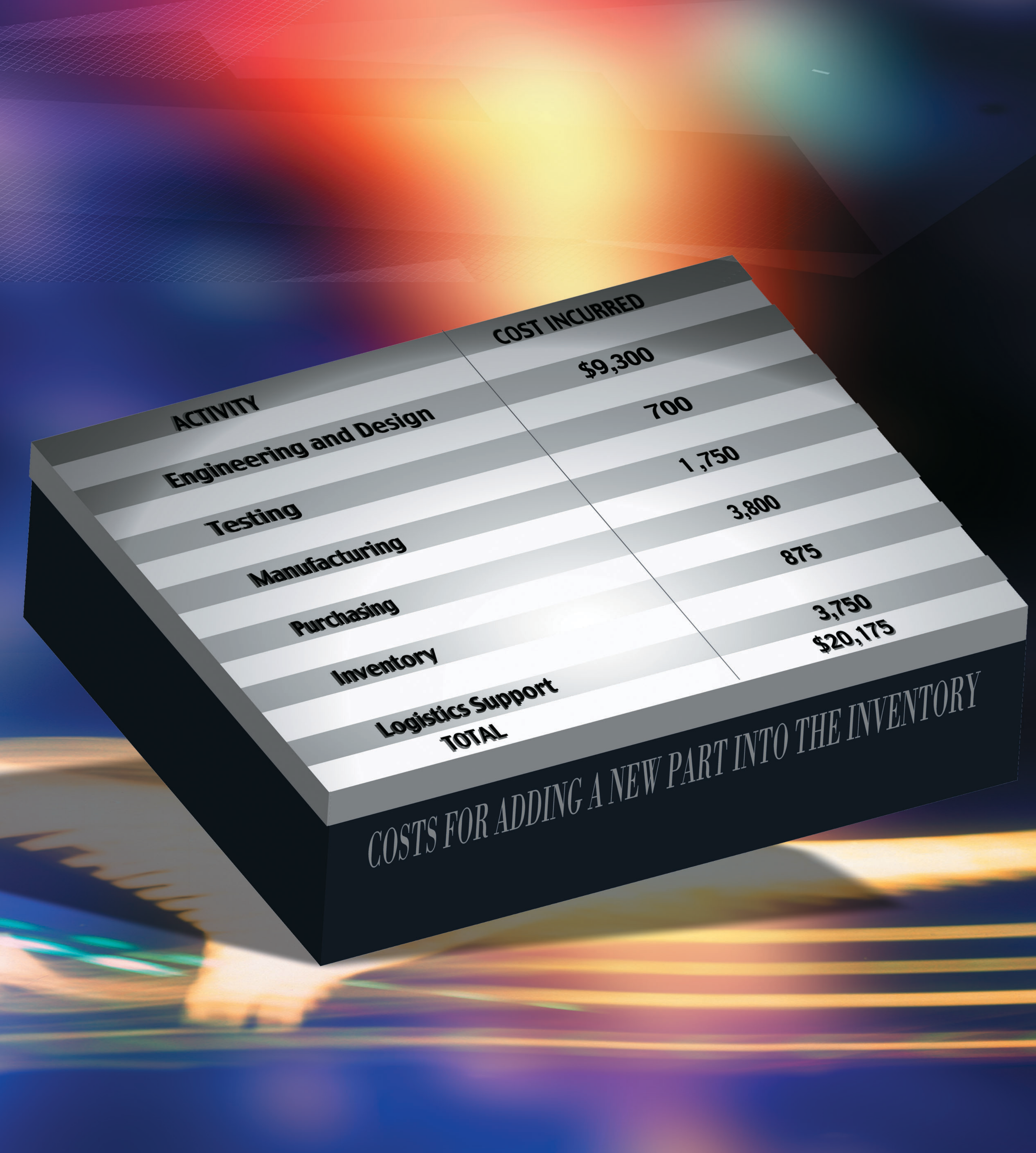
Introduction

Parts management helps program managers achieve their objectives for improving logistics support, enhancing reliability, and managing obsolescence. Parts management saves money, enhances logistics readiness and interoperability, increases supportability, and reduces acquisition lead-time.

The average total cost for adding a new part into the inventory is about $20,000 (see Figure 1). The $20,000 cost accumulates in six different program areas: engineering and design, testing, manufacturing, purchasing, inventory, and logistics support. An effective parts management program will avoid this cost every time it precludes introducing an unnecessary new part into the system. For example, by not introducing a single new part as trivial as a nut or bolt, parts management can save approximately $20,000 during a weapon system's life cycle. A program with 10,000 parts can easily save $5 million, a not insignificant amount, through parts management. Cost avoidance represents money not spent, materials not handled, facilities not required, labor not expended, and time not used.

Government and industry program managers and contractors must manage their scarce resources carefully to procure the advanced technology systems and equipment needed to retain and improve capabilities. They are properly reluctant to invest in marginal programs that add little value or little return on investment.

Today, a parts management program, tailored to your program's needs, supports your program's best interest: performance, schedule, budget, and reduced program life-cycle costs. This article illustrates the potential recurring cost avoidance that you can achieve by managing parts and standardizing in six specific areas. The overall benefits of a parts management program to these areas, such as design, engineering development, acquisition, and logistics support



ACTIVITY	COST INCURRED
Engineering and Design	$9,300
Testing	700
Manufacturing	1,750
Purchasing	3,800
Inventory	875
Logistics Support	3,750
TOTAL	$20,175

FIGURE 1. Costs for Adding a New Part into the Inventory

functions, are tangible and substantial throughout a program's life cycle.

In today's acquisition environment, characterized by rapidly changing component designs, part obsolescence, and a preference for commercial items, the need for suppliers to manage their parts standardization efforts is greater than ever before. Parts management is critical for reducing total ownership costs and achieving the performance required of systems and equipment. In this article, we help define and validate the need for parts management.

Parts management, integrated into the engineering process, also helps effectively mitigate and manage part obsolescence problems. Avoiding the extremely high cost of resolving part obsolescence problems is another reason why parts management helps control life-cycle costs. (For example, costs range from $1,800 for parts reclamation to a high of $400,000 for a major redesign effort.)

Parts Management Explained

WHAT IS PARTS MANAGEMENT?

Parts management is an integrated effort to streamline the selection of preferred or commonly used parts during the design of systems and equipment. Parts management is a process for determining the optimum part while considering all the factors that may affect program outcomes. The factors considered include application, standardization, cost, availability, technology (new and aging), logistics support, diminishing sources, and legacy issues.

KEY OBJECTIVES

Parts management has three key objectives:

- *Improving logistics support.* Reducing the number of unique parts used in a system enhances its suitability and simplifies logistics support. Introducing fewer parts into the logistics system translates into savings in procuring, testing, warehousing, and transporting parts. Parts management also helps the program identify and acquire reliable and documented parts at an economical price. By reducing the number of new or unique parts in a design, parts can be standardized. And, by reducing the proliferation of parts, operational effectiveness is improved, resources conserved, and costs avoided.
- *Enhancing reliability.* Using proven parts with a history of quality makes the end item inherently reliable. Promoting the use of standard or commonly used parts ensures that the program uses reliable and documented parts purchased at an economical price. Using standard parts minimizes the number and variety of new parts and part types introduced into an end item, reducing design risks. A part's technical characteristics, testing, maintainability, safety, and source of supply should all be factored in when selecting a part.
- *Managing obsolescence.* An increasing concern in parts management is the effect of diminishing manufacturing sources and component obsolescence, especially in electronics. Some product life cycles are so short that obsolescence problems arise during production and sometimes as early as system development and demonstration. A parts management integrated process team uses data about component obsolescence from the system development phase through the logistics support phase to control the costs of part obsolescence. Managing obsolescence should be a factor

in developing the design at the earliest possible stage.

BENEFITS OF PARTS MANAGEMENT

The key benefits of parts management are as follows:

- ***Cost savings.*** Parts management helps save design and life-cycle costs of equipment by promoting the application of commonly used or preferred parts. Standardization of parts, replacing numerous similar parts with one common part, results in larger part-type buys because the common parts are used in multiple applications. Larger part-type buys enable both the contractor and the customer to benefit from the economies of scale. Part standardization also reduces the contractor's cost of maintaining technical data and storing, tracking, and distributing multiple parts.
- ***Enhanced logistics readiness and interoperability.*** When items or systems share common components, repair time is shorter because parts are more likely to be on hand and technicians spend less time solving individual problems. Furthermore, using common components simplifies logistics support and enhances substitutability because fewer parts are stocked. This translates to savings in procuring, testing, warehousing, and transporting parts.
- ***Increased supportability and safety of systems and equipment.*** Preferred parts reduce risk and improve the chances that equipment will perform reliably. Preferred parts have a history of proven reliability, withstanding rigorous testing and performing at stated levels. Their use decreases the number of part failures, reducing the number of maintenance actions and potentially precluding failures that could cause mission failure or loss of life.
- ***Reduced acquisition lead-time.*** When preferred parts are used, the government and industry avoid the expenses and delays of designing and developing parts and the issues of acquiring a new item with no available history or documentation. Using preferred parts reduces the time between the purchase request and the receipt of the part.

ELEMENTS OF AN EFFECTIVE PARTS MANAGEMENT PROGRAM

SD-19, *Life Cycle Costs Savings through Parts Management*, is a useful guide for implementing an effective in-house parts management program. The document defines the essential elements of a parts management process, including

- establishing an in-house parts management board,
- developing a preferred parts list or corporate parts baseline,
- establishing a process for selecting and authorizing parts,
- establishing a process for qualifying parts,
- managing obsolete parts and diminishing manufacturing sources,
- establishing a process for managing alternate or replacement parts,
- using integrated process teams to manage parts,
- measuring standardization effectiveness (metrics), and
- establishing a documented plan for a parts management program.

Six myths surround parts management. Figure 2 lists the myths that we expose.

- ***Myth: Acquisition reform and the implementation of contractor logistics support has removed the need for parts management and the promotion of standard parts.***

In today's lean and changing environment, the need for standardizing is more important than ever. Contractors should manage parts to remain competitive, improve logistics readiness, and reduce total ownership cost. Using standard parts increases interchangeability among systems and enhances interoperability among military systems, military services, and coalition forces.

- ***Myth: "Standard" part is synonymous with "military" part.***

A standard part is a "preferred" part, designated because of its usage history, established reliability, and availability. It may be a company standard, industry standard, or military standard part.

FIGURE 2. Myths in Parts Management

- ***Myth: A parts management program restricts design flexibility and inhibits the introduction of new parts and technology insertion.***

An effective parts management program improves a company's design and manufacturing processes. An effective program team integrates system, design, and parts management personnel who jointly participate in selecting parts. Parts management helps with reviewing new parts for application across a company's entire business base. Introducing new parts and inserting technology become a systematic process.

- ***Myth: Parts management is a bottleneck.***

Today's parts management process facilitates and supports real-time part selections, providing for cost-effective design decisions.

- ***Myth: Parts management is burdensome.***

Identifying the right parts during design is much faster than correcting bad decisions after designs are already set. Automated systems allow real-time or near-real-time analysis and provide decision-support tools.

- ***Myth: Parts management is a cost driver.***

Parts management saves design, engineering, and procurement dollars and reduces logistics support and part obsolescence costs over a weapon system's life cycle.

Cost-Benefit Analysis

When designing a system, each nonstandard part added can cost an average of $20,000 over the life of the program. Engineering and design of the new part is nearly one-half of the total cost, but even adding an existing but nonstandard part to a system still affects costs significantly. This section examines each of the six cost drivers and demonstrates how parts management mitigates the added cost of designing in new parts without sacrificing design flexibility. The six specific drivers for which parts management provides cost benefits are

- engineering and design,
- testing,
- manufacturing,
- purchasing,
- inventory, and
- logistics support.

Figure 3 shows how the total cost for introducing a new part into the design is distributed across the six areas.

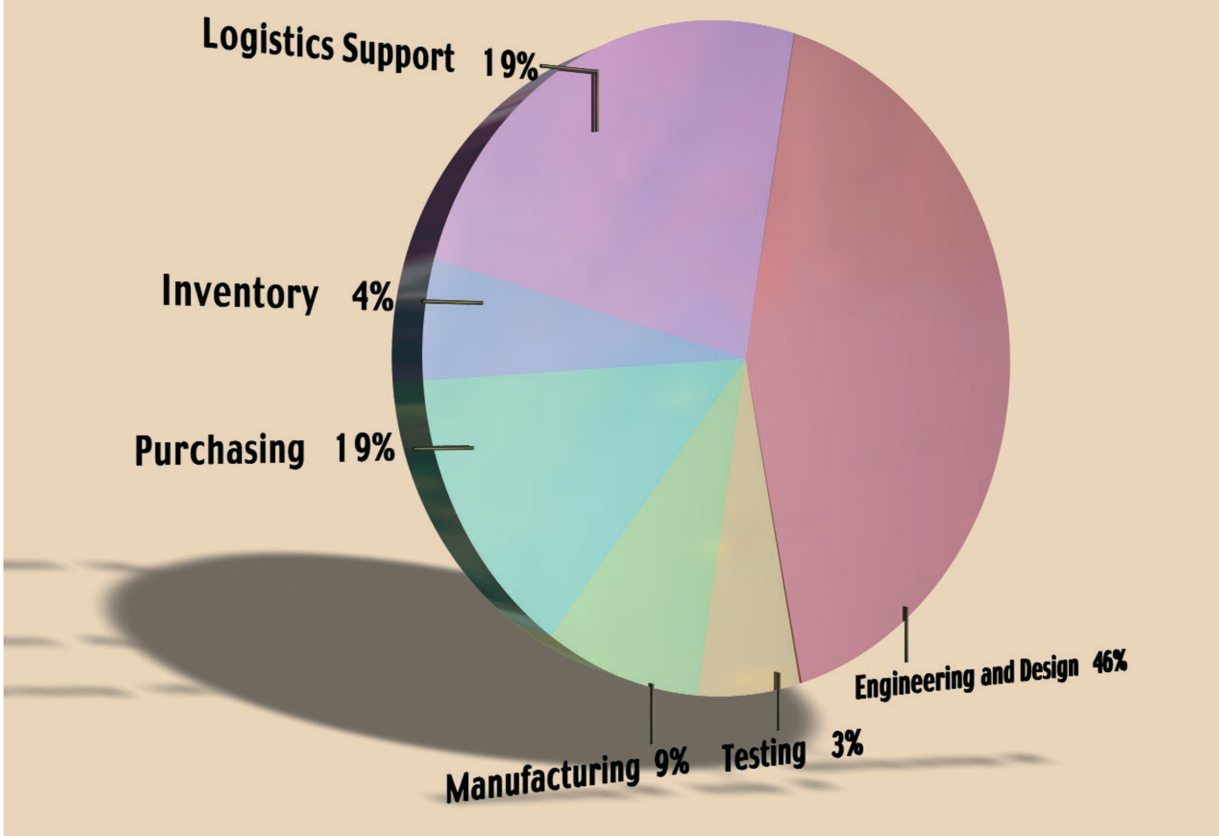
ENGINEERING AND DESIGN

The majority of the cost of introducing a new part into the inventory is in engineering and design, which is done early in the process. This means that costs can be saved very early when an effective parts management process is in place. Using a parts management process for selecting parts in engineering and design will help

- avoid duplication of work between designers, engineers, and support personnel;
- avoid creating, releasing, and maintaining unnecessary drawings;
- reduce program risk resulting from the use of unknown or untested parts;
- reduce the time required searching for parts;
- enhance part interchangeability; and
- avoid schedule slips caused by unobtainable parts.

Table 1 shows the costs for engineering and designing a new part.

FIGURE 3. Distribution of New Part Introduction Costs



Intangible costs may be associated with the following factors:

- Use of a part without performance history
- Technical support (to suppliers, manufacturers, purchasers, etc.)
- Risk to end-item delivery schedule
- Lack of lessons learned
- Lack of technology pool (part experts)
- Procurement lead-time
- Scheduling of parts for end-item manufacturing.

TESTING

One of the most important drivers of new part selection is qualification and testing. Depending on the complexity and use of the part, different strategic elements need to be considered, such as environmental conditions, operating conditions, and performance. Before introducing a new part into the design, the part may need to be qualified and bench tested, and its use validated. Qualification includes determining the optimum test requirements, developing procedures, and documenting the results. Through the application of parts management, the costs of activities of determining that a part is acceptable for an intended use can be avoided. Those activities include

- creation of test procedures,
- test documentation,
- qualification testing,

TABLE 1. Costs for Engineering and Designing a New Part

Activity	Hours to Support the Task	Cost (@ $100/hr.)
Average search time for a part[a]	4	$400
Duplication of effort	2	200
Creation, review, and release of documentation (includes part analysis and approval)	60[b]	6,000
Failure rate analysis	12[c]	1,200
Maintenance of standard	15	1,500
Total		**$9,300**

[a]NAS 1524, *Standardization Savings, Identification and Calculation*, September 1971:

- NAS 1524-4, *Standardization Savings from Reduced Engineering Search Time.*
  Savings = [annual number searches for data × engineering rate] × [time to finish search × success rate].
- NAS 1524-6, *Standardization Savings from Using a Stocked Standard Part in Lieu of a New Design.*
  Savings = cost of releasing and stocking a new part drawing, including all paperwork + cost of quality testing + [hours to engineer new part × engineering rate] + [hours to design and draft new part × engineering rate].
- NAS 1524-2, *Standardization Savings in Paperwork and Handling.*
  Savings = [cost to process purchase order + reduction in shipments] × cost of paperwork and inspection.

[b]Hours for mechanical parts = 50; hours for electrical/electronic parts = 70; average = 60 (45 hours for creation and 15 hours for review and release; engineering change order signatures: 15–20 persons).

[c]Hours for mechanical parts = 8; hours for electrical/electronic parts = 16; average = 12.

- component bench testing, and
- quality conformance testing.

For every new part added to an inventory, part testing is in most cases essential in determining if the part will meet the specified requirements for the intended application. The creation of test procedures, documentation, quality conformance testing, and component bench testing can be required with the introduction of a new part. The cost of testing will vary depending on the part type (mechanical or electrical) and its application. Table 2 illustrates the average part-qualification-related costs.

MANUFACTURING

During manufacturing, parts management helps avoid the negative effects of introducing new parts in the manufacturing process. These effects include the

- cost of purchasing and setting up new or special tooling,
- additional risk of line stoppage and conformance problems from using an unproven part, and
- cost of additional storage at the manufacturing site.

Considering only the cost of additional storage at the manufacturing site, parts management saves $1,750 every time it helps engineering choose an existing or commonly used part instead of adding a new part to the manufacturing inventory. Table 3 shows the calculation.

The manufacturing-related costs are exceptionally conservative because they include only the costs of item storage space. Including tooling and documentation costs related to introducing a new part into inventory would add significantly to the total cost. For instance, a one-time tooling cost of about $10,000 results whenever a new mechanical part (e.g., rivet, screw, or bolt) requires a new installation tool. In addition, new documentation created to support the manufacturing or installation of a new part costs approximately $3,000 per document.

A number of intangible costs could result from using a new or unproven part, including the costs of

- part-related schedule slippage,
- resources to identify and locate substitute parts,
- part-related line stoppages,

TABLE 2. Average Part-Qualification-Related Costs

Activity	Cost
Audit for those parts on a qualified manufacturers list or qualified products list (QPL)[a]	$2,000
Establish QPL (qualifying part by performing qualification testing)	5,000
Reference Total	7,000
Total[b]	**$700**

[a] Defense Logistics Agency (Defense Electronics Supply Center), *Cost-Benefit Reporting Technique for Military Parts Control Advisory Groups*, CRPCP-88-01, 15 April 1988.

[b] Not every part added to inventory is subjected to a full qualification test or added to a QPL. Each part is, however, evaluated for the application before it is used. This evaluation can include analysis by similarity, a simple bench test, metrology analysis, etc. On this basis, a conservative 10 percent, or $700, is used.

TABLE 3. Manufacturing-Related Costs

Item	Cost/ Year	Total Cost[a]
Annual cost of space for one manufacturing inventory storage bin	$50	$250
Annual part bin maintenance cost for a part in manufacturing inventory	100	500
Stock bin one-time setup cost for a part in manufacturing inventory	1,000	1,000
Total		**$1,750**[b]

[a] Assumes a part remains in the manufacturing inventory for 5 years.
[b] New parts incur storage-space-related costs wherever placed into inventory, such as when spare parts are used at intermediate and field logistics support locations. Although a manufacturing operation might require only one additional part bin, a spare part item might require numerous bin locations in the field. For simplicity and to err on the conservative side, we used only the $1,750 cost figure to calculate the cost of adding a new part into the inventory (Figure 1).

- supporting data requirements (e.g., new manufacturing bill of material),
- part-related engineering support,
- technical interface with new suppliers, and
- part shelf life or storage condition requirements.

PURCHASING

Avoiding the need to purchase a new part avoids procurement-related costs. Adding a new part has a widespread effect on procurement. Costs are incurred for each of the following:

- Market research, audits, and approval of suppliers
- Part number setup
- Preparation of procurement documents (e.g., request for quotations or purchase order)
- Analysis of drawing and specification requirements.

Table 4 illustrates the cost elements used to compute the recurring costs related to purchasing.

A number of other procurement-related costs could result from buying a new or unproven part. Part availability may create procurement problems. Inadequate availability may limit the ability to purchase needed quantities, reduce competition, and drive up prices. Insufficient competition typically drives up prices. In addition, a new item generally is purchased in small quantities and pro-

TABLE 4. Purchasing Recurring Costs

Activity	Hours to Support the Task	Cost (@ $100/hr.)
Part number setup	2	$200
Additional purchase-related paperwork	4	400
Increase supplier base (search, audit, contract)	30	3,000
Receiving inspection/quality assurance	1	100
First article inspection	1	100
Total		**$3,800**

vides no economy of scale, resulting in a higher purchase price.

INVENTORY

Each new part added to the inventory adds costs for additional warehouse capacity. Earlier, in the manufacturing section, we calculated the cost of additional storage required for each unique part introduced into the system at $1,750. This cost applies to each bin and location stocking the item. Again, being conservative, we assume only one intermediate stock point and one bin. In addition, we discount the $1,750 cost by 50 percent ($875) to accommodate the new items that use just-in-time or direct delivery from a factory rather than intermediate stock.

A variety of additional nonrecurring costs can be associated with inventory management. For example, supply items that use just-in-time or direct delivery from a factory may incur expediting fees or other parts management costs.

LOGISTICS SUPPORT

The addition of a new or nonstandard part affects the follow-on logistics support in the following ways:

- Establishment of a new part number and associated changes to information systems
- Required changes to support documentation, such as spare parts bulletins and maintenance manuals (this issue is more complex if the unnecessary part requires special tools or tooling)
- Additional segregated storage (parts bins)
- Reduced potential for part substitution of nonstandard parts
- Changes to the bill of material (master database of parts)
- Increased chance of obsolescence with nonstandard parts.

Each new part added to the inventory for which spare parts are required adds costs for additional storage of spare parts at field support locations. In addition, each field location must have and maintain parts-related documents, such as maintenance manuals and replacement part documents. The $1,750 storage cost used earlier applies to each field support location that must stock the item. Again, being conservative, we assume only one field support location and only 5 years of logistics support. Table 5 illustrates these costs.

Additional nonrecurring costs can be associated with logistics support. For example, there are costs for obtaining a national stock number for new supply items.

TABLE 5. Logistics Support Recurring Costs

Activity	Hours to Support the Task	Cost (@ $100/hr.)
Maintenance manual	8	$800
Replacement part documentation	4	400
Associated documentation[a]	8	800
Parts storage at one logistics support facility[b]	8	1,750
Total		**$3,750**

[a] For example, illustrated part breakdown, component maintenance manual, or spare parts bulletin.
[b] Based on calculation shown earlier in manufacturing section.

Cost of Parts Management Compared to Parts Obsolescence

An effective parts management program assists with managing parts obsolescence in the following ways:

- Allows proactive obsolescence management
- Enables estimating, planning, and budgeting for part obsolescence by providing relative information about prospective parts
- Provides visibility of suitable replacements for obsolescent parts.

Because of the high costs of resolving obsolescence problems, the capability to plan ahead and take advantage of a greater range of solutions can result in a more cost-effective resolution. Figure 4 shows average costs for various nonrecurring engineering-resolution cost factors.[1]

In addition, if parts require qualification or testing, costs increase:

- ***Radiation hardening testing.*** Added costs range from $5,000 for dose-rate testing only to $52,000 for dose-rate, total-dose, and single-event-upset testing; costs may reach $82,000 for microprocessors.
- ***Plastic-encapsulated microcircuit testing.*** Increased costs range from $600 for acoustic microscopy only to $47,340 for full qualification of a 100-piece lot.

Other factors that may add costs include

- lifetime buys,
- bridge buys,
- requalification,
- reverse engineering, and
- expediting fees.

Program Savings

The following formula estimates cost-avoidance savings from using parts management practices:

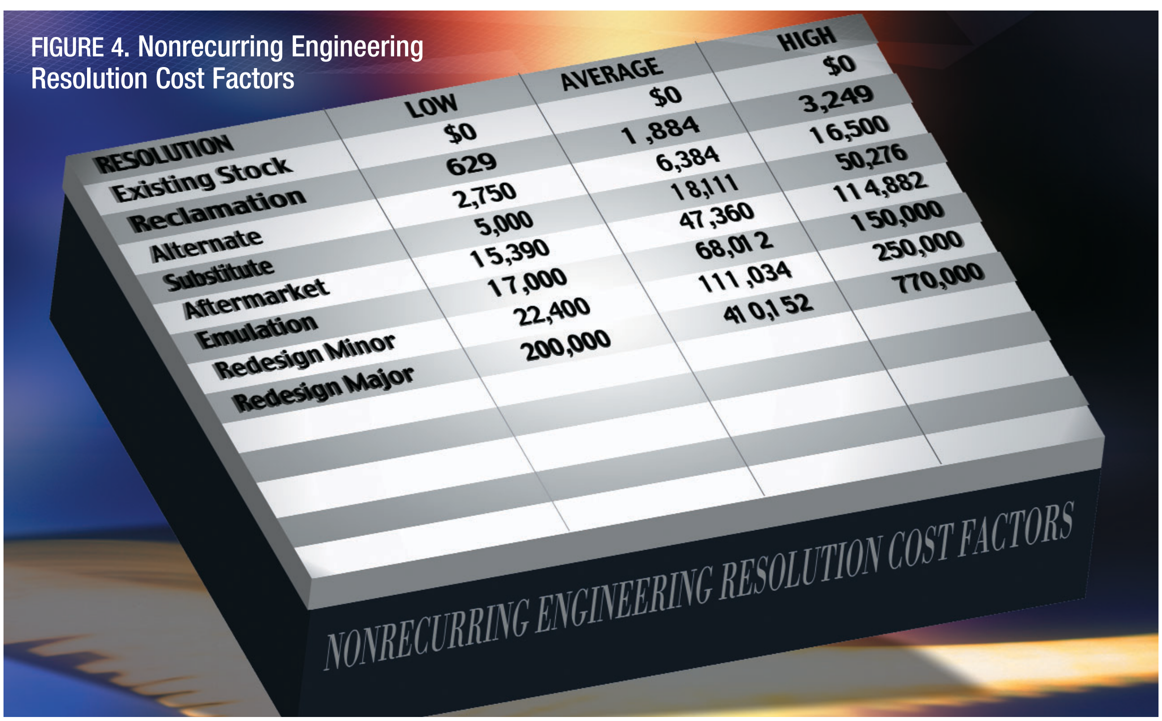
$$\textit{Total Estimated Savings} = PPPg \times NSP\ (25\%) \times SP\ (10\%) \times QSF,$$

where

$PPPg$ = estimated number of parts per program (system, end item, etc.);

NSP = number of potential standard parts = 25%;

FIGURE 4. Nonrecurring Engineering Resolution Cost Factors



RESOLUTION	LOW	AVERAGE	HIGH
Existing Stock	$0	$0	$0
Reclamation	629	1,884	3,249
Alternate	2,750	6,384	16,500
Substitute	5,000	18,111	50,276
Aftermarket	15,390	47,360	114,882
Emulation	17,000	68,012	150,000
Redesign Minor	22,400	111,034	250,000
Redesign Major	200,000	410,152	770,000

SP = standard parts used due to parts management (new parts avoided) = 10%; and

QSF = quantified savings factor = $20,000.[2]

Experience shows that programs without parts management discipline introduce 2.5 percent more new nonstandard parts into the logistics system than do programs with parts management discipline.

The following is an example of applying the formula:

> For a program (end item) with 10,000 separate part numbers, about 2,500 parts (25 percent) will be candidates for using standard or common parts, such as microcircuits, resistors, nuts, or bolts, already in the logistics system. Of these 2,500 potential standard parts, an additional 250 (10 percent) will end up using common or standard parts rather than new parts by applying parts management discipline. Parts management will help the program avoid adding 250 new part numbers to the system, saving about $5 million (250 × $20,000) across the program life cycle.

A different approach for calculating partial program savings uses only the actual cost differences. This method does not consider factors such as those in Figure 1. However, this method is useful for programs that already have a complete bill of material (BOM) before introducing parts management discipline. The approach identifies tangible cost savings by determining the exact cost for a BOM after applying standardization decisions as compared to the cost before standardization:

Total Actual Parts Cost Savings = BOM (before standardization) – BOM (after standardization).

The cost difference reflects cost changes resulting from substituting parts, replacing parts with preferred standard parts, or other parts management.

About the Author

The Parts Standardization and Management Committee is a national, nonaffiliated joint industry/government working group. The objectives of this joint committee include fostering standardization by promoting commonality of parts and processes, thereby reducing life-cycle costs; moving toward standardization of commercial parts; commercializing the government-furnished baseline; promoting education and training; and developing guidelines for use during the request for proposals process. The committee's website—http://www.dscc.dla.mil/programs/psmc/—is managed by the Defense Supply Center Columbus, a component of the Defense Logistics Agency.

[1] From Defense MicroElectronics Activity, *Resolution Cost Factors for Diminishing Manufacturing Sources and Material Shortages*, Final Report, February 1999.

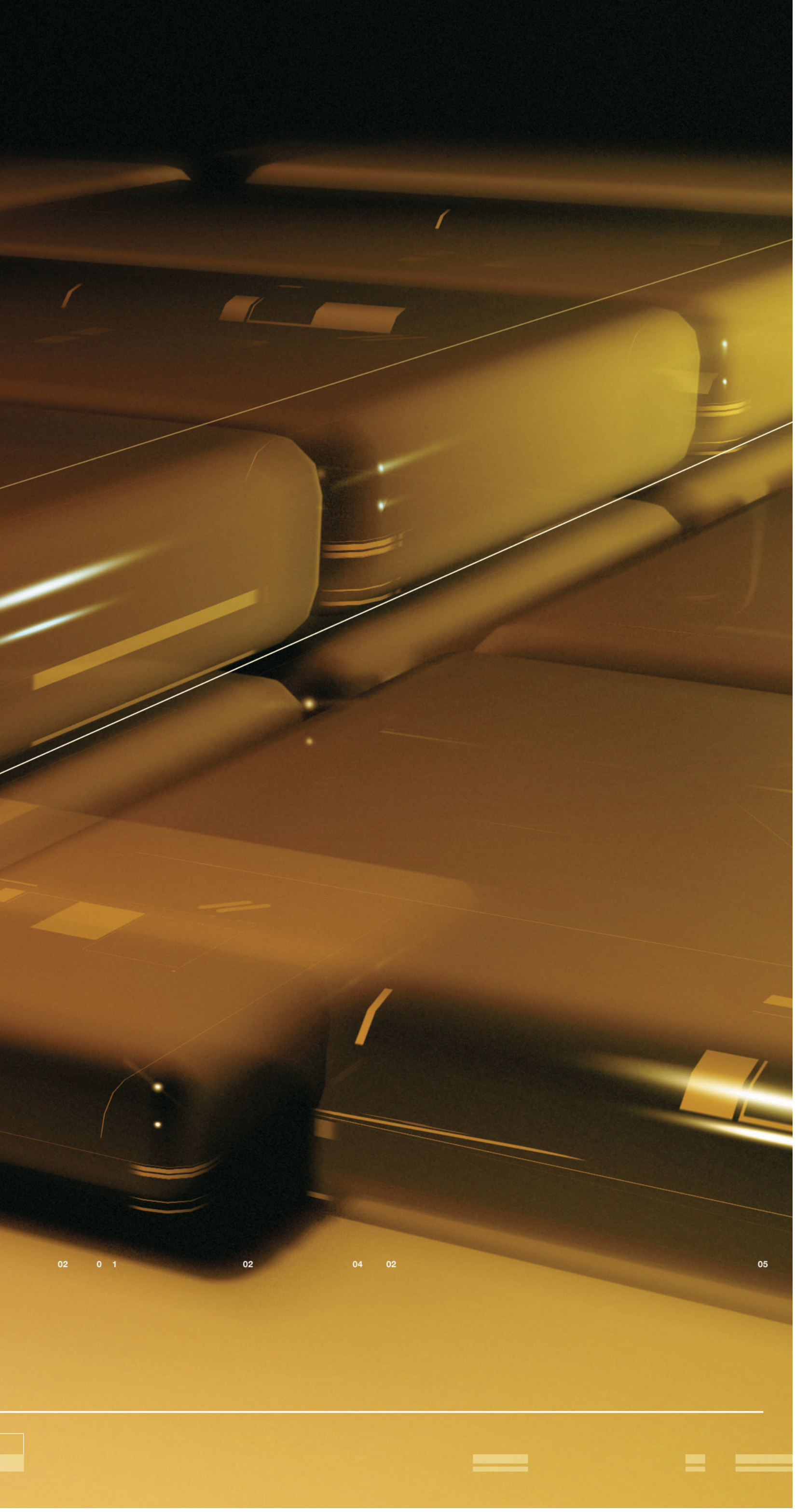
[2] Based on the computations illustrated in Figure 1.

Related Websites

Defense MicroElectronics Activity	http://www.dmea.osd.mil/index.html
Government-Industry Data Exchange Program	http://www.gidep.org
Parts Standardization and Management Committee	http://www.dscc.dla.mil/programs/psmc/
Defense Standardization Program	http://www.dsp.dla.mil
Navy Lakehurst Systems Standardization and Parts Management	http://www.lakehurst.navy.mil/ssd/toc.htm

A New Standard for Data Management

By James Forbes, Ph.D., and Cynthia Hauer, CCDM, DMII



For more than 30 years, "data management" (DM) has meant the process used to create, retain, update, sell, distribute, guard, and dispose of information. Examples of the information that falls within DM's scope are specifications, drawings, parts lists, and repair instructions produced during the development of complex products such as weapons systems. And that information is costly. For instance, the maintenance manuals for the B-1B aircraft cost more than $400 million when they were created in the early 1980s (roughly $660 million at today's prices).

The discipline of data management grew up in a world where data products were managed using a paper- or form-based process. Nobody thinks these products have been well managed. There is no end of stories about data that were bought but were never used, became obsolete, were not readily accessible, or were hard to use. Those same B-1B aircraft maintenance manuals were electronically authored, and the electronic source data are still available, but nobody can read the manuals because the electronic format in which they are stored is obsolete. Today, when the manuals must be reproduced or revised, the approach taken is to scan in the last clean paper copy and go from there.

In June 2000, DoD and the Government Electronics and Information Technology Association (GEIA) jointly recognized that the DM process had become woefully out of date in an era of web-enabled, shared electronic data repositories, management of which could also be web enabled. To address the problem, DoD and industry worked together to develop a new set of data management principles. The result, GEIA-859, *Consensus Standard for Data Management*, is a nearly wholesale reinvention of the field of DM into a process that addresses contemporary realities—especially the benefits brought by modern information technology.

This article discusses the evolving DM environment that motivated DoD and industry to develop a new DM standard. It then summarizes the new data management principles.

The Evolving Data Management Environment

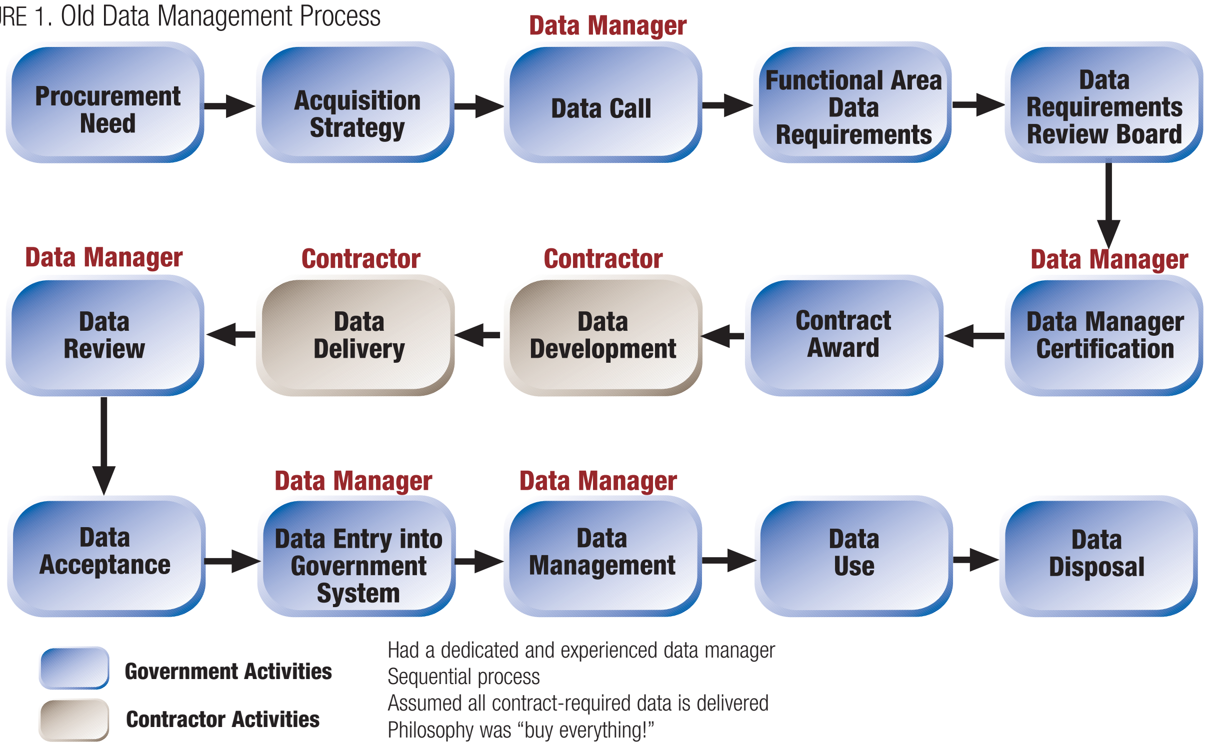
The world of data management has been evolving over the last 15 years or so, as information technology has advanced. The process for ordering, creating, and delivering data used to be (and, in some cases, still is) highly linear and lengthy, as demonstrated in Figure 1. The process reflected a particular set of basic assumptions and standardized practices:

- It assumed a fairly radical separation between who was doing the ordering and who was doing the delivering. The order was "thrown over a fence" and then the data products were thrown back over the same fence.
- Delivery used to be via paper or other hard-copy equivalents. Reports were in paper form, manuals were delivered in photo-ready negatives, and drawings were in aperture card format. Delivery occurred through the mail. The developer of the data mailed it, and the recipient opened it.
- Deliverable products used to be highly standardized. DoD and other agencies that followed the DoD "model" specified what they wanted in data item descriptions (DIDs). Use of a rigidly prescribed set of DIDs was mandatory; tailoring generally amounted to deleting (not modifying) certain requirements, and tailoring in the sense of modifying was made intentionally difficult. The intent was to reduce costs by specifying a common, one-size-fits-all set of requirements.
- The data environment required storage of large quantities of paper documents and provided for a limited number of copies because of the expense of storing and transporting hard copies, and sometimes it was difficult if not impossible to find or obtain a copy.
- Data were infinitely available and interoperable as long as copies were not misplaced or destroyed. (We can still read 11 tablets of the Sumerian Gilgamesh and Agga epic even though they are more than 3,000 years old.)[1]

The emerging data management process, illustrated in Figure 2, has the following characteristics:

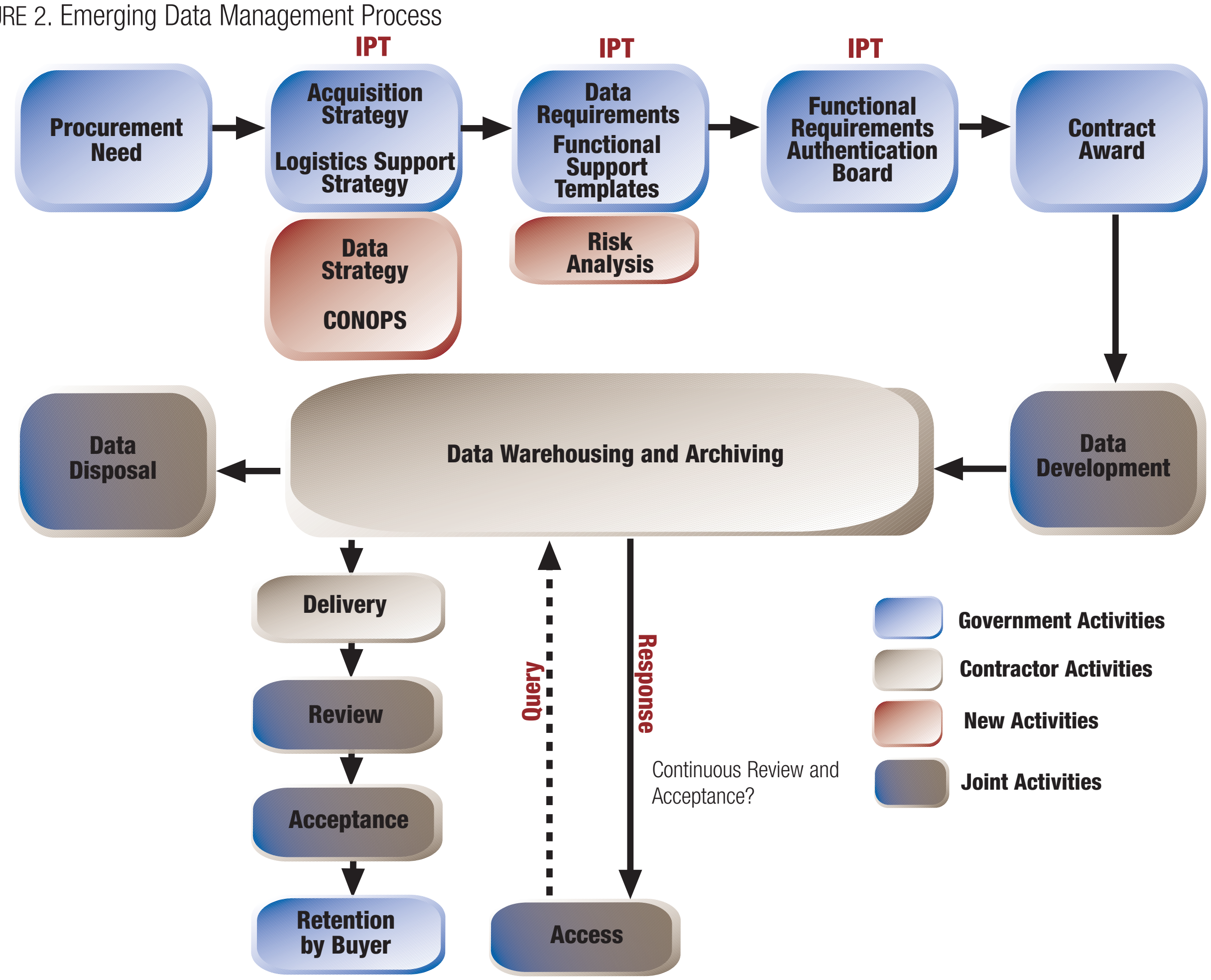
- A data strategy is created in parallel with the acquisition strategy for the system that the data represent.
- A data concept of operations follows from the strategy, specifying how the data will be used, for what purpose, and by whom.
- Data risks are explicitly analyzed. The risks include having too little data, too much data, data too early or too late, and related intellectual property issues. Although shown in the figure as subsequent to the strategy and concept of operations, risk analysis is, in reality, an iterative process; the risk analysis also informs the strategy and concept of operations.
- The data strategy, concept of operations, and risk analysis are created through an integrated product or process team (IPT) comprising representatives of both (or even multiple) trading partners.
- Both the seller and the buyer obtain the data from a common data repository, or data warehouse. No longer a one-way deal, data delivery (access) is now recognized as a two-way flow:
  - Although a pro forma hard-copy "deliverable" may be provided, electronic interchange is becoming more dominant. In particular, it is increasingly common for the data product to be posted on a website, and everybody who needs it accesses it.
  - DIDs are radically tailored or ignored entirely. Because the cost of providing not just tailored but personalized data has dropped so rapidly, there is little contemporary impetus for rote standardization of data. It is an idea whose time has passed.
  - Because storage is electronic, delivery (access) is rapid to instantaneous, and essentially an infinite number of copies are available to anyone needing them. Of course, you must know on what website data are stored, have the patience to learn to navigate that website, and have an application that can read the data.
  - Formats are not standardized and are subject to rapid technological obsolescence; data created 20 years ago are unreadable.

FIGURE 1. Old Data Management Process



Note: This figure shows the procuring agency as government but the same basic flow obtained even when it was in the context of other trading partner relationships such as commercial firm to commercial firm.

FIGURE 2. Emerging Data Management Process



The data management process illustrated on Figure 2 is, as we indicated, emergent. Existing written procedures often still reflect the process (and related assumptions) of Figure 1. It is not that those procedures are somehow perverse; they had been situationally correct when the world of data management looked like Figure 1. The problem was the world changed and the codified procedures did not. Thus, data managers found themselves between the devil and the deep blue sea: if they followed the accepted procedures, they had authorities they could point to—but outcomes would not be what was needed. If they adopted new DM practices, they had no such authorities and were open to challenge for not following established and understood procedures. What was needed was a new set of methods, situationally correct for the present environment.

Data Management Principles

Because the data management environment is neither stable nor monolithic, the DoD/GEIA DM panel decided that it could not write a set of procedures that will work for everybody now and into the future. Instead, the panel concluded that what is needed is a set of core principles that would be (more or less) stable even as the environment continues to evolve. Such an approach follows one of the precepts for "good" standards development, a focus on a core standard that addresses what everybody needs rather than a comprehensive standard that includes what everybody might want.[2]

The panel defined nine DM principles, based on the combined expertise of the individual members. The principles are as follows:

- Principle 1—Define the enterprise-relevant scope of data management
- Principle 2—Plan for, acquire, and provide data responsive to customer requirements
- Principle 3—Develop DM processes to fit the context and business environment in which they will be performed
- Principle 4—Identify data products and views so that their requirements and attributes can be controlled
- Principle 5—Control data, data products, data views, and metadata using approved change control processes
- Principle 6—Establish and maintain an identification process for intellectual property, proprietary, and competition-sensitive data
- Principle 7—Retain data commensurate with value
- Principle 8—Continuously improve data management
- Principle 9—Cooperate with knowledge management (KM) where DM and KM intersect as KM methods develop.

PRINCIPLE 1—DEFINE THE ENTERPRISE-RELEVANT SCOPE OF DATA MANAGEMENT

Different enterprises come to different conclusions regarding the scope of DM. Traditionally, DM has been thought of as including five functions: identification and definition, acquisition and preparation, control, disposition, and archiving. Although these functions remain valid DM tasks, they are no longer a sufficient response to contemporary DM needs. The intent of GEIA-859 is to highlight the importance of the strategic DM and supporting infrastructure. Accordingly, the standard defines a set of four higher level DM tasks:

- DM strategy and architecture development
- DM process and infrastructure design
- DM execution
- DM process and infrastructure maintenance.

The traditional DM tasks are execution tasks. What GEIA-859 adds is tasks related to strategy and architecture development, process and infrastructure design, and process and infrastructure maintenance. How the four higher level tasks are accomplished, and by whom, will differ from organization to organization. It may even be that parts of them are (or could be) the responsibility of a parent organization. Thus, this principle establishes the highest level DM tasks (scope in the broadest sense) and then acknowledges the need to match scope to specific context.

PRINCIPLE 2—PLAN FOR, ACQUIRE, AND PROVIDE DATA RESPONSIVE TO CUSTOMER REQUIREMENTS

This principle addresses the steps in the model illustrated in Figure 2, beginning with product need and ending with contract award.[3] Later principles discuss data development; storage, retention, and disposal; delivery and access; as well as important related topics. There are five aspects of this model important to planning for and acquiring data that meet customer requirements.

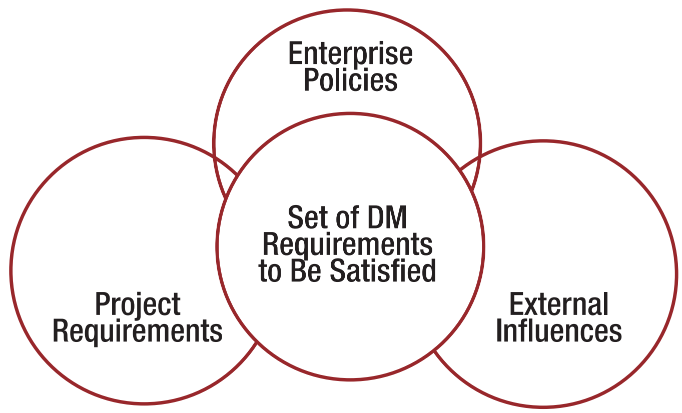
- The data customer can be either external or internal to the enterprise.
- The data can be provided to the customer using two different modes of delivery:
  - In hard copy or, increasingly, electronic form.
  - By providing the customer access to the data in a database or repository maintained by the data developer or a third party. Data products in a conventional sense may not exist and data objects may be formed at the time of need in response to customer-created queries against a database.
- Data development, review, acceptance, and disposal may be joint activities, conducted by the data developer and customer.
- Planning for data is deliberately linked to the overall product acquisition strategy and long-term sustainment planning through development of a data strategy and data concept of operations.
- The data requirements authentication process, which almost always exists in some form, is preceded by a data risk analysis that examines
  - the risks of not providing for delivery or access to data and
  - the risks of overprocuring data (e.g., where the data may become rapidly obsolete).

PRINCIPLE 3—DEVELOP DM PROCESSES TO FIT THE CONTEXT AND BUSINESS ENVIRONMENT IN WHICH THEY WILL BE PERFORMED

The business context and environment are characterized by both internal and external factors; DM solutions are necessarily conditioned by those factors. Requirements to be satisfied come not only from projects themselves but also from future expectations related to projects, from enterprise policies and processes, and from the environment external to the enterprise (Figure 3). Taken together, these sources define the context and business environment in which DM will operate.

In a particular circumstance, the project-specific, enterprise-wide, and externally imposed requirements can be complementary. In this instance, planning for their solution amounts to identifying all of the requirements and deciding, within available resources, which can be satisfied, when they can be satisfied, and how. But the requirements can also be in conflict. An example is a requirement for enhanced data sharing and a simultaneous requirement to improve controls over intellectual property. Regardless of whether they are synergistic, additive, in conflict, or—more likely—a mixture of the three, it is DM's task to identify and then address the full set of requirements, including examining tradeoffs where appropriate.

FIGURE 3. Data Management Requirements



PRINCIPLE 4—IDENTIFY DATA PRODUCTS AND VIEWS SO THAT THEIR REQUIREMENTS AND ATTRIBUTES CAN BE CONTROLLED

Data are of value to the enterprise when it can be located or accessed by users. Metadata, or data about data, is essential for data managers and others to identify, catalog, store, search for, locate, and retrieve data. Metadata includes attributes and relationships. Careful consideration of requirements when selecting elements of metadata enhances the ability of users to locate data regardless of storage medium or the amount of data stored. Creating standard processes for selecting metadata provides for consistent, uniform, repeatable processes that can be tailored to specific business requirements. The creation of taxonomies (a traditional task for library science that also is vital for the management of data) adds and enhances the context, relevancy, and use of data. Further, using uniform data characterization processes saves time, reduces cost, and allows projects to reap economies of scale through adoption by multiple users or enterprises that exchange data.

Not all data are delivered as a data product; if anything, the trend is away from delivery and toward access as needed. Such access is more often than not ad hoc—creating special challenges for data management, as well. When access is provided for, an authorized user can retrieve data that have been grouped or organized to meet specific needs—what is referred to in GEIA-859 as a data view, a generalization of the concept of a data product. Data views, whether implemented as queries, as XML schema, or by other means, are described by metadata. Particularly when the data views are complex and when it is important to ensure that the same view is provided each time it is needed, it is important to define and control the metadata.

PRINCIPLE 5—CONTROL DATA, DATA PRODUCTS, DATA VIEWS, AND METADATA USING APPROVED CHANGE CONTROL PROCESSES

DM and configuration management (CM) are two disciplines critical to the success of any complex project. They are strongly related and interwoven in their scope, application, and elements. DM is more frequently focused on the organizational (or enterprise) level of data generation and use; CM is usually oriented to data considered part of a product deliverable. The ultimate purpose of both disciplines is ensuring the integrity of the products they support. One of the functions of each of these disciplines is to control change or, in some cases, to protect the data from change. Not all data require formal change control or the same level of control—it is a matter of balancing cost and benefits. Principle 5 addresses the body of data for which some level of control is appropriate. The data product needs to be in a state of maturity that makes control both meaningful and productive. The following are some considerations:

- The format and media are in concert with the end-item requirements.
- The data are accurate and at an appropriate level of completeness.
- The timing of the transfer is appropriate to the data product's end use (too early is just as critical as too late).
- The data product has been reviewed by an appropriate level of authority (for example, the engineering manager or IPT lead).

The change control functions and principles defined in ANSI/EIA-649, *National Consensus Standard for Configuration Management*, are appropriate for DM. For that reason, GEIA-859 borrows heavily from ANSI/EIA-649 and describes how the change control process applies to DM.

PRINCIPLE 6—ESTABLISH AND MAINTAIN AN IDENTIFICATION PROCESS FOR INTELLECTUAL PROPERTY, PROPRIETARY, AND COMPETITION-SENSITIVE DATA

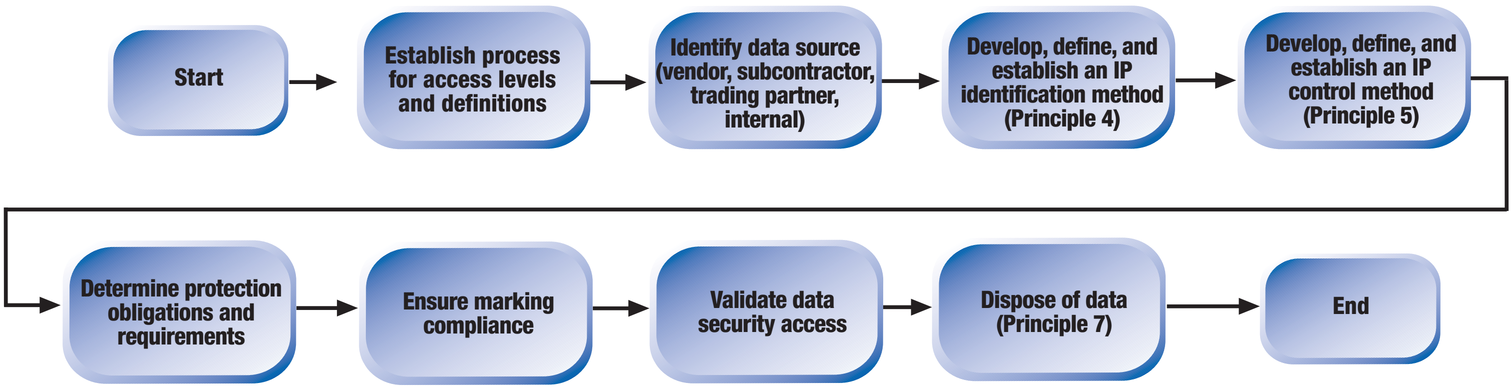
Intellectual property (IP) is a term used to describe real but intangible assets, embodied in such items as patents, copyrights, trademarks, and trade secrets. IP is at the center of an enterprise's competitive position and ultimately contributes to financial success. For this reason, protection of IP is necessary to maintain an enterprise's competitiveness. In many cases, it is also necessary to comply with legal obligations to suppliers and customers.

IP assets come from a variety of sources. In addition to internally developed data, IP is received from suppliers, subcontractors, and trading partners. All of the data are identified and tracked for protection based on data rights. Figure 4 illustrates, at a relatively high level, the management process for IP and its relationship with other DM principles.

PRINCIPLE 7—RETAIN DATA COMMENSURATE WITH VALUE

The purpose of this principle is to delineate methods for ensuring adequate retention and preservation of data assets that are of value to the enterprise and effectively disposing of data assets that are no longer of value. Any data assets with potential business, project, or operational value should be retained until their value is depleted. Data of sustained value to the enterprise should be retained and evaluated on an ongoing basis. To ensure that data are retained commensurate

FIGURE 4. Process for Managing Intellectual Property



with its potential entrepreneurial, legal, contractual, and other worth to the enterprise and customer requires the following actions by the enterprise:

- Plan to ensure data are available when needed
- Maintain data assets and an index of enterprise data assets
- Assess the current and potential future value of the enterprise's data holdings
- Determine disposition of data.

In the interest of space, we will call attention to an important aspect of the second consideration. To ensure that data assets are readable in future years, they need to be maintained in an appropriate format. Neutral formats work well for data needed only for reference and not as a source for future work. However, neutral formats may not work well for data that will need to be manipulated. In that case, to ensure that data assets are readable in native formats for later manipulation, the enterprise will need to retain the computer resources to recall and install, view, revise, or print images, or it will need to refresh to newer technology. An alternative is to periodically migrate data assets to current software applications and hardware formats for continued currency and availability for retrieval, establishing and paying special attention to refresh schedules and media life span. The decision process to retain obsolete computer resources or to refresh to newer technology is a business case, driven by economics pertinent to the predicted likelihood of data reuse. Retaining obsolete resources may involve extending date expiration-sensitive licenses or arranging software support into outyears. By retaining computer resources, the enterprise ensures that pertinent records are viewable and editable upon later need. Failure to continue migration to current formats can be costly to the enterprise—as illustrated by the B-1B technical manual example cited earlier. It is time-consuming and often expensive to locate a supplier or enterprise with the capability to migrate to current technology media.

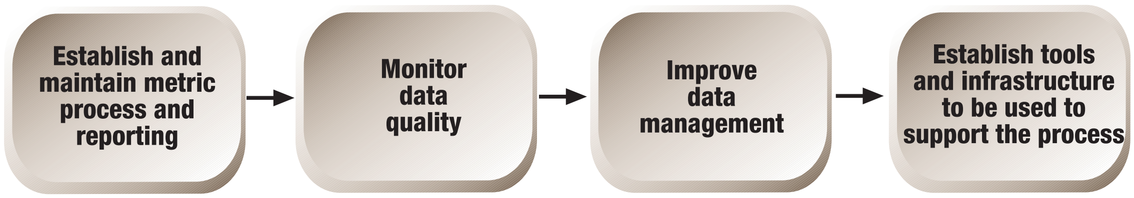
PRINCIPLE 8—CONTINUOUSLY IMPROVE DATA MANAGEMENT

In a rapidly changing technological society, it is crucial to continuously improve the quality of the resources that house one of an enterprise's most valuable assets—data. DM is the function responsible for ensuring that the quality of data is consistent with the users' requirements. In this principle, data management takes a proactive stance to ensure user satisfaction with data quality and availability over time. The purpose of Principle 8 is to provide a basis for implementing a process for data quality improvement.

As indicated on Figure 5, metrics are essential for determining where to improve and to monitor improvement. Metrics should, of course, be designed to positively motivate, rather than keep score, and should focus on future strategy rather than providing a compilation of past history. To effectively facilitate continuous improvement, a number of questions need to be considered:

- What type of data is required, by whom and when?
- Who will use the data?
- How will the data be used?

FIGURE 5. Improving Data Management



- What is the user's infrastructure?
- How will the data be delivered?
- Where are the data maintained?

The answers to these questions establish the basis for a meaningful process and should be considered not only for the specific project but also reviewed for the overall impact to the enterprise.

PRINCIPLE 9—COOPERATE WITH KNOWLEDGE MANAGEMENT WHERE DM AND KM INTERSECT AS KM METHODS DEVELOP

This principle addresses the interdependent relationship between data management and knowledge management. Table 1 depicts that interdependency. As the table shows, KM addresses both explicit and tacit information, while DM addresses explicit information only:[4]

- Explicit information comes in both structured and semi-structured forms. Structured information is the data found in the rows and columns of databases. Semi-structured information includes engineering drawings, documented tradeoff studies and other reports, technical manuals, and lessons learned when they are committed to a permanent record.[5]
- Tacit information includes mental models, recipes, rules of thumb, and lessons learned. Communities of practice (COPs) are important to sustaining such information and associated ontologies.[6] Much of the attention of knowledge management has been on tacit information and the associated COPs.[7]

TABLE 1. Interdependency of Data Management and Knowledge Management

Knowledge management		
Data management		
Explicit		
Structured	Semi-structured	Tacit
Purchase order Purchase order acknowledgement Invoice Remittance advice Request for quote Shipping schedule	Technical report Analysis report Specification Manual Parts list Drawing	Mental models Informal recipes Rules of thumb Lessons learned Communities of practice

The objective of Principle 9 is to distinguish the roles of each so that, in practice, DM and KM efforts are complementary. That requires two key actions by the enterprise:

- Understand the state of KM in the enterprise. Research in knowledge management can do much for data management. One example is the extensive research underway to develop better search engines. A second is the research into better, more useful taxonomies—closely related to the metadata discussed under Principle 4. However, organizations vary considerably in the maturity of their KM practice. Thus, they need to understand the state of KM before linking KM and DM.
- Coordinate DM and KM efforts. The specifics of coordinating DM and KM efforts depend on the state of KM and DM, as well as on enterprise needs. Table 2 illustrates the general relationship between KM and DM tasks.

Summary and a Look Forward

In this article, we have discussed the discipline of data management, and how it initially did not keep pace with technological change. We have stressed that because of ongoing change, reinvention of DM was necessary. Although the nine principles articulated in GEIA-859 were developed in the United States, we

TABLE 2. Relationship Between Knowledge Management Tasks and Data Management Tasks

KM tasks	DM tasks	Comments
Capture explicit knowledge in sharable form; retain it; know what it is, where it is, and who is responsible for it; dispose of it when obsolete	Essentially the same, hence, this is logically a data management role; adopt KM taxonomies for creation of metadata	Is already underway, albeit with significant problems to be resolved (e.g., overcoming technological obsolescence and developing practical protocols for disposal)
Facilitate sharing of explicit knowledge between communities	Provide and manage links between data archives and KM portals (as well as other KM mechanisms)	KM portals, and related mechanisms in period of rapid innovation, are nonstandard; will require equivalent innovation on part of data management Will almost certainly encounter resistance to opening up databases for unstructured searches
Increase learning rate; increase sharing and retention of valid, tacit knowledge	Expand scope of data managed to include representations of tacit knowledge (e.g., working notes, e-mail)	May be well beyond traditional or even emergent DM roles for most organizations
Facilitate transformation of tacit knowledge to explicit knowledge	Provide knowledge workers broad access to representations of tacit knowledge	Is likely to encounter significant organizational and cultural issues, especially because COPs do not respect organizational boundaries

believe they are applicable in the international arena. Thus far, when we have presented these principles in any forum, the consistent response has been that they make sense for the present and emerging context of data management.

About the Authors

The authors were coleaders of the GEIA-859 effort.

James Forbes is a senior research fellow at LMI Government Consultants, McLean, VA. A Certified Professional Logistician, Dr. Forbes has experience in policy analysis, technology management, program management, and information management. At LMI, he is a principal researcher in numerous studies of information systems and associated standards.

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[1] J.B. Pritchard, *Ancient Near-Eastern Texts Relating to the Old Testament* (Princeton, NJ: Princeton University Press, 1992), p. 45.

[2] M.C. Libicki, *Information Technology Standards: Quest for the Common Byte* (Boston: Digital Press, 1995), p. 17.

[3] In GEIA-859, the term "contract" includes formal contracts between two companies, formal contracts between a government agency and a company, interdepartmental work authorizations within a company, memorandums of agreement, and any other form of agreement that describes the duties of a supplier to perform data management for a customer. GEIA-859 also recognizes that data may be provided through a standalone contract or, and more generally, as part of a larger contract for goods or services.

[4] E. von Hippel, *Management Science* 40 (1994), pp. 429–439.

[5] The information technology term often used for this type of information is "unstructured." Here we adopt the term "semi-structured," because reports, manuals, and drawings do have structure, even if it is not the exacting regularity of a database.

[6] E. Carayannis and J. Forbes, *Technovation* 21 (2001), pp. 197–207.

[7] J. Mandelbaum and J. Forbes, *McMaster World Congress 2002*, eds. S. Young, E. Skotolova, and S. Hashmi (Hamilton, Ontario, Canada: McMaster University, 1992).

Good News

Radio Frequency Identification Standards Are Coming

By Maurice Stewart

One of the great paradoxes of technology is standardization. As the multitude of researchers toil to develop new solutions to old problems, the users face the issue of when to place their flag in the sand? When do they say, "I choose this technology"? When is the current version good enough to last a life cycle without becoming obsolete? When is my investment safe?

Radio frequency identification (RFID) users have been facing that dilemma for years. But now, DoD has placed its flag in the sand. DoD has decided that the benefits of a RFID system outweigh the costs. The Under Secretary of Defense has issued policy directing the department to begin using RFID by January 2005. In fact, the department has been using *active* RFID to track containers and air pallets for more than 7 years. By January 2005, the department will require cases and pallets of material delivered to DoD to be marked with *passive* RFID.

So what standards did DoD choose? The answer is, DoD did not choose a particular standard. Instead, DoD chose to work with EPCglobal™—a joint venture between EAN International and the Uniform Code Council, Inc. (UCC)—and its standards development process. EPCglobal carries the weight of the retail industry with it.

The EPCglobal process develops specifications or specifications that become standards. These new specifications will grow today's technology into a solution set for tomorrow. This solution maximizes return on investment and yet remains vibrant and robust for the future.

The EPCglobal Business Action Group begins the specification development process by developing and defining user needs. The needs then go to the Hardware Action Group or the Software Action Group. EPCglobal is working on several specifications and has identified the need for several more.

EPCglobal is addressing a total RFID solution and not just tags and readers. The solution also covers data processing, privacy, and data formats. The EPC Network uses global "look-back" ability to access data. Starting with only the RFID tag, users could access all of the data on an item. EAN/UCC backing of the EPCglobal concept for RFID ensures global approval.

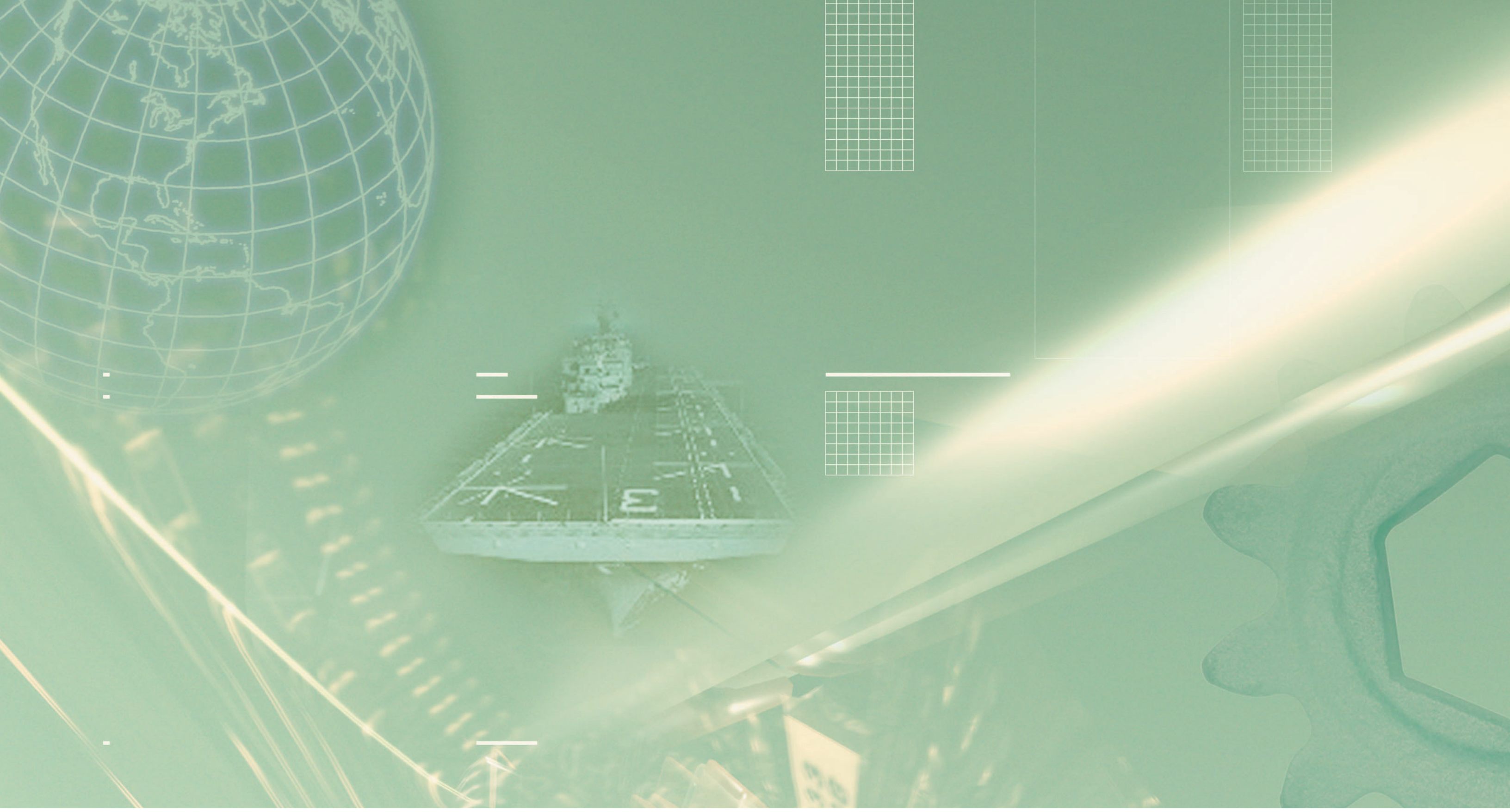
The adoption of standards will spur the spread of RFID throughout the supply chain. The worldwide adoption of RFID will yield economies of scale in production and support. As prices lower and the technology becomes more stable, RFID will become a truly ubiquitous technology.

DoD is well versed in the problems of fielding an RFID system. DoD's active RFID system is the largest in the world. DoD has more than 850 interrogators and 300,000 tags worldwide. DoD solved a number of problems to create the worldwide system in use today. Connectivity, theft, and foreign operating approval for specific frequencies are just a few of them.

The view of business and the military is global in scope. The Canadian Defense Forces and the United Kingdom Ministry of Defence have both used DoD's active RFID system. Joint operations in Iraq, Afghanistan, and the Balkans have proven that RFID works.

About the Author

Maurice Stewart is the deputy chief of the DoD Logistics Automatic Identification Technology Office at Headquarters, Defense Logistics Agency, Fort Belvoir, VA. He is responsible for policy, standardization, and implementation of automatic identification technology in military supply chain functions.



Unique Item Identification

Global Asset Visibility and Accountability Enables Intelligent Decision Making

By Rob Leibrandt

In 1998, the General Accounting Office (GAO) documented concerns with DoD management of its inventory of equipment.[1] It found that DoD's inventory exceeded its war reserve or current operating requirements, but lacked key spare parts (particularly aviation spares). The GAO concluded that DoD's inventory problem was due primarily to a lack of adequate accountability over material shipments and ineffective monitoring of defective spare parts.

DoD's logistics community has actively advocated the use of various bar-coding schemes to improve visibility and configuration tracking of parts. But DoD needs more information about its inventory—particularly, individual high-dollar-value and critical tangible items—than can be provided in a standard bar code. Specifically, DoD needs an asset identification approach that

- is globally unique and unambiguous,
- ensures data integrity and data quality throughout the life of the asset (marking that is permanent throughout the asset's life), and
- supports multifaceted business applications and users.

That identification approach is referred to as unique item identification (UID).

During 2003, Michael Wynne, Acting Under Secretary of Defense for Acquisition, Technology and Logistics, issued three memorandums that established and then refined the specific UID requirements.[2] DoD's UID program encompasses part marking, configuration control, systems engineering, asset management, and asset accountability and valuation.

Implementing the "Mark"

The first element of UID implementation is actually placing the permanent, correctly formatted mark on the item. This may be done by direct part marking in the form of dot peen, laser etch, chemical etch, or other techniques. Where practical, the mark may appear on a data plate or label as long as it can withstand normal wear and tear, including the range of solvents or other chemicals that may come in contact with the mark.

UID does not necessarily affect the method of applying the mark. However, the format of the mark will change from human readable to machine-readable. In addition, it must conform to the requirements of the Defense Federal Acquisition Regulation Supplement (DFARS) and the latest version of MIL-STD-130.

Contractual Requirements and Data Submission

Contractual language to implement UID was needed not only for the specification of marking of delivered items for which a UID is required, but also for the capture of pedigree data that serves as the "birth record" for each item. The UID requirement was realized in the issuance of the second interim rule, DFARS 252.211-7003, Item Identification and Valuation, as published in the *Federal Register* on December 30, 2003.

The interim rule establishes the following requirements for contractors to furnish unique item identifiers, or other item identification, and to provide the government's acquisition cost of items that are to be delivered under a DoD contract:

- All items delivered to DoD will be delivered under a contract line item; the department's acquisition cost of each item will be identified under a contract line item or subline item.
- Contracting officers must include DFARS 252.211-7003 in all solicitations and contracts that require delivery of items.
- Contractors must provide unique item identification, or a DoD-recognized unique identification equivalent, for all items with an acquisition cost of $5,000 or more.
- Program managers will identify items under the $5,000 threshold that will require a UID. Such items may require tracking, because they are classified as serially managed, controlled inventory, or mission essential and may also include embedded subassemblies, components, and parts.
- Under DFARS 252.211-7003, items must be marked in accordance with MIL-STD-130L, *Identification Marking of U.S. Military Property*.

The Way Ahead

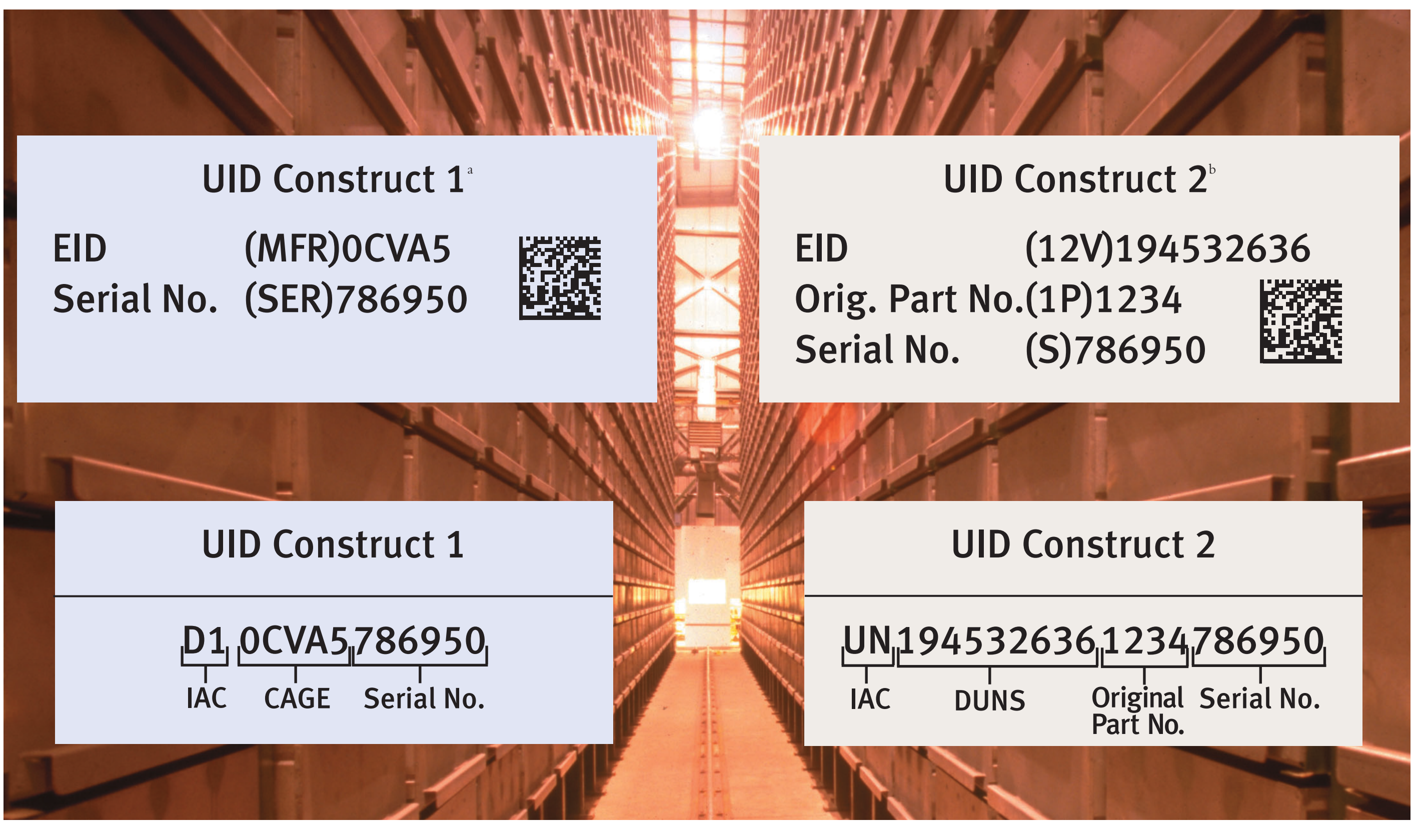
With the dedicated support of a government and industry integrated product team, the UID program determined that the elements for unique identification already exist. The data required consist of (1) an issuing agency code (IAC), an enterprise identifier (EID) such as a Contractor and Government Entity (CAGE) code or a Dun and Bradstreet (DUNS) number, and a serial number, or (2) an IAC, an EID, a part number, and a serial number that is unique within the part number. Construction of the UID is a matter of concatenating (linking sequentially) the required data elements. Figure 1 shows examples of the two constructs.

With three basic data elements identified, one must next address the question: how can the data be encoded consistently, reliably, and unambiguously? The answer lies in collaborative solution—a solution that creates a globally interoperable approach to direct part marking.

To establish interoperability among industries or business sectors requires a "common language" for part identification and a common marking approach. For UID, that means establishing a language and a carrier medium. Fortunately, the language exists in the international standard, ISO/IEC 15434, *Information Technology—Syntax for High Capacity Automatic Data Capture (ADC) Media*. Likewise, the carrier medium is a high-density two-dimensional (2-D) data matrix (depicted in Figure 1). The UID data matrix is built on a square grid arranged with a finder pattern around the perimeter of the grid.

The language of ISO/IEC 15434 provides the ability for automatic identification technology (AIT) devices to "read" the embedded data and accurately place the data into supporting applications such as inventory control systems. This standard is widely accepted in industry, and it recognizes the prevailing commercial data constructs. One notable exception is the aerospace industry, which uses data constructs called text element identi-

FIGURE 1. Two Constructs for UID



[1]This example uses text element identifiers.
[2]This example uses MH10.8.2 data identifiers.

fiers (TEIs), which are described in the Air Transport Association's SPEC 2000. DoD can use TEIs by declaring a DoD-defined format code "DD" in the ISO/IEC 15434 format to signify the use of TEIs.

Figure 2 shows the UID collaborative solution. In that figure, one can see the construction of the data that are encoded into the 2-D data matrix. Obviously, the human eye cannot read what has been encoded in the data matrix. However, the AIT device can. In other words, humans use the AIT device to obtain UID data from a part; the data can then be used for inventory control.

What Is the Impact?

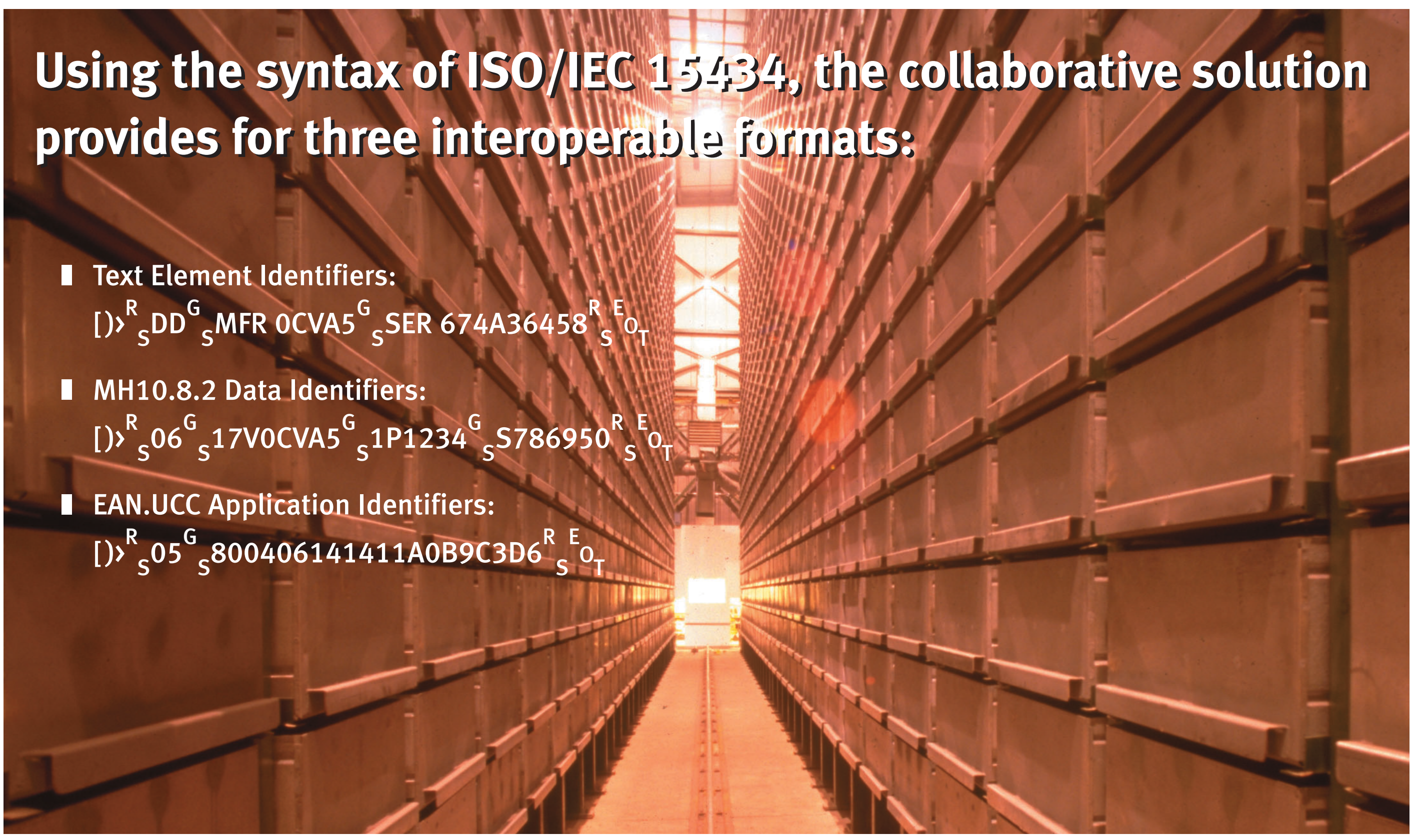
The use of the UID changes data capture, storage, and use across the board—both for contractors and the DoD acquisition community. For some contractors, the requirement to mark parts with the 2-D matrix means simply adding the 2-D matrix to existing part-marking techniques (for example, laser etching or dot peening onto data plates). For others, the requirement may represent the first foray into high-capacity automatic data capture. Meeting the requirements of UID policy and the latest version of MIL-STD-130 also may have infrastructure and other impacts that contractors must address with their management and the government program manager.

For the DoD acquisition community and contractors that provide logistics support, the technology provides an automated approach to data capture and a means for traceability throughout the life of an item. As the data capture occurs and is linked to in-service data sources, the acquisition community will have visibility over a broad range of reliable data for engineering analysis, logistics support decision making, valuation, and even operational decision making.

What Is the Future of UID?

In the short term, the primary focus

FIGURE 2. UID Collaborative Solution Issue



is on marking the items and electronically submitting the pedigree data. Concurrently, the acquisition, finance, and logistics communities are working to determine how UID marking and data capture can contribute to functional processes.

In the long term, UID can become a factor in knowledge-enabled acquisition and logistics. The following are some possible applications that are either enabled or enhanced by the use of the UID:

- Failure reporting/analysis and targeted repair (reactive and predictive)
- Recall or latent defect resolution
- Maximizing capability while minimizing logistics
- Reliability studies to determine best equipment available
- Tracking and redirecting as necessary in route
- Planned maintenance
- Repair
- Supplier performance
- Parts (end items and spares)
- Logistics support.

The insight provided through this basic, but effective means of uniquely and unambiguously identifying parts is limited only by the ingenuity of smart people with creative ideas and their combined ability to recognize the value of those ideas.

About the Author

Rob Leibrandt is the deputy program manager for UID, Defense Procurement and Acquisition Policy, Office of the Under Secretary of Defense (Acquisition, Technology and Logistics).

[1]General Accounting Office, *Major Management Challenges and Program Risks: Department of Defense*, GAO-03-98, January 1, 2003.

[2]Michael Wynne, Acting Under Secretary of Defense for Acquisition, Technology and Logistics, Memorandums of July 29, 2003; November 26, 2003; and December 22, 2003. Available at www.acq.osd.mil/uid.

The MultiView Program and GEIA-927

An Update

By John Reber

Image of JSF X-35C © Lockheed Martin Corp.

Second in a series of articles on the development of GEIA-927, Common Data Schema for Complex Systems. *This standard is being developed by the Electronic Industries Alliance (EIA) Government Electronics and Information Technology Association (GEIA).*

In the October/December 2003 issue of the *Defense Standardization Program Journal*, we discussed the nature of the business problem addressed by the U.S. Army Logistics Transformation Agency's MultiView Program and the process that is leading to the development of GEIA-927, *Common Data Schema for Complex Systems*. To the extent that legacy logistics systems with disparate data representations must integrate with emerging automated capabilities, MultiView can provide the underlying means to create seamless data exchange. Seamless data exchange can be a key enabler for end-to-end supply chain management and can enhance the connection between the logistician and distribution management where a variety of existing and emerging systems must interoperate on the battlefield. This article describes the standard data models that have been integrated.

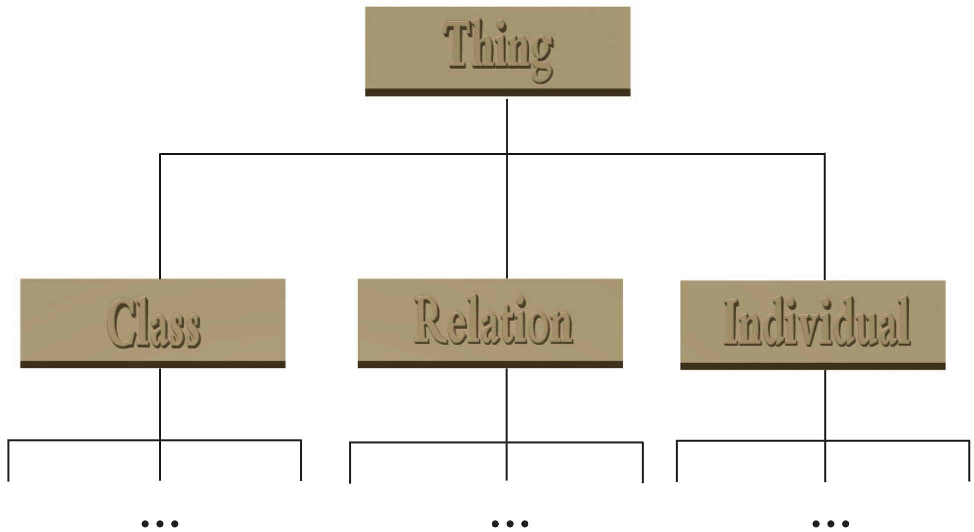
For this discussion, we need to define a few terms:

- Class—the representation in a model of a set of objects that are similar in some way.
- Model—a logical representation of a system; an abstraction of something for the purpose of understanding it.
- Object—any part of the conceivable or perceivable world.
- Schema—a representation of the structure and constraints of the contents of an information system using a graphical or textual language; a data model, which defines a vocabulary of terms, defines their properties and relationships, and specifies how the information must be organized. We use the terms "schema" and "data model" interchangeably in this article.

As reported earlier, the integration model chosen for the MultiView Program is the data model from ISO 15926, the EPISTLE Core Model version 4.0. It is important to choose this initial integration model carefully so that, as additional models are integrated, new concepts from these models will still fall within the scope and context of the initial model. If so, then a new concept can be added as a specialization of an entity that already exists in the model; if not, then it will be necessary to find a new abstract entity that is a generalization of every concept already in the model in addition to the new one.

The data model in ISO 15926 is a class hierarchy with a single root class: thing. That is, every other concept depicted in the model is a specialization, directly or indirectly, of thing. That, in and of itself, is rather unremarkable and obvious. Few concepts cannot be considered a kind of thing. At the same time, that observation of the mundane illustrates the power of this model: if any new concept we wish to add to the integration model is a specialization of some concept already present in the model, then the new concept, by definition, falls within the scope and context of the integration model. Notice that the definition for object is similar to our notion of thing.

ISO 15926 Root Classes



The STEP (Standard To Exchange Product data) standard models reflect a general practice in data modeling: models are generally developed first at a conceptual, or reference level, typically by individuals who are experts in the subject matter being represented. After the reference model is finished, data modelers will interpret the model to provide a schema that is ready to be implemented on a computer. The MultiView model is being constructed through integration of reference models.

Having made the decision for the initial integration model for MultiView, the next step was to choose the first application model to incorporate by integration. Because we are creating a data model for complex systems, we decided to integrate a model covering the data concepts involved in systems engineering. On the basis of our survey of standard data models, we chose an application protocol (AP) from the ISO STEP world, AP233, systems engineering data representation. This model, although still under development, appears to provide the best overall representation of the data concepts, and the relations between them, in the domain of systems engineering.

The next model selected for integration was the portion of the Defense Data Architecture known as the Corporate Logistics Data Model (CLDM). We selected this model for several reasons, not the least of which is that the subject area fits well with a pilot implementation of the schema being planned for use at the Army's PM Abrams and Tank-automotive and Armaments Command. Upon investigation, we learned that the CLDM is closer to the interpreted level of abstraction than the reference level. The integration was accomplished by "reverse engineering" to create a reference model containing the primary concepts from CLDM and subsequently integrating that reference model with the MultiView schema.

Another significant domain to be represented in the schema is electrical and electronic engineering. This domain is represented in the STEP standard by two application protocols: AP212—Electrotechnical Design and Installation, and AP210—Electronic Assembly, Interconnection and Packaging Design. AP212 was chosen, and major portions of it were integrated. Other areas within AP212 were not integrated—yet.

Some conceptual areas are common to a number of STEP APs. For example, configuration management concepts are represented (differently) in various APs. The decision was made to avoid integrating some areas that would probably be better represented in a different application model. In addition, the STEP community has recognized that a single representation of the conceptual areas that are common to multiple APs would be advantageous. As a result, ISO has created the "STEP PDM Schema," consisting of representations of conceptual areas that are common to AP203—Configuration Controlled Design; AP212; AP214—Core Data for Automotive Mechanical Design Processes; and AP232—Technical Data Packaging: Core Information and Exchange. The MultiView Program is presently integrating the STEP PDM Schema.

Current plans call for integrating the following ISO STEP models:

- AP203—Configuration Controlled Design
- AP210—Electronic Assembly, Interconnection and Packaging Design
- AP214—Core Data for Automotive Mechanical Design Processes
- AP232—Technical Data Packaging: Core Information and Exchange
- AP239—Product Life-Cycle Support.

In addition, the data model from GEIA-836, Configuration Management Data Exchange and Interoperability, currently under development by GEIA, will be integrated.

To provide potential users with foresight of where the development will lead, the above referenced models will be incorporated by reference in the initial release of GEIA-927, expected to be released for ballot in December 2004.

About the Author

John Reber is the lead for GEIA-927 schema standard development at Trident Systems, Inc. He has been deeply involved in data management and interoperability for the past 15 years and has more than 30 years of experience in data modeling and database system development.

Extensible Markup Language

Improving Logistics Interoperability

By Mark Crawford and Don Egan

Standardization of the diverse and large population of DoD logistics transactions has been a difficult objective to achieve and maintain. The development of Extensible Markup Language (XML), in combination with federal and DoD initiatives for standard enterprise architectures, offers a new opportunity to improve standardization and interoperability in logistics data exchanges. This article introduces XML, identifies how it can improve interoperability between systems, and discusses challenges that DoD and civil agencies must address to implement XML widely and consistently.

Background

DoD first established standardized inter-service/agency logistics electronic transaction formats in the 1960s with the Military Standard Requisition and Issue Procedure (MILSTRIP), which defined both standard 80-character exchange formats and inter-service procedures. Between 1962 and 1978, DoD established seven additional standard procedures and numerous supporting directories. These were collectively identified as the Defense Logistics Standard Systems (DLSS), but nicknamed the MILS. DoD also established a communications system to transmit them and a centralized processing hub—the Defense Automatic Addressing System (DAAS).

This period saw a steady growth in DoD use of electronic transactions, as the military services and defense agencies developed large automated systems to use the DLSS. They were also developing additional systems and electronic transactions for intra-service exchanges and exchanges with industry and other logistics stakeholders.

However, this growth also highlighted limitations. The fixed-length 80-character records were packed with data and had no room to support additional data requirements. Beginning in the late 1980s and into the 1990s, DoD undertook an effort to convert the more than 400 fixed-length DLSS formats into a commercial standard—the American National Standards Institute's electronic data interchange (EDI) variable length formats. This important step was intended for DoD-wide adoption. The revised documentation was renamed the Defense Logistics Management System (DLMS) in 1995. However, although some DoD organizations implemented EDI, especially for DoD/industry exchanges, EDI never accounted for a large percentage of the total volume of DoD logistics system exchanges.

In the last two decades, the number of logistics data exchanges through the DAAS has increased to more than 11 million transactions daily (of which EDI makes up less than 5 percent), enabled by the proliferation of new technologies such as data warehouses, enterprise resource planning systems, and the World Wide Web.[1] Moreover, this automation is supporting new logistics initiatives such as pre-positioned material, direct vendor delivery, total asset visibility, and unique item tracking. As new DoD processes and supporting systems were implemented, they sometimes bypassed the data limitations of the old DLSS without implementing EDI—instead, using a variety of record formats. These diverse and sometimes unique formats cannot be shared with other systems without custom format-conversion routines, making the exchange of data more complex and increasing IT overhead. In short, at a time when DoD management is seeking greater interoperability, we continue to have relatively low levels of standardization (or where it exists, it uses a 40-year-old format) within the logistics data exchange community. Interoperability—both within DoD and with its external trading partners—can be improved by using XML.

About XML

XML is a subset of the Standard Generalized Markup Language (SGML). Like most markup languages, XML associates data to a tag. For example, a requisition date may have a "ReqDate" tag. The transmission of a specific requisition date of July 4, 2003, might appear as follows:

<ReqDate>2003-07-04</ReqDate>.

XML supports including data as well as metadata within the markup. This is accomplished through the use of attributes. For example, the above requisition date <ReqDate> tag could include an attribute that defines the date format as follows:

<ReqDate format="Julian">4032</ReqDate>.

The structure for XML documents is defined in either a Document Type Definition (DTD) or an XML Schema Definition Language (XSD) Schema. DTDs are a legacy of SGML and were designed to support document-centric (i.e., publishing) XML. XSD Schema are written in the XML syntax and are designed to support both document- and data-centric XML. An XML document is a structured collection of XML tags forming an electronic transaction (e.g., a requisition) that can be validated against its XSD XML Schema. An important XML feature is the capability to build "partial schema" components (e.g., XSD Schema module for standardized address information) that can be reused in different XML Schema.

Although most initiatives focus on XML for data exchange (often as a replacement for EDI), XML is also very suitable for internal storage and access within application software and for presentation through web browsers, print, and other media.

Benefits of XML for Logistics

Applying structured, coordinated markup to data organizes and defines the data so that systems and applications that support XML can store, retrieve, manipulate, present, and exchange the data. Because XML-defined data can support all of these functions, XML is a significant improvement over previous formats for exchanging data electronically among systems. As a result, XML is rapidly replacing EDI as the dominant exchange data format for new implementations. The following are some of the benefits of XML over EDI:

- Software tools for moving between XML formats and applications are cheaper and easier to use than EDI translation software.
- XML and supporting web services are designed for the Internet. Although EDI can be, and is, transmitted through the Internet, most EDI production implementations have been through specialized commercial communications services companies.
- The EDI specifications and syntax are not readily usable for any purpose other than data exchange/translation, whereas XML can be used for storage and can be transformed for presentation as well. Moreover, XML works equally well both for fielded and text data.
- A wide variety of commercial software systems are incorporating XML into their products. These include database management systems, enterprise resource planning systems, enterprise application integration software, and others. Also, a substantial body of standalone XML software exists.

In short, XML is flexible, inexpensive, easy to implement, usable in diverse business processes, and supported by a wide array of commercial software. These features make it an attractive option for many organizations and business needs.

As XML continues to grow as the dominant data representation/exchange standard, the benefits will increase significantly. Broad use of XML can reduce DoD IT overhead associated with developing and maintaining transformation software, inter-service data coordination, training, software tool acquisition support, application development, and other areas.

Status of XML Implementation

The World Wide Web Consortium (W3C) established and maintains the suite of XML technical specifications. The W3C is a nonprofit consortium with membership open to organizations worldwide.[2]

The W3C released the first W3C XML technical specifications as a recommendation in February 1998. Industry quickly adopted XML, and the number of implementations has been steadily increasing. Within the federal government, XML use is included in both the Federal Enterprise Architecture Technical Reference Model[3] and the DoD Joint Technical Architecture.[4]

Numerous federal agencies and cross-agency initiatives are planning around XML. The General Services Administration is supporting several initiatives to encourage government-wide XML adoption. Among these, the agency is publishing design rules to assist developers with writing XML Schema and a Schema-writing best practices document. Nineteen of the 23 initiatives in support of the President's Management Agenda also are using XML in cross-agency plans; for example, the National Archives and Records Agency is using a prototype XML Schema for transmitting metadata regarding agency electronic records transfers. The Environmental Protection Agency and state environmental offices have selected XML for exchanging environmental data and are deploying a web-services–based network to support the effort. The Internal Revenue Service is collecting some tax data using XML exchanges, and the Customs Service is transmitting port-of-entry data to a central system in XML format.

Federal research agencies are also investigating XML. The National Cooperative Research Program is planning to sponsor a grant to develop TRANSXML to support exchanges among state transportation offices and other stakeholders regarding highway construction standards and materials. The current Army Research Laboratory's Broad Agency Announcement includes creating a MILXML to support both strategic and tactical transactions, particularly from devices.

Also the Chief Information Officer at the Department of the Navy (DON) has initiated a DON-wide program to promote XML technology insertion. This effort includes releasing the DON-wide vision and policy for

XML implementation.[5] The DON is establishing effective coordination through a DON-wide XML Working Group. The group has formulated technical guidance, promoted DON participation in standards bodies, and established a formal DON governance structure with both technical and functional representation from across DON. The Air Force and the Army have also initiated XML programs.

Standardization Challenges

XML can be a key element in both defense and civil agency efforts to standardize data exchange processes for decades to come. However, simply adopting XML is not enough. The W3C XML and XSD specifications define only the syntax rules for creating XML vocabularies and document structures. They do not provide a fixed vocabulary, they do not provide the business rules for a particular exchange, and they do not provide standard approaches to implementing all of the different features of XML or XSD. For example, the W3C specifications do not define what data elements would be included in a DoD requisition. They do not determine whether a name consists of a single field, of two separate fields for first name and last name, or of several separate fields for title, first name, middle name, last name, and suffix.

In the commercial world, numerous industry groups are defining schema, naming rules, and business conventions for their respective industries, but there is no overall coordination. Within the government, agencies that adopted XML early may well have employed design rules and naming approaches focused on the job and system at hand rather than designing for the future and a broader set of systems and players.

How do we promote standardization—and the reuse—of XML components? One approach is a standardized design process supported by a registry process, which is in turn supported by a governance structure like that established by the DON. The DON governance structure includes provisions that all DON XML components will be developed through a standard set of design and naming rules that apply both technically and functionally. These design rules are based on international voluntary consensus standards.[6,7,8] Further, DON functional namespace coordinators will collect newly developed XML components and submit them to a central technical analysis team that will review them for both technical and business consistency. Once approved, they will be included in the DON enterprise community of interest within the DoD XML registry. Developers seeking to develop new applications can then search this registry first to determine if whole or partial XML components exist that will meet their needs. Figure 1 depicts the envisioned review cycle. The key to this process is standardized XML that is capable of being harmonized in a standard fashion.

The General Services Administration is also in the early stages of developing a collaborative discovery, reuse, registration system for Federal Enterprise Architecture components, including XML.

The environment is now also changing for the DLSS/DLMS. Some 95 percent of the data flowing through the DAAS remained in the 40-year-old DLSS (MILS) formats. In December 2003, the Office of the Under Secretary of Defense for Acquisition, Technology and Logistics issued a memorandum establishing December 2004 as a sunset date for exchanging the DLSS transactions. Beginning in January 2005, DLMS exchanges must be in X12 EDI or XML format. Implementation of this directive will bring significant changes to service and agency systems as they move to support a new exchange technology.

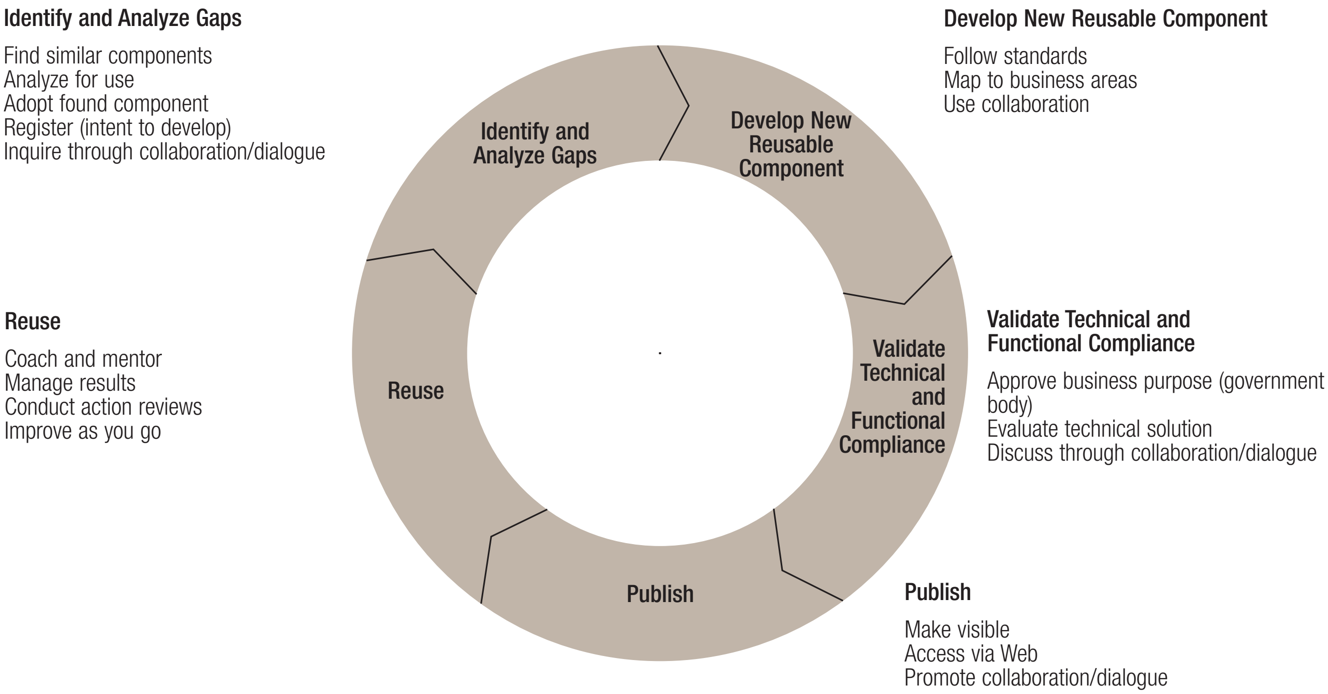
Conclusion

An international, consensus-based standard that is independent of both hardware and software platforms, XML is being used in an increasingly large group of commercial products and supports diverse business applications (e.g., supply chain, documentation, acquisition) and user functions (e.g., presentation, storage, exchange).

Use of XML can improve interoperability, reduce costs, and contribute to improved data quality. However, the extent of these gains will depend heavily on the following:

- How broadly DoD implements XML within and among the military services and defense agencies, as well as with other federal agency and commercial trading partners

FIGURE 1. XML Review Cycle



- How consistently DoD adopts design and naming rules and how aggressively the government develops a governance structure/registry process to manage consistency
- Whether DoD and federal agencies participate in W3C and commercial standards bodies to encourage them to create open and consistent specifications and standards that support unique government business and technical requirements.

The tool is in hand, but we need to employ it consistently and effectively.

About the Authors

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[1] DoD MILS Elimination Briefing, February 2004.

[2] The URL for the W3C is www.w3c.org. In addition to specifications for XML and Schema, the W3C website includes specifications for stylesheets, namespaces, security, web services, Simple Object Access Protocol, and other related functions.

[3] Federal Enterprise Architecture, *The Technical Reference Model*, Version 1.1, "Component Framework," p. 34. XML and related standards are identified through the framework figure.

[4] Joint Technical Architecture, Version 5.1, September 2003, Section 2.5.4, Data Interchange Services, p. 19. Also, a July 9, 2001, U.S. Air Force Memorandum identifies XML as one of four standards that all Air Force systems must implement.

[5] Department of the Navy, Chief Information Officer, Memorandum, "DON Policy on the Use of Extensible Markup Language (XML)," December 2002.

[6] International Organization for Standardization (ISO)/International Electrotechnical Commission (IEC) ISO 11179, *Information Technology Specification and Standardization of Data Elements, Part 5, Naming and Identification Principles for Data Elements*, June 1995.

[7] UN/CEFACT, *Core Components Technical Specification, Part 8 of the ebXML Technical Framework*, Version 2.01, November 15, 2003.

[8] Organization for the Advancement of Structured Information Standards (OASIS), *Universal Business Language (UBL) Naming and Design Rules*, February 27, 2004.

Integrated Aerospace Parts Acquisition Strategy

By Joe Chapman

Dateline: The Pentagon, February 24, 1994, "Acquisition Reform: A Mandate for Change."

Today, Dr. William Perry, Secretary of Defense issued a directive of great significance. Declaring it was time for the United States Department of Defense to move into the modern age in terms of utilizing state-of-the-art electronics related equipment, Dr. Perry directed DoD *"to use performance and commercial specifications and standards instead of military specifications and standards, unless no practical alternative exists to meet user needs."* In a practical sense this resulted in military contractors beginning the preferential use of Commercial Off-The-Shelf (COTS) electronic components. This innovative and far-reaching declaration and the subsequent transition to commercial technology usage has had an astounding impact across the Defense industrial base in the past decade.

One can look back on this date and realize that, overnight, across the electronics arena of the United States, we moved from "misguided micromanagement," with the attendant and intrusive top-down, burdensome, and heavy-handed oversight, to a period of "irresponsible ignorance" in which suppliers were permitted to do virtually anything they chose with little or no direction or oversight.

It has become evident to all stakeholders that, when it comes to critical equipment and components for DoD and similar high reliability applications, the swinging pendulum of checks and balances needs to be brought into more of an equilibrium or, perhaps, a new model of supplier-customer relations needs to be developed.

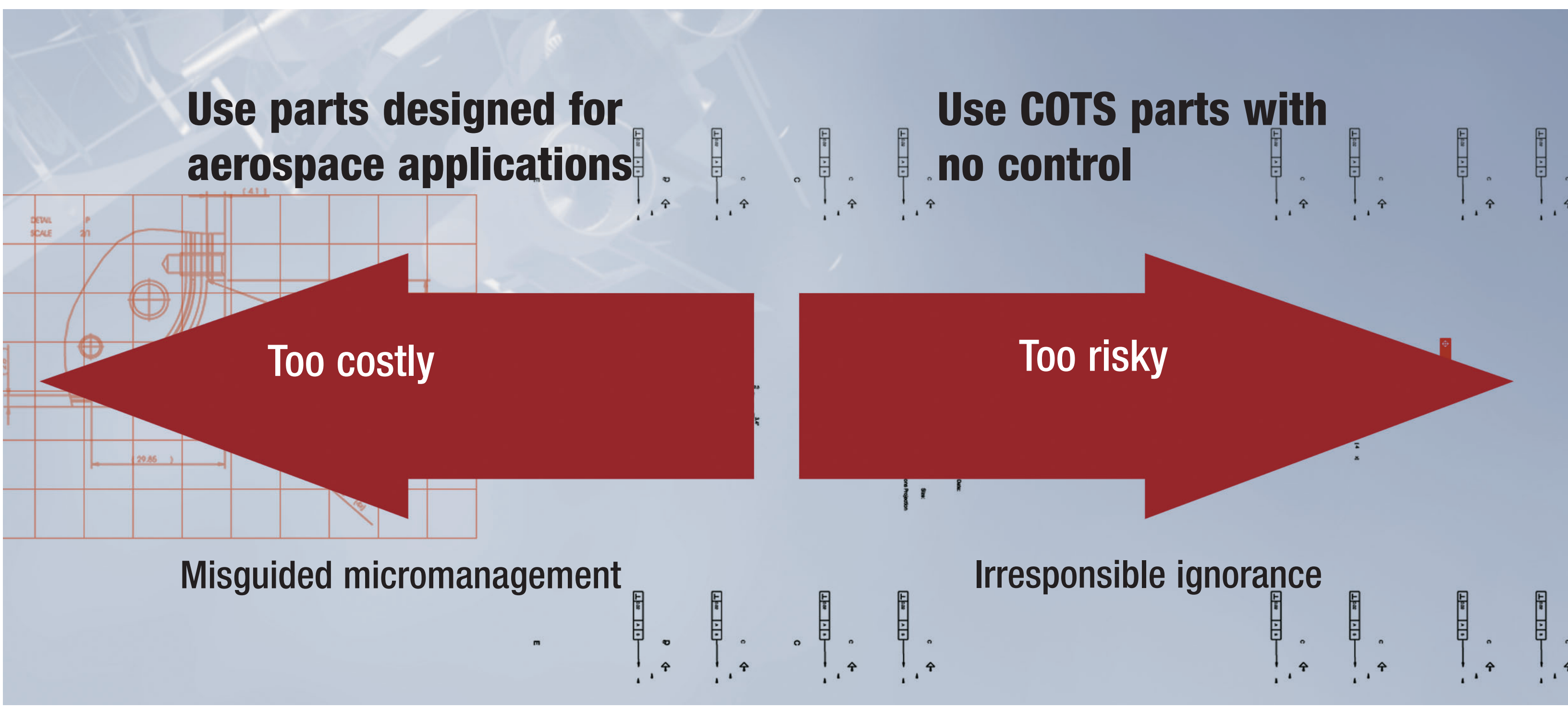
At the heart of today's weapons systems and attendant support equipment, an observer will virtually always find integrated circuit (IC) technology—the technology that has revolutionized our lives through its use in cell phones, computers, automobiles, and many other consumer applications. These tiny and often ill-understood microcircuits have capabilities hardly imagined in 1994. As the geometries have continued to shrink from microns to nanometers, and manufacturing techniques have been continually refined and mastered, the insatiable appetite of consumers around the world continues to drive suppliers to seek ways to make faster, better, and cheaper microcircuits.

All of this has left the original equipment manufacturers (OEMs) in the military, avionics, and aerospace communities searching for safe and reliable ways to design, procure, and use microcircuits, which are the "brains" of our most sophisticated electronic systems. Every aircraft on which civilians and military personnel fly daily now contains systems with microcircuits that were initially never intended for use in those types of ultra-high-reliability applications. How has that happened? How have catastrophic consequences been avoided? How can it continue?

The safety and success record is a credit to the electronics industry from the beginning to the end of the supply chain, as well as to the commitment every individual segment of that chain has in place to maintain reliability. Imagine the challenge of designing a Fully Automated Digital Engine Controller (FADEC) using microcircuits produced for the cell phone industry or the laptop computer industry. A FADEC rests in the cowling of an aircraft where the temperatures and environmental conditions are extreme. The microcircuits must be reliable—failure is not an option—in temperatures ranging from -55 degrees C or colder to 125 degrees C or hotter. In contrast, the microcircuits used in personal computers must operate in temperatures that remain at about 70 degrees F, and where humidity, dust, and other environmental issues are not much of a concern.

At first glance, meeting that challenge might seem impossible. But over the past decade, incredible progress has been made by OEMs as they have dealt with such challenges as that described above. One common solution, crossing many mission-critical applications, was to purchase COTS consumer microcircuits (those specifically designed to operate at temperatures of 0 to 70 degrees C, test them at greater temperature extremes to determine their ability to survive and operate, and then use those specific components in applications like those described above. This practice, known in the industry as "uprating," was of concern to all—the concern that the uprated microcircuit, never having been designed or manufactured for a high-reliability application, might fail and cause a catastrophic event.

The care and attention that the OEM quality and engineering community paid to part selection, testing, and design safety margins, along with the high quality of the IC parts themselves, ensured the mission success of end systems. But trouble was brewing even as the successes continued.



During this decade of dramatic change, microcircuit manufacturers wrote letters advising of the danger of uprating, explaining that such practices violated the conditions of the sales contracts and would therefore remove the liability from the microcircuit manufacturer in the case of system failure. Some microcircuit manufacturers even stated that, should legal action be initiated over some catastrophe, they would appear in court against the user.

However, realization has set in that all of us—manufacturers, OEMs, end customers—stand to lose if a catastrophic event occurs that could have been avoided had we acted wisely and responsibly. That includes recognizing that we all have a part to play in avoiding the catastrophe by responsibly addressing factors that can contribute to the proper utilization of microcircuits, even in instances where they are required to perform in arenas beyond those for which they were expected to be used.

This critical communication has come about through the collective cooperative efforts of a small number of individuals and companies. Now, a continually growing segment of the supply chain across the electronics arena is getting involved. The resulting dialogue brought about the creation of an Integrated Aerospace Parts Acquisition Strategy (IAPAS), which has widespread and active participation and support. Led by the aerospace community of suppliers and users, this has been a two-phased approach thus far.

The initial phase, now well into the implementation stage, is the imposition of a requirement for an electronic component management program or plan (ECMP). Each major "black-box" supplier to the airframe companies prepares its own plan for using and controlling the electronic components included in the manufacture of systems for the end customer.

The IECQ-CECC, a worldwide approval and certification program for electronic components, then audits the plan for completeness against an international specification crafted by these very participants over the past few years. The specification is either Electronic Industries Alliance (EIA) 4899 or IEC Technical Specification 62239, both of which spell out the requirements for an ECMP. Once it has determined that a supplier's ECMP is compliant, the IECQ-CECC grants the supplier a certificate, which is deemed active for up to 3 years. The supplier can use the certificate as proof of a sound and compliant plan for managing components, thereby paving the way for that supplier to forego further system audits by multiple and redundant assessor bodies. It is easy to see the economic benefit accruing to the ECMP owner by avoiding costly additional audits.

The second phase of the IAPAS is the appropriate recognition of a class of microcircuit components suitable for use "as is" from designated IC producers. Currently, such parts are designated as Aerospace Qualified Electronic Components (AQECs). This term—whether or not it becomes institutionalized—was a result of work done collaboratively by microcircuit suppliers and users and by representatives of DoD, NASA, the Federal Aviation Administration, and many industry associations. The significance of AQECs is not as obvious at first glance as the casual observer might think. Its importance lies in the fact that IC manufacturers may be able to communicate "means of safe and reliable use" to those who want to use a component designed for a consumer product such as a cell phone in a severe environment. This information, once communicated, enables the customer to use the component without performing added testing or screening. This elimination of the uprating process is a distinct advantage, because the IC manufacturer has performed the testing required and because the user can design with knowledge and confidence in the reliability of the parts.

Stakeholders all across the supply chain—from IC manufacturers, distributors, and OEMs, to end users (both contractors and defense and civil government entities)—are involved and participating in outlining the next steps in bringing IAPAS to fruition. Several specific elements of the Office of the Secretary of Defense and the military departments are directly involved in portions of this strategy and are, indeed, contributing resources as the strategy evolves. Among those elements are the Naval Air Systems Command; Defense Standardization Program Office; Defense Microelectronics Activity; Defense Logistics Agency; Wright-Patterson Air Force Base; Aviation and Missile Research Development and Engineering Center–Huntsville, AL; and Warner-Robins Air Logistics Center. Several industry associations have also provided valuable input and support. They include EIA's Government Electronics and Information Technology Association, Aerospace Industries Association, Joint Electronic Device Engineering Council, and Aerospace Vehicle Systems Institute—a research consortium. As more organizations become aware of this effort, additional support is clearly anticipated.

The next 3 to 6 months of effort on IAPAS are critical as others make decisions regarding participation. Cost studies are underway to determine the economic impact of the use of AQECs in systems and the anticipated total ownership cost over the life of systems using such parts. Considerable effort to understand changes required in acquisition regulations is also expected.

The bottom line? Much work lies ahead. And as is often the case, accomplishing small gains will require significant effort. Appropriate actions are underway to make the use of AQECs not only the obvious "right choice" but also so attractive that AQECs become de facto "required parts" for aerospace and military applications.

About the Author

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Bridging the Military–

By Glenn Benninger

Unless you have been living on a tropical island for the past decade, you are probably aware that today's weapons systems are now based extensively on commercially available products. This reliance has resulted in the logistics strategies for supporting those systems struggling to keep up with the rapid pace of technological change and a shifting business environment. It also has surfaced serious differences between the military's approach to reliability and the approaches favored by commercial suppliers. In this article, we outline some of those differences and propose that the military adopt a different approach to reliability, one that attempts to bridge this military–commercial gap.

Background

Most managers of weapons systems that use commercial off-the-shelf (COTS) items have adopted some form of selection process for identifying, evaluating, and setting priorities on the products used in the system. Those processes must consider countless factors, including reliability, environmental concerns, life-cycle issues, obsolescence, ownership cost, and performance. Sorting out these factors is a huge undertaking. In addition, many of the companies making the products define standardization and quality differently. This situation frequently forces government product evaluation teams to understand the business background behind the products before they can be evaluated.

One factor that is at the root of product support is reliability. Estimating the reliability of a particular product is the science (some even say art) of trying to predict the likelihood of a product failing given the environment in which it operates, its design characteristics, and other qualities of the various parts of the system. With roots tracing back years, "reliability" has been applied in many ways to various products. The military emphasis on reliability has been to make it as high as possible, while the commercial focus is more like "is it reliable enough."

With the shift to commercial products in military systems, the military approach to reliability has met face to face (or more like head-on) with those favored by commercial suppliers. The result is a dispute between the

—Commercial Reliability Gap

and Jeff Harms

military customers and the commercial product companies over the techniques for predicting reliability, the reliability numbers, and the very definition of reliability.

Predicting Reliability—A Variety of Approaches, Uses, and Problems

The reliability prediction process involves a combination of generalities and observations of a variety of factors applied to a specific design. Reliability engineers must understand the failure mechanisms of many converging technologies—such as soldering, packaging materials and processes, integrated circuit design, PC board materials, and assembly methods—and the interactions of these techniques with the operational environment (effects of time, temperature, humidity, shock, and vibration, to cite a few). They must also consider extensive statistical field and test data, plus other elements that are difficult to identify when the technology is fairly new.

Predicting reliability is a process for estimating the likelihood of failure of a particular product. There are a number of ways to make such predictions, from collecting detailed field data and performing life tests on large samples of devices to simple guesses based on past experiences with similar devices. The primary use of a reliability prediction is to compare two designs to see which would be more reliable. The secondary use is to allocate reliability among assemblies making up a system to determine the need for spare parts. When developing reliability predictions, consistent approaches must be used; otherwise the predicted reliability between two items is not comparable. In turn, the reliability numbers contribute to other areas of product evaluation and system supportability such as cost modeling, technology assessment, and budget forecasting. If the reliability values are suspect, the value of the entire evaluation is diminished.

Our Experience

At the Naval Surface Warfare Center (NSWC), Crane, IN, we have been evaluating the reliability of COTS products for the past 10 years. In a recent study of commercial products, we found an astonishing array of reliability prediction techniques.

A common technique, MIL-HDBK-217, uses large tables of assigned values to quantify the reliability factors for parts and assemblies. Another technique, Bellcore/Telcordia, a commercial reliability standard, prescribes a similar reliability prediction approach. Both of these techniques require substantial design data, such as parts lists and board layouts, which most vendors treat as valuable intellectual property. Other techniques include demonstrated field reliability, evaluations based on similarity with other products, and coarse engineering estimates.

Some of the techniques are used with great precision, others somewhat loosely, to supply a reliability number on a product. Some suppliers do not use scientific predictions; they simply claim a reliability number for the product. These differences make comparisons of reliability merit among products from various companies very difficult, if not impossible. They also affect military system developers in selecting products, performing system support analyses, and making sparing decisions. Commercial manufacturers are further hampered when their competitors are serving up inflated reliability data with no basis in fact or scientific principles, so they too must "play the game" to make their products look competitive.

An Alternative Approach to Reliability Prediction for Military Applications

Rather than trying to appease all vendors of COTS products with a single agreed-upon reliability prediction technique, the military could develop its own predictions after collecting sufficient data from vendors. The results could then be supplied back to the vendors for use in product marketing, internal engineering, or other purposes. As an alternative, vendors could supply the military with their detailed predictions for evaluation, which the military would assess and provide feedback. In both cases, the results would be a well-understood assessment of a given product's reliability that could be put to better use in support decisions.

Both approaches would start with the collection of information about the product: bill of material, parts list, layout, and associated information from the vendor. Next, the application environment and operating profile would be identified. Information on individual parts would be collected to verify that each part is suitable for the identified application, and any issues brought to the attention of the vendor of the COTS items. Part models would be developed, including all assumptions. Finally, the military would perform the complete reliability analysis, which would yield failure rates for different operational environments, values for mean time between failures, and predicted reliability over time.

The benefits of these approaches are many and varied:

- Military
  - Improves overall quality and consistency of vendor-supplied reliability predictions
  - Makes spares allocation more accurate and realistic
  - Lowers overall ownership costs

Approaches to Reliability Prediction

MIL-HDBK-217

The military establishment has long used a physics-based prediction process (outlined in MIL-HDBK-217) that uses reliability data on individual components and package types, as well as formulas for computing a reliability factor for different configurations of components and environments. The handbook formulas can be adapted to all types of military environments. Huge matrices of reliability values for all types of components are documented, making reliability prediction quite an undertaking on a large system with numerous assemblies and components. This approach has been at the center of many arguments about the validity of the process and the manner in which the reliability data are derived, especially for newer electronic components. However, the technique, when applied consistently, still produces amazing results when used to determine the assemblies with the poorest reliability of the system (commonly called the "bad actors") for selecting system spares. The main gripe with MIL-HDBK-217 has been the failure rate number that is calculated (the secondary use of the process). Expressed in failures per million hours or as mean time between failures, this number has often been misinterpreted as a true prediction of actual faultless operational hours for assemblies and systems. It is often found to be in error by wide margins once the system is actually fielded and sufficient data collected.

Bellcore/Telcordia

A popular commercial standard, Bellcore/Telcordia, is similar to MIL-HDBK-217, but its formulas and component data are much less complex. Also, the standard tends to be more forgiving of newer integrated circuit technology. An interesting twist is the application of a higher first-year failure rate, which indicates that there is a higher expectation of problems with any new product. The reliability number output is in FITs (failures in time) expressed as number of failures per billion hours, which immediately sounds better than MIL-HDBK-217's failures per million hours.

Field Data

Collection of field data to support or validate a reliability prediction is a common activity, but rarely is the information shared. The approach to data collection is often flawed, because some events are not detected or documented. An example is collecting the number of failures by tracking product returns to the factory. Except for the most expensive items, it is almost certain that not all failures will be returned. Some will be repaired by the customer's in-house capability, or done elsewhere, or simply thrown away. The number of products in service, or total operational hours, is also a likely unknown. Some products are considered "in-use" upon shipment to a customer, when in reality, they may sit in a warehouse for months awaiting system integration.

Similarity Analysis

Analyzing similarities to predict reliability is based on the premise that if one already has acceptable reliability data on a given design, a similar design should have similar reliability. The assignment of reliability values to a product by similarity is better than nothing, but deciding if a design is similar enough to a known one is an issue. This approach is not given high marks for accuracy unless the reliability engineer has determined that the designs are indeed very similar. This would include having comparable part quantities and types and similar construction, size, and operational characteristics.

Reliability Testing

Also called "accelerated life" or "accelerated stress" testing, a sampling of product is put through a fairly lengthy test under extreme conditions meant to simulate some period of years of normal operation. Such testing usually yields results suitable for improving products by obtaining some indication of how long the product will last. The rub comes from predicting the actual length of time or failure rate from test data. Extrapolation of such test results into actual service life is based on the Arrhenius principle, which is an equation developed for predicting future rate of change based on temperature. The basic idea is to run the product for a period of time at an elevated temperature until failure, measure this time, and use the equation to suggest the time period for a lower temperature. Often there are insufficient test samples, and too many other variables, to accurately apply the Arrhenius principle, leading to the familiar reliability engineer quip, "Arrhenius is erroneous." Testing sometimes also requires complex equipment and special software, making such testing costly.

Modeling and Simulation

Over the past several years, modeling tools have evolved to accurately predict reliability. The tools need detailed design information to develop an accurate model of the design, data that are likely not made available by the product vendor.

- Helps in product selection for new equipment design and technology refreshes
- Commercial
  - Creates a level playing field
  - Helps streamline acquisitions by removing a barrier to competition for small and medium companies
  - Improves understanding of military requirements for support data.

The military is not the only organization that needs accurate predictions of product reliability. Commercial industry is just as interested. Designers need a tool that optimizes designs for longevity in the field, an area in which reliability prediction techniques such as MIL-HDBK-217 excel. Such designs not only lead to better products, but they can be used to help with marketing the products and establishing a strong product support infrastructure in the company. For example, a manufacturer could find that by moving a large (and costly) component, a particular product's reliability improves substantially. It could even use this "feature" as a marketing advantage over a competitor, who has a similar component in the "wrong" place. In addition, the manufacturer may be able to estimate the expected number of product returns over a particular time frame and size its repair capability accordingly.

Summary

In this article, we propose an improved approach for predicting the reliability of commercial products in military applications. By working together toward a common understanding of product reliability, both the military and its commercial vendors should be able to reap significant benefits such as more reliable systems, lower support costs, enhanced support projections, and increased customer satisfaction.

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DoD's Collaborative Approach to Developing Biometrics Standards

By John Woodward Jr.

Introduction

DoD has a growing need to control access to its many assets both in times of war and in times of peace. Similarly, DoD organizations must always be ready to identify "friend or foe." This requirement is heightened in the global war on terrorism, where the enemy has demonstrated its ability to use sophisticated methods to exploit flaws in current identity management systems. The terrorist attacks of September 11, 2001, reinforced the need for technologies that can enhance homeland security, force protection, and counterterrorism measures.

Biometric technologies may seem exotic, but their use is becoming increasingly common. In 2001, *MIT Technology Review* named biometrics as one of the "top ten emerging technologies that will change the world." DoD recognizes the fast-paced developments in biometric technology, and the great need for interoperability in DoD systems. Accordingly, DoD, through its Biometrics Management Office (BMO), has developed a collaborative approach for the development of DoD biometrics standards. This approach will enable DoD to guide biometrics standards development to ensure that the standards promote biometric technology's interoperability and support for the joint warfighter.

Compared with other, more established types of information technology, the commercial biometrics industry is still relatively new and evolving. The biometric industry has achieved successes in the growth of its capabilities, but from DoD's perspective, industry's efforts have sometimes resulted in competing, redundant, or proprietary-based capabilities.

In recent years, biometric technology has matured and become more viable for DoD uses. DoD endeavors to promote the efficiency of biometric technology development through the use of biometrics standards to prevent DoD from building stovepipes, to discourage developers from continually "reinventing the wheel," and to encourage DoD organizations to use biometric technologies that contribute to joint warfighter capabilities.

Coordinating Biometric Activities within DoD and Other Federal Agencies

On August 25, 2003, Deputy Secretary of Defense Paul Wolfowitz promulgated his "Department of Defense (DoD) Biometrics Enterprise Vision," which states that, "by 2010, biometrics will be used to an optimal extent in both classified and unclassified environments to improve security for physical and logical access control." To support this vision, he directed the BMO to "ensure that a scalable biometrics component of the Global Information Grid (GIG) infrastructure is in place, and that the appropriate standards, interoperability tools, testing frameworks, and approved product validations are available to assist the DoD community in using this technology."

As part of its directive and in keeping with the guidance from the Secretary of the Army (DoD's Executive Agent for biometric technologies), via the Army Chief Information Officer (CIO), who has oversight responsibility, the BMO established the BMO Standards Working Group to coordinate biometrics standards activities within DoD. The BMO Standards Working Group membership includes the Defense Information Systems Agency, National Security Agency, U.S. Air Force, U.S. Navy, U.S. Army, Biometrics Fusion Center (BMO's technical arm), National Institute of Standards and Technology (NIST), and others.

One of the BMO Standards Working Group's major efforts in 2003–2004 has been the development of *DoD Biometrics Standards Development Recommended Approach*. This document details a recommended approach to the identification of, participation in, and development of biometrics standards. Various DoD and other federal agencies and oversight bodies are reviewing this document. If approved, the document will be the first concrete step toward coordinating the development of biometrics standards with other federal agencies.

Participating in National and International Standards Organizations

The National Technology Transfer and Advancement Act of 1995 (Public Law 104-113) requires federal agencies to adopt commercial standards, particularly those developed by standards developing organizations, wherever possible, in lieu of creating proprietary, nonconsensus standards. Through active participation in national and international standards organizations, the DoD BMO exerts its influence to facilitate and promote DoD interests in the biometrics arena. As a result, the standards developed through these national and international organizations will better reflect and support the interests of DoD biometrics-related activities.

In the United States, the primary body responsible for developing national biometrics standards is the M1 biometrics standards committee of the International Committee for Information Technology Standards (INCITS). INCITS is the recognized standards development organization for information technology within the United States and operates under the rules of the American National Standards Institute (ANSI). It does not restrict membership and attracts participants in its technical work from 13 countries. Mr. Fernando Podio of NIST, an advisor to the BMO director and a member of the BMO Standards Working Group, chairs the INCITS M1 committee. The M1 committee, established in November 2001, is one of several standards committees that develop U.S. national commercial standards related to information technology.

Two other INCITS committees, B10 and T4, also are involved in biometrics-related issues. The B10 committee covers identification cards and related devices (for example, issues related to smart cards); the T4 committee covers security techniques, which include a broad range of data security issues such as the security of biometric data. In addition, another ANSI-chartered organization, X9, is responsible for developing, establishing, publishing, maintaining, and promoting standards for the financial services industry.

ANSI is the official representative to the International Organization for Standardization (ISO), the world's leading standards body. Under ISO, the counterpart biometrics standards body to M1 at the international level is SC 37 of the ISO/International Electrotechnical Commission Joint Technical Committee 1 (JTC 1). Mr. Fernando Podio of NIST also chairs JTC 1 SC 37, which is the committee responsible for the development of international biometrics standards. INCITS M1 represents the United States in JTC 1 SC 37.

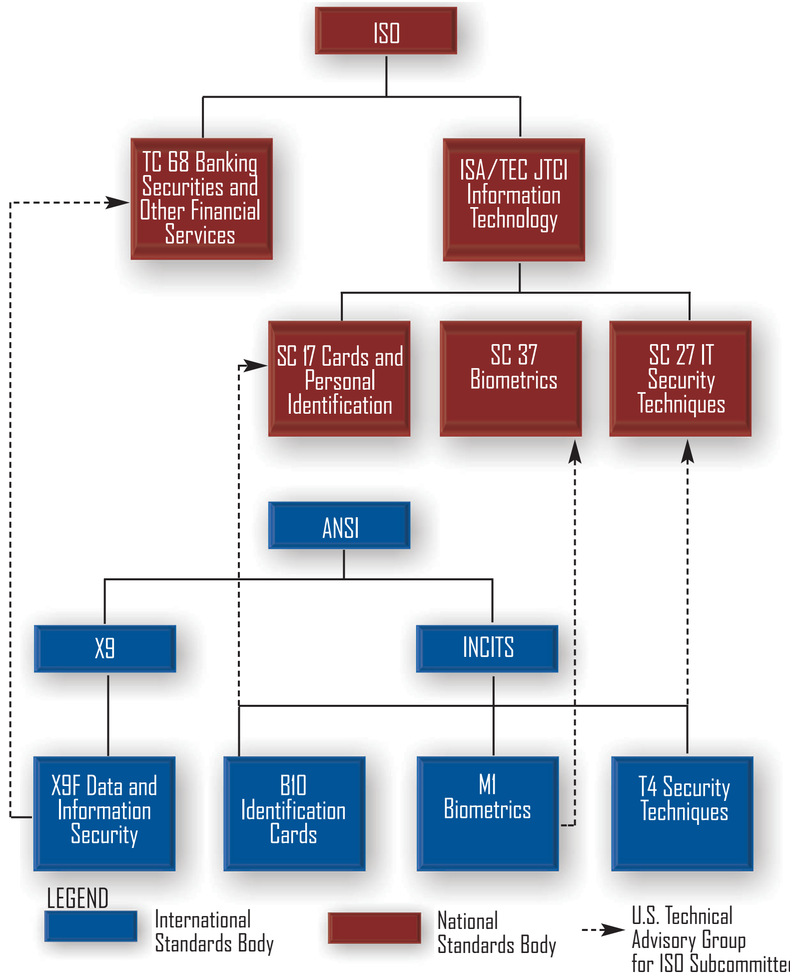
During a recent BMO Standards Working Group meeting, Mr. Podio stated that "the BMO's collaborative approach in the development of national and international biometrics standards is an example to imitate. Taking a proactive role in the development of these standards and seeking coordination with other government agencies and the industry will support DoD's decision of adopting open-system-based biometric technology solutions." Mr. Podio also said that "standards-based enterprise systems and applications are more likely to be interoperable, scalable, usable, reliable, secure, as well as more economical to the user than proprietary systems."

DoD's coordination with the NIST program in accelerating the development of national and international biometrics standards, DoD's related conformity assessment and interoperability efforts, and other U.S. government initiatives will support DoD's goals to provide high-performance, interoperable, and scalable biometrics solutions to the DoD community.

Figure 1 shows the relationship between the U.S. standards bodies working on biometric technology and their international counterparts. Currently, the BMO actively participates in INCITS M1, T4, B10, X9, and JTC 1 SC 37 (through INCITS M1) on behalf of DoD interests. Recent contributions to INCITS M1 include

- providing the coeditor for a project that is developing a conformance testing methodology for a Biometrics Application Programming Interface (BioAPI) specification within SC 37 and
- providing key technical contributions to this and other projects in SC 37's program of work (e.g., data formats and biometric performance testing).

FIGURE 1. U.S. National Standards Bodies for Biometrics and Their International Counterparts



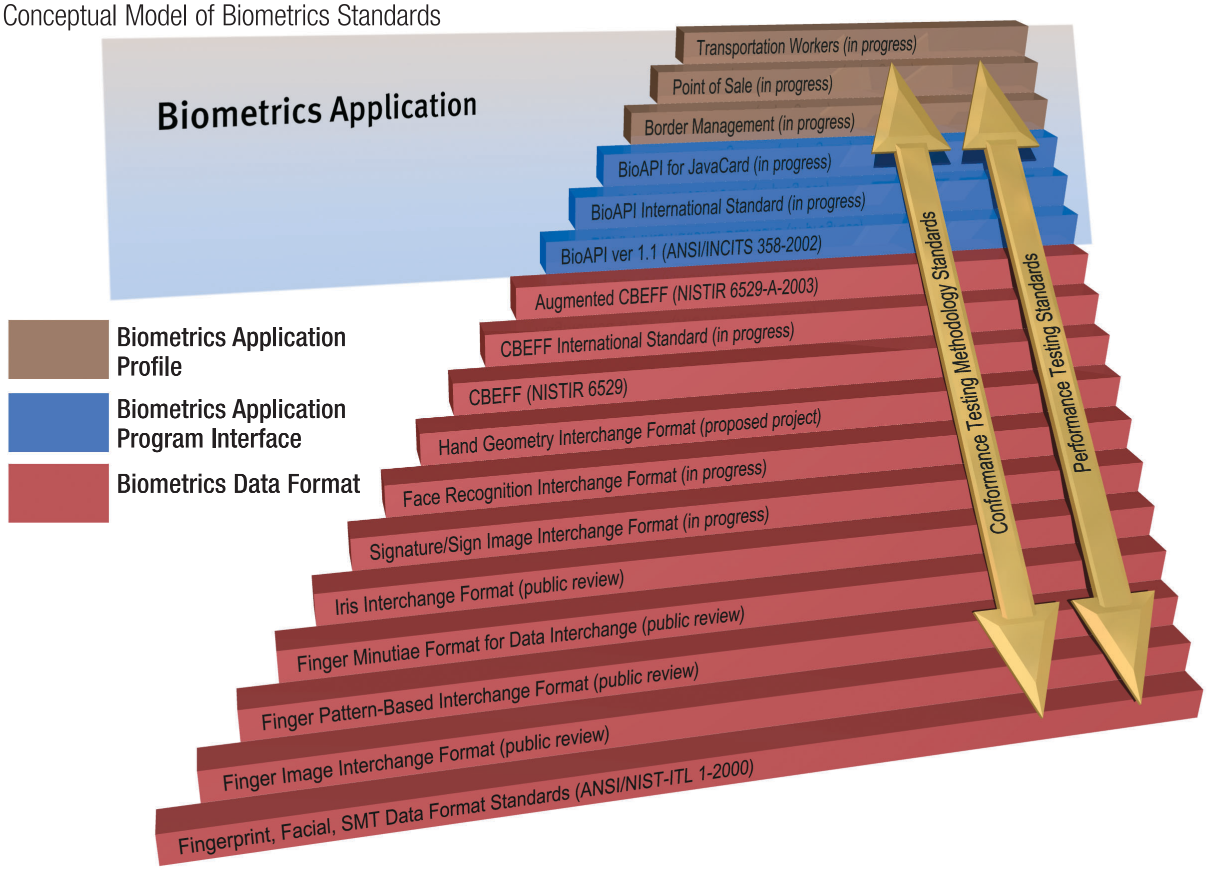
Within INCITS M1, the BMO is also developing a standard: "DoD Application Profile—Standards Guidance for DoD Implementation of Biometrics." This standard's development will include capturing DoD best practices for biometrics and facilitating an increase of interoperability and data interchange in DoD deployments of biometrics.

Status of Biometrics Standards Development

The BMO has developed a conceptual model to categorize the types of standards needed to promote biometric technology's interoperability and support for the joint warfighter and to clarify what biometrics standards exist and what standards are under development or planned. The model categorizes the standards as follows:

- Biometrics data format standards
  - Image standards

FIGURE 2. Conceptual Model of Biometrics Standards



  - Template standards
  - File format standards
- Interface standards
- Application profile standards
- Performance testing standards
- Conformance testing methodology standards.

Figure 2 depicts the model and indicates the status of the standards.

In summary, a significant amount of work on developing biometrics standards is well under way. The BMO must encourage and facilitate interoperability. With this goal in mind, *DoD Biometrics Standards Development Recommended Approach* represents a solid starting point for DoD's comprehensive, coordinated approach to DoD use of biometrics. Going forward, the BMO hopes that this approach will serve as a framework for biometrics standards in DoD and receive consideration from other U.S. federal agencies in their implementation of biometric technology. Ideally, U.S. government agencies should work together for a collaborative U.S. government strategic approach, leveraging the resources of participating agencies in the spirit of cooperation. This cooperation not only will advance the development of the necessary standards, but will accelerate the establishment of an environment of interoperability.

About the Author

John Woodward Jr. is the director of the DoD Biometrics Management Office. The BMO leads, consolidates, and coordinates the development and adoption of biometric technologies within DoD; it also tests and evaluates biometric technologies at its Biometrics Fusion Center. Mr. Woodward has testified about biometrics before Congress, the Commission on Online Child Protection, and the Virginia State Crime Commission. His numerous publications on the subject include *Biometrics: Identity Assurance in the Information Age* (McGraw-Hill, 2003).

Acknowledgment: The author thanks Mr. Donald Waymire and Dr. Ramy Guirguis, contractors supporting the BMO, for their invaluable assistance in drafting this article. The members of the BMO Standards Working Group also deserve praise for their dedicated efforts. The author also thanks Mr. Fernando Podio of NIST for his contribution to this article and for his continued support to the BMO Standards Working Group.

About DoD Biometrics

In wartime, DoD's dependence on information as a tactical and strategic asset requires DoD to carefully control its networks and information systems. From logistics flows to intelligence on enemy forces, DoD depends on confining access to its data to authorized personnel. This need for access control is also critical at the special operations and weapon system level, where, for example, a U.S. military operative deep in enemy territory must quickly and securely communicate actionable intelligence back to other units.

Access control issues are important to the peacetime DoD because improving the efficiency of operations, including controlling access to installations, facilities, computer systems, and networks, depends on fast and accurate identification. DoD also operates a vast set of human resource services involving health care, retiree and dependent benefits, and troop support services. These services create the need for identity assurance to prevent fraud and abuse.

Congress, the White House, and DoD leadership recognize that biometrics, or automatic recognition of a person using distinguishing traits, can be an enabling technology to provide better security through identity assurance.

Biometric systems take identity assurance beyond the basic "something you have" (e.g., a token badge) and "something you know" (e.g., user name and password), to "something you are"—a biometric. Biometric-based identity assurance systems rely on physical or behavioral characteristics—such as fingerprints, hand geometry, iris patterns, or signature verification—that are distinctive to individuals and can be measured to ensure that a person's identity is accurately determined.

The association between an individual and a "trusted identity" is the foundation for identity management. A trusted identity is something that proves beyond a doubt that you are who you say you are (your identity has been "vetted") and that another person cannot "assume" your identity or masquerade as you (your identity has been "fixed"). Identity management is the process that creates and maintains the use of trusted identity.

With the vetting and fixing of a trusted identity, identity management can be further associated with a set of assigned permissions and access rights. Before the information age, DoD faced its greatest identity challenge in the area of physical access control. However, the exponential growth and use of information technology throughout DoD has dramatically increased the security challenge for logical access control, of which trusted identity is essential.

No one is more aware of this challenge than Army CIO LTG Steven Boutelle, who has oversight responsibility for DoD biometrics. Borrowing from the Army slogan, LTG Boutelle seeks to make biometrics "ready and relevant" for DoD. He emphasized his guidance in his presentation to the September 2003 Biometric Consortium Conference: "Introducing biometric technologies into the DoD is not enough—they must be part of an integrated, interoperable, DoD-wide enterprise solution, in coordination with other U.S. Government initiatives."

At the same conference, LTG Boutelle also made clear his view that standards development work should be one of the BMO's highest priorities. Without comprehensive standards in place, DoD runs the risk of creating insular, fragmented, and expensive biometric "fiefdoms" that will not be able to share data or communicate with one another. Such an approach is bad for DoD and a detriment to national security.

Marine Corps AAAV is one of the programs using evaporative spray cooling.

Evaporative Spray Cooling for Electronic Assemblies and Systems

By Glenn Benninger and Jason Christensen

Introduction

Although manufacturers have made great strides in reducing the power consumption of electronic devices, computers and many other densely packaged electronic items still produce enough heat to destroy themselves if the heat is not removed. Recent advancements in low-power, low-voltage designs open the door to substantial performance improvements, but those same designs are accompanied by greatly increased circuit density. The resulting overall system does a lot more, but also dissipates as much power as ever, sometimes even more. This growing thermal management problem has led to the development of many innovative cooling approaches, one of which is evaporative spray cooling.

Evaporative spray cooling uses some sort of cooling fluid, sprayed via nozzles, plates, or caps, onto components to remove heat. When the spray mist evaporates, it carries away the heat. Several commercial and military applications employ evaporative spray cooling to solve difficult heat problems. In this article, we present an overview of cooling systems, compare evaporative spray cooling with traditional cooling approaches, and offer several insights into the use of evaporative spray-cooling designs.

An Overview of Cooling Systems

Many consumer applications (including TVs and stereos) almost neglect thermal issues except for power-dissipating parts, such as power transistors and diodes. These parts are simply attached to a sufficiently large heat sink, and natural convection currents take care of the rest.

Personal computers use fans to force an air convection current through the electronics enclosure to cool the hotter components. Fans are essential because the processors and power supplies in the relatively small enclosures are too power-dense to rely on natural convection airflow. Reliability concerns also demand that the million-transistor devices in PCs operate as cool as possible, otherwise customers probably would need to replace their equipment every few weeks. Even though water-cooled aftermarket add-ons for top-of-the-line PCs are now available, they have yet to supplant the basic fan. In fact, some of the newer PCs now require several fans—one or two for the power supply, one for the case, one for each central processor, and one for the graphics processor.

Military systems operating in harsh environments with high operating temperatures have used fans for many years, but even those systems are beginning to employ more innovative cooling approaches. Power density is stretching air-based cooling past its limits.

Airplane and shipboard systems have long employed liquid cooling techniques. As an example, chilled water cabinets have been used for years on ships. They use conduction-cooled electronic boards that move the dissipated heat out via metal frames, cold plates, and heat pipes, rather than via air movements over the boards. The ship provides a chilled water source that is plumbed through large electronics enclosures and returned to the chiller for heat removal. High-power dissipation devices such as traveling wave tubes in radar systems and rectifiers in large power microwave transmitters use similar cooling devices.

Alternatively, Cray Computer makes use of evaporative spray in the new Cray X1. This massive parallel processor incorporates specially designed spray assemblies into integral multichip processing modules. Each module is made up of eight processors, and the system has dozens of modules. Other parts of the system are cooled differently, using both liquid flow-through and air cooling.

The military is investigating the use of evaporative spray in several different platforms, including the Navy's EA-6B electronic warfare aircraft; the Marine Corps' Advanced Amphibious Assault Vehicle (AAAV); the Air Force's U-2 reconnaissance plane, F-16 fighter, and Global Hawk unmanned aerial vehicle; and the Army's Crusader mobile artillery vehicle. Although evaporative spray cooling is being incorporated into select applications across the military, it is far from a universal cure-all. It is primarily being used in system boxes that are unable to be cooled by other means.

Comparing Traditional Cooling to Evaporative Spray Cooling

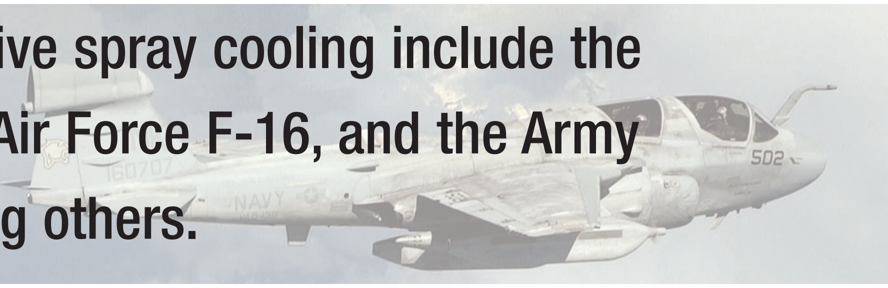
At the Naval Surface Warfare Center in Crane, IN, we have been working with many types of cooling approaches in different enclosures for several years. Most recently, we have been working to engineer and apply evaporative spray cooling to a variety of systems. Although evaporative spray cooling shows great promise, traditional air cooling still has considerable merit, as the following discussion shows.

COST

Air-based cooling is typically much less expensive than evaporative sprays. More enclosures are designed around air cooling, and fans are typically not very expensive. Evaporative spray-cooling enclosures cost significantly more, while the requisite pumps, atomizers, nozzles, and plumbing add costs and complexity to the overall design. The extra maintenance issues with evaporative spray hardware also tend to increase costs. Evaporative spray cooling, and other novel cooling approaches, may enable use of lower-cost commercial circuit boards in an otherwise harsh environment, which could offset some of the added cost of integration and cooling hardware.

RELIABILITY

A fan failure on an air-cooled enclosure can often be tolerated, especially if the system has built-in redundancy. However, the higher operating temperatures of dense, heat-generating components in air-cooled designs may lower overall system reliability. Evaporative spray-cooled system pumps tend to be as reliable as fans, but a pump failure could be catastrophic if redundancy or adequate controls and "fail-safes" haven't been incorporated into the design. Evaporative spray cooling of dense, heat-generating components tends to lower operating temperatures on the hottest parts, which may boost overall system reliability. In some evaporative spray-cooled systems, the temperature is about the same throughout (an isothermal design), which has led to much debate about whether this phenomenon helps or hurts system reliability (some low-power parts actually run hotter than in a comparable air-cooled system).



Programs using evaporative spray cooling include the Navy EA-6B Prowler, the Air Force F-16, and the Army Crusader follow-on among others.

MAINTENANCE

Maintenance of air-cooled designs is very straightforward and familiar to most technicians. They have no fluids to drain, plumbing to unhook, or seals to check. Evaporative spray-cooling designs add extra steps to system maintenance procedures. The improved reliability and environmental isolation of evaporative spray-cooled designs could offset their added maintenance needs, since the fluid helps keep internal components cleaner and cooler (leading to less corrosion, contamination, and operating failures). Many engineers have concluded that repairs to evaporative spray-cooling equipment must be performed only at well-equipped depots.

PERFORMANCE

Air-cooled systems have a much lower total heat capacity than evaporative spray-cooled systems of the same size. Although additional space must be devoted to a heat exchanger in an evaporative spray-cooled design, the exchanger may be located separately from the functional system, allowing for some flexibility. This feature may be considered a benefit of evaporative spray-cooled designs because the collected heat is transferred to a remote location. In air-cooled designs, the system produces local area heating, which could put additional strain on area air conditioning. This effect is often not considered when calculating the overall space needs of air-cooled designs. Evaporative spray-cooled systems can be environmentally isolated easier than air-cooled designs, which may permit their use in severe operating conditions without much change. Air-cooled designs, because they draw in large quantities of external air, cannot be used in hot, dirty, or water-soaked areas without careful adaptation to deal with the poor quality intake air. In contrast, an evaporative spray-cooled system could potentially be used in a complete vacuum, such as outer space.

Evaporative Spray-Cooling Design Steps in a Nutshell

From our experiences with various cooling systems, we offer several insights into the use of evaporative spray-cooling designs:

- *Decide if it fits the application.* Air cooling is easier and cheaper, so expending some effort to see if the system design can be changed to make use of air is preferable to plunging into a spray-cooling design. Only the most power-dense applications demand powerful cooling approaches, so make sure the system design requires the power density. Spray cooling can be made to work for most designs, but why spend the extra money if it isn't needed?

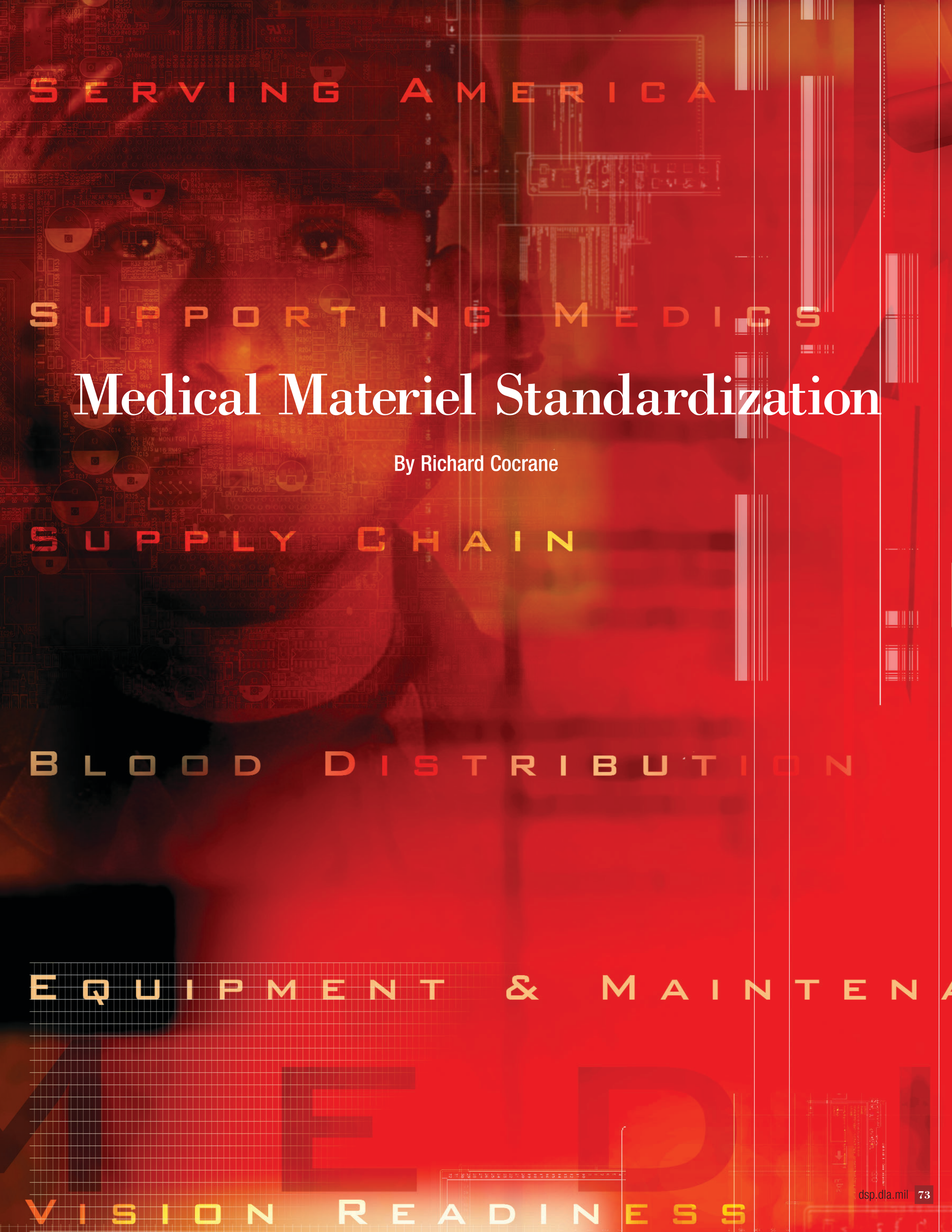
- *Formulate an approach that works.* The electronics to be cooled should be made ready for spray cooling, as much as the spray-cooling hardware must fit the electronics. Consider a blended approach, such as using air for less dense parts of the system and applying evaporative spray only where needed.
- *Allow for a sizable learning curve.* Many aspects of evaporative spray cooling are not intuitive. They include how spray patterns and electronics board layout interact, the way pumps work under various configurations and conditions, and the collection and handling of the fluid inside and out of the system.
- *Keep safety in mind.* The specialty fluids used in evaporative spray cooling often have unusual characteristics—some are beneficial, but others pose concerns. Make sure these fluids meet all environmental requirements and won't create a hazard if and when they degrade, age, burn, or leak.
- *Design the chassis carefully.* Chassis designs must contain the cooling fluids and vapors; allow access for maintenance, including the adding and draining of fluid; and house the needed plumbing, pumping and filtering hardware, safety pressure relief valve, and system electronics.
- *Plan for the added weight, size, and costs.* The evaporative spray hardware frequently adds weight, requires more space, and costs more than other alternatives, so plan accordingly. Save wherever possible by a total-system approach that melds spray-cooling hardware with the electronics and their support hardware. Strive to make components do double duty.
- *Select the most appropriate fluid.* Operating conditions and heat-flux requirements figure heavily in the selection of the fluid, but other factors such as safety, handling, maintenance, and material interactions and compatibility also must be considered.
- *Decide how to handle the fluid circulation.* Determine how many spray nozzles, plates, or caps are required, and size the pumps and filters accordingly. Minimizing the number of spray nozzles and plumbing is essential to controlling the size, weight, and cost of the system. The vapor and fluid must be collected in a sump or reservoir after it has been sprayed, but an elegantly designed system can minimize the effects of this feature.
- *Determine how much heat will be collected and where it will go.* Heat exchangers can be separate from the electronics enclosure, integrated into or onto it, or the chassis itself could act as the heat sink. Account for the plumbing and fluid handling required if the heat exchanger is located external to the main chassis.

Summary

Many options exist for cooling electronic equipment. Some are more effective, others require less space, while still others are less costly. As we outlined above, the use of evaporative spray cooling has several benefits, but it also presents many design and engineering challenges. Hopefully, the issues we raised in this article will help military designers decide whether evaporative spray cooling is right for their systems.

About the Authors

Glenn Benninger is a senior engineer in the Commercial Technology Management Branch, Naval Surface Warfare Center, Crane, IN. He performs technology trending, cost modeling, commercial product support, and market analysis. Currently, Mr. Benninger leads the AEGIS Advanced Technology Integrated Product Team. Jason Christensen is an engineer at the Naval Surface Warfare Center. Currently, he is project lead for several advanced electronics cooling projects in support of the Navy.



Medical Materiel Standardization

By Richard Cocrane

Operations in Afghanistan and Iraq have pointed out inefficiencies and misperceptions about DoD's ability to provide medical supplies—Class VIIIa materiel—during conflicts. The inability to accurately predict requirements for Class VIIIa items has resulted in some items being unavailable and others being readily available in the inventory but remaining untouched. Some will point to decreased warehouse inventories and the commercially based system of manufacturers and distributors (prime vendors) as the source of the problem. Yet during the recent conflicts, prime vendors have been a strength, not a weakness.

I believe that the problem stems largely from the lack of standardization, or commonality. Commonality is an indicator of the extent to which the services use the same item—the degree of "jointness." As commonality increases, the variability of medical items ordered through the Class VIII system decreases. Moreover, increasing commonality will increase efficiency and responsiveness by keeping down the number of contracts maintained and the amount of line items processed through the supply chain.

Today, medical materiel standardization is low. Although the services treat patients for the same illnesses and injuries, only 4 percent of Class VIIIa items are used by all branches of the military. Why? The services use unique processes, and DoD-wide standardization systems are ineffective.

The Readiness Management Application (RMA), a database for classifying sustainment requirements, is one tool for measuring Class VIIIa requirements and comparing commonality across the services. As Table 1 shows, of the 9,492 national stock number (NSN) items in the Medical Contingency File (MCF) of the RMA, a full 67 percent are service unique.

Of the 390 NSN items used by all four services, the level of commonality varies depending on the federal supply service category. Table 2 shows a higher rate of commonality in dental products (9 percent) and pharmaceuticals (9 percent), while nonmedical supplies and other medical supplies trail the pack at about 1 percent commonality across services.

TABLE 1. RMA/MCF NSN Items, by Level of Commonality (as of May 2003)

Level of commonality	Number	Distribution
Items unique to one service	6,315	67%
Items used by two services	1,732	18%
Items used by three services	1,055	11%
Items used by all four services	390	4%
Total	**9,492**	**100%**

In meeting combatant command requirements, each service purchases its initial outfitting of supplies and equipment to make a functional unit. To provide the precise resources to meet the need, each military department employs a unique, service-centric process to predict the requirement for their platforms. For instance, the Navy has a three-step clinical review approved by a line-type commander, while the Air Force process calls for an 11-step procedure with approval by the surgeon general.

No joint review occurs to maximize standardization. In fact, no organization is responsible for the entire supply chain. Because initial outfitting is a service responsibility covered by Title X, the military departments are not required to collaborate on the Class VIIIa items contained in their sets, kits, and outfits. Also, service reviews don't require a joint evaluation of medical materiel. All contingency requirements sent to the Defense Supply Center Philadelphia are processed for contracting. The result? Only 32 percent of items ordered during recent operations (OEF/OIF) are contained in the RMA/MCF database.

These factors result in medical assemblages that vary widely and have low commonality. In addition, the time from item identification to procurement is lengthy, and many of the items are not requested until unit deployment. Couple

TABLE 2. RMA/MCF NSN Items Used by All Services, by Category

Category	Total number of items	Number of items used by all services	Items used by all services as a percentage of the total
Dental	890	76	9%
Laboratory	1,029	29	3%
Medical/surgical	3,806	126	3%
Nonmedical	1,267	15	1%
Other medical	891	13	1%
Pharmaceutical	1,512	130	9%
X-ray	97	2	2%
Total	**9,492**	**390**	**4%**

that with the fact that deploying clinicians are not the ones who established the original requirements, and it's simple to see why there is a disconnect between predicted requirements and actual use.

The solution is apparent but will require transformation in organizational relationships:

- DoD must establish an executive agent for medical materiel.
- The executive agent must take the lead in the requirements process, establishing strong ties to combatant commands and the services, as well as using common tools to predict requirements.
- The executive agent must develop performance-based agreements and standard metrics.
- The executive agent must develop a fresh approach to war reserve materiel, using technology and best business practices.

Supply chain responsiveness depends on the predictability of requirements and the suppliers' capability and capacity to support them. Accurate prediction of Class VIIIa requirements is critical in acquiring and having ready the commodities needed to care for wartime casualties, at the least cost and risk.

About the Author

Richard Cocrane is a research fellow at LMI Government Consultants in McLean, VA. A member of the American College of Healthcare Executives, Mr. Cocrane has experience in medical plans and operations. At LMI, he is a principal researcher in numerous studies of health systems and homeland defense.

2003 Defense Standardization Program Awards

The 2003 DSP award winners demonstrated that concerted standardization efforts can result in substantial savings as well as improved readiness.

On March 16, **Lou Kratz**, Assistant Deputy Under Secretary of Defense (Logistics Plans and Programs) and the DoD Standardization Executive, and **Gregory Saunders**, Director, Defense Standardization Program Office, presented seven awards to recognize three teams and four individuals whose standardization efforts demonstrably promoted interoperability, reduced total ownership cost, or improved readiness. ▮ The 2003 Distinguished Achievement Award, which includes an engraved crystal Pentagon, went to the members of the Joint Strike Fighter (JSF) Program, Air Vehicle Directorate, Weapons Integration Integrated Product Team (IPT). The members of this team were **David Prater**, Navy; **Charles Wagner**, Navy; **John Brady**, Air Force; **Mark Jones**, United Kingdom; and **John Fahnestock**, Navy. ▮ Through its persistent drive toward commonality, the JSF Weapons Integration IPT reduced the complexity of the design, cost of development, and scope of certification required for the JSF Program. With more than 50 different weapons designated for use on the Joint Strike Fighter, testing for certification of their many variations was a huge and costly undertaking. Certification of all possible weapons stores configurations between services was clearly not achievable. To reduce risk and complexity, generate substantial cost savings, and build in long-term interoperability, the IPT methodically scrubbed the baseline weapons list to balance capability against cost. In particular, the team looked for service-common weapons solutions. ▮ The IPT developed a Joint Service Store Certification Guide and significantly reduced unique weapon requirements. For example, it identified a common bomb and a common fuzing system. The team's efforts resulted in a cost avoidance of nearly $1.2 billion. The reduction of the number of targeted configurations to only those that were most relevant and used by more than one military service enhanced interoperability and decreased the overall scope and complexity of JSF store certification, while also substantially increasing warfighter combat capability.

Pictured above are Greg Saunders, DSPO Director, and winners of the 2003 Distinguished Achievement Award: Mark Jones, David Prater, John Brady, John Fahnestock, and Charles Wagner.

The six other winners were as follows:

- A team—with representatives from the **TRI-SERVICE INTERACTIVE ELECTRONIC TECHNICAL MANUAL TECHNOLOGY WORKING GROUP**, the **AIRCRAFT INDUSTRIES ASSOCIATION**, and defense contractors (**Joseph Fuller, Navy; Steve Holloway, Air Force; Eric Jorgensen, Navy; Hervé LeBoeuf, Ph.D., IEM Technologies, Inc.; Dennis Raitz, AIA**)—worked with European counterparts to expand a European aeronautical specification, S1000D, into an international specification that meets all user requirements. Warfighters rely on IETMs to maintain weapons systems. S1000D will enable the United States and its allies to view and access technical data in a common format improving interoperability. The team identified technical shortfalls, developed technical solutions, and incorporated important aspects of many related military standards into S1000D. Programs that use the standard, rather than proprietary IETMs, should see significant savings in total ownership costs. The new specification will also enable more competitive sourcing and follow-on contracts for technical data. The project produced an AIA–European Aerospace Industry Association agreement for the continued support and further development of S1000D. This will cut DoD's support cost because industry will maintain the specification over its life cycle, while providing full liaison with U.S. defense customers.
- **A NAVY TEAM (Evangelos Karagiorgis, Diane Jones, Elaine Chandler, Art Peterson, Stephen Froelich)** worked with 10 naval surface, subsurface, and airborne programs to standardize commercial off-the-shelf hardware and architectures for the AN/UYQ-70(V)—the Navy' s newest generation of display and processor systems for use with combat systems. The team looked at standard processors, graphics, network interfaces, storage devices, and advanced operating systems. The solution, a flexible, open-ended computer architecture standard used in commercial, industrial, and military applications worldwide, will ensure interoperability within the battle group, compatibility within ship installations, and improved combat system readiness for the fleet. The team identified and incorporated the design changes needed to satisfactorily complete all qualification testing, while allowing for progressive development and fielding of new warfighting capabilities. Customer involvement and a rigorous development and test process ensured the delivery of a robust, well-received set of products. The team's solution increased system performance 5-to-1 over legacy products. By using a standard processor architecture to upgrade aging, obsolete, and high-maintenance equipment, the team reduced the total ownership cost of all 10 participating programs, resulting in an estimated recurring cost avoidance of $10 million over 2 years.
- **Clem Huckins** of **MITRE CORPORATION**, led a diverse international team developing NATO Standardization Agreement 4607. STANAG 4607 provides a common format for disseminating radar data, enabling interoperability of U.S. and NATO air-, space-, and ground-based systems. Radar data are crit-

Pictured above are members of the team that expanded the IETM specification S1000D. Left to right: Greg Saunders; Lou Kratz, Assistant Deputy Under Secretary of Defense; Joseph Fuller; Dennis Raitz; Eric Jorgensen; Jon Buresh, Boeing; Hervé LeBoeuf; Steve Holloway; Nicholas Kunesh, Navy Standardization Executive; F. Joseph Garner, NSWCCD; Jeffrey Allan, Navy Departmental Standardization Officer; and Howell Mei, IEM Technologies, Inc.

A Navy team standardized COTS hardware for the AN/UYQ-70(V). Left to right: Greg Saunders; Lou Kratz; Evangelos Karagiorgis; Diane Jones; Joe Misanin, Processors and Displays Program Office; Elaine Chandler; Glen Johnson, Lockheed Martin; Beverly Hobbs; Stephen Froelich; Mike Frick, Command and Control Directorate; Nicholas Kunesh; and Jeffrey Allan.

Clem Huckins shows his plaque for the work he did on NATO STANAG 4607. Shown left to right are Greg Saunders; Lou Kratz; Clem Huckins; James Engle, Air Force Standardization Executive; and John Heliotis, Air Force Departmental Standardization Officer.

ical for battle management and situational awareness. Problems arise when systems are not interoperable, which is the case for many weapons systems. The lack of interoperability is a major impediment to full integration of coalition forces. Mr. Huckins's team surveyed existing standards and adopted the best features into a new common format providing a universal standard for legacy and future systems. The resulting agreement will reduce the proliferation of unique "stovepiped" systems, enable increased efficiency and interoperability between systems, and provide a basis for the development of an advanced (XML) version of the data format. Mr. Huckins was key to resolving the conflicting needs of different systems, determining which parameters were common and which were essential, predicting the requirements of future and evolving systems, and adequately addressing those needs.

Alfredo Berard is congratulated by Greg Saunders and Lou Kratz for developing a standardized data-recording format. Joining him are Lorin Klein, Eglin Air Force Base; James Engle; and John Heliotis.

- **Alfredo Berard**, **AIR FORCE**, led an international team in developing a standard data-recording format that will provide uniform flight test data at all training ranges using airborne solid-state recording equipment. Recent testing requirements for advanced weapons had exceeded the capabilities of available test data tape recorders. Mr. Berard recognized that solid-state technology, capable of multiplexing high-rate streams of data, could solve the problem and meet the higher performance requirements. Mr. Berard's team developed hardware technical specifications and a new standard format for recording data. The standard, published in Inter-Range Instrumentation Group Standard 106 Chapter 10, will save millions of dollars by reducing the proliferation of contractor-specific systems with proprietary software and license fees. Standard compliant recorders are in use at several testing locations. Those locations have already realized cost savings of $750,000. The savings can be attributed to a wider supplier base, resulting in increased competition and lower life-cycle cost, and to a tenfold increase in mean time between failures. In addition, those locations have seen improved interoperability, operational readiness, and efficiency, as well as higher customer satisfaction.

Pictured above are DLA winners led by Kenneth Henz accepting the award from Greg Saunders and Lou Kratz. Also pictured are Pamela Serino, Product Technology and Standardization Division; Mark Iden, Bulk Fuels; William Lee, DLA Departmental Standardization Officer; and Christine Metz, DLA Standardization Executive.

- **Kenneth Henz** of the **DEFENSE LOGISTICS AGENCY** reengineered the Petroleum Quality Information System database, used by the Defense Energy Support Center, into a fully automated data processing system. DESC can now use PQIS to gather and disseminate standardized quality control data and to track trends in petroleum quality data for all DoD major fuel purchases. As a result, DoD has a single database that contains a complete quality history of all bulk fuel procurements worldwide. DESC is working with the petroleum industry to develop a single standard, based on the new system, for exchanging petroleum quality data. In the past, the services had multiple small labor-intensive fuel quality databases with incomplete and inaccurate data that afforded limited data access and had minimal analytical capability. The new system is complete, accurate, flexible, and nearly paperless, with rapid data access and excellent decision support and analysis capabilities. When the Navy required a low sulfur fuel for marine use in Europe, analysis of data in the system enabled the Navy to avoid $20 million in fuel and transportation costs.

James Byrd receives his plaque from Greg Saunders and Lou Kratz. With Mr. Byrd are John Geise, Avionics Engineering Division; James Engle; and John Heliotis.

- **James Byrd**, **AIR FORCE**, led the effort to develop revision D to MIL-STD-1760, which provides for interoperability of weapons across a variety of aircraft. He also updated MIL-HDBK-1760, which provides background information to facilitate implementation of the standard. Publication involved extensive negotiation and coordination among the military services, Society of Automotive Engineers, aerospace contractors, the British Ministry of Defense, and NATO. Thanks to MIL-STD-1760D, new air-to-ground stores use the same connector and signal set and most of the same aircraft software, lowering costs and improving interoperability through a standard weapon electrical interface. The first generation of smart weapons used unique interfaces and, therefore, required extensive aircraft design changes for compatibility. The Air Force expects to spend approximately $2 billion over the next 10 years on weapon integration. Availability of this standard, with the consensus support of the three services and industry, will substantially reduce costs and increase capabilities.

August 16–17, 2004, Ottawa, Ontario, Canada

53rd Annual Standards Engineering Society Conference—"Standards Without Borders: New Times, New Approaches"

The 2004 Standards Engineering Society conference will focus on how market globalization and new geopolitical alignments are blurring national and regional attitudes about standards. Recently approved NATO guidance on using non-government standards reflects this changing attitude about "borderless" standards by directing that the selection of standards in NATO should "lay with their open availability, accessibility, effectiveness, relevance, market acceptance and technical excellence and not with their region of origin and/or their development process." The SES conference will be looking at a wide variety of broad topics of interest to DoD and the defense industry, including alternative funding strategies for standards development, the pros and cons of traditional versus consortia standards, the efforts of the Aerospace Standards Users Group, updates on standards legal issues, and automation tools from DoD, industry, and standards developers to help users in the selection and application of standards. The conference will be held at the Crowne Plaza Ottawa Hotel, in Ottawa, Ontario, Canada. For more information or to register, please go to www.ses-standards.org/conference.html.

August 29–September 2, 2004, Norfolk, VA

SOLE 2004—"Future Logistics: The Integrated Enterprise"

SOLE—The International Society of Logistics—will hold its 39th Annual International Conference and Exhibition at the Marriott Waterside in Norfolk, VA. For more information, please visit www.sole.org/conference.asp or call 301-459-8446.

October 13, 2004, Washington, DC

U.S. Celebration of World Standards Day 2004

World Standards Day will be held at the U.S. Chamber of Commerce, in Washington, DC. The event will include a reception, exhibits, dinner, and presentation of the Ronald H. Brown Standards Leadership Award. The Aerospace Industries Association is the administrating organization for this year's event.

October 13, 2004, Washington, DC

ANSI Annual Conference

The American National Standards Institute will hold its annual conference from 9 a.m. to 5 p.m. at the Marriot–Metro Center in Washington, DC. For more information, please contact Pamela Suett at 212-642-4976 or e-mail her at psuett@ansi.org.

October 25–28, 2004, Houston, TX

DoD Maintenance Symposium and Exhibition

SAE International will be hosting a symposium to explore the latest developments in DoD weapons systems and equipment maintenance, including military and commercial maintenance technologies, information systems, and management processes. The symposium will be held at the Hilton Americas and George R. Brown Convention Center, Houston, TX. For more information, please call 877-606-7323.

November 15–18, 2004, San Diego, CA

36th International SAMPE Technical Conference

The Society for the Advancement of Material and Process Engineering will hold its 36th conference at the Sheraton, San Diego Hotel and Marina, San Diego, CA. For more information, please visit www.sampe.org, call 626-331-0616 ext. 610, or e-mail registration@sampe.org.

New Report Feature in ASSIST-Online

A report on non-government standards (NGSs) adopted by DoD, formerly available only to a few systems administrators, has now been moved to the main menu in the left frame of ASSIST-Online. The new menu choice—NGS Adopted—brings up a report of the number of NGSs adopted by DoD, organized alphabetically by standards developing organization. The report indicates the number of active and inactive adopted NGSs, as well as the number of standards where DoD has withdrawn its adoption. All of these numbers, in turn, are hyperlinks. Clicking any of them brings up a list of the documents organized by document number. Check it out next time you log on to ASSIST-Online.

New DSPO Staff Member

Tim Koczanski recently joined the Defense Standardization Program Office (DSPO) as a program analyst. He is responsible for all public relations duties, including training, conference planning, and production and editing of the *Defense Standardization Program Journal.*

Tim comes to DSPO with more than 12 years of public relations and marketing experience in both the private and not-for-profit arenas. Most recently, he worked as a district manager for the American Red Cross. In that capacity, he oversaw the day-to-day activities of mobilizing blood collection teams in the field, supervised a staff of account managers, and was instrumental in acquiring new sponsor groups in the public and private sectors. He also ensured that collection goals were met and that collections were distributed to area hospitals.

A new employee of the federal government, Tim is very excited about his new position and is looking forward to a long tenure with DSPO.

Farewells

We bid farewell to several standardization personnel. We appreciate their contributions to the Defense Standardization Program.

Reatha Artman retired from federal service. Reatha was an invaluable asset to the excellent customer service provided by the Aeronautical Systems Center/Air Force Research Laboratory Engineering Standards Office at Wright-Patterson Air Force Base, Ohio. We will miss her professionalism and can-do attitude. We congratulate Reatha on her retirement and wish her all the best.

Barbara Fox recently retired from the DLA Systems Integration Office after 36 years of dedicated federal service. Her hard work and leadership contributed greatly to the Item Reduction Program. Thanks to Barbara's knowledge, expertise, and tireless efforts, the program has evolved from a paper, card-file-driven operation to an electronic online process. We wish Barbara a happy, healthy retirement.

Janet Jaensch, who served as NAVSEA's Command Standardization Executive for 2½ years, left that position to become the director of the NAVSEA's Small Business Innovative Research Program. We appreciate Janet's efforts to sustain the NAVSEA standardization program in spite of scarce funding, and wish her well in her new position.

Dottie McDowney left NAVSEA HQ to work closer to home. She served as NAVSEA's Lead Standardization Activity point of contact, responsible for ensuring the optimal degree of standardization in a federal supply group, class, or standardization area. She was the focal point for NAVSEA's specifications and standards. We will miss Dottie's hard work and positive attitude and wish her well in her new venture.

Patricia Pearce, a fuels engineer for the Air Force Research Laboratory at Wright-Patterson Air Force Base, Ohio, is transitioning to a new job within the Laboratory after serving 15 years in support of the Defense Standardization Program. She contributed significantly toward standardization in the defense and commercial fuel-related communities. We will miss Patricia's professionalism and enthusiasm in meeting the warfighter's needs and wish her much success in her new endeavors.

Upcoming Issues—
Call for Contributors

We are always seeking articles that relate to our themes or other standardization topics. We invite anyone involved in standardization—government employees, military personnel, industry leaders, members of academia, and others—to submit proposed articles for use in the *DSP Journal*. Please let us know if you would like to contribute.

Following are our themes for upcoming issues:

Issue	Theme	Deadline for Articles
October–December 2004	Navy Standardization	May 15, 2004
January–March 2005	Defense Laboratories	August 15, 2004
April–June 2005	Qualification & Conformity Assessment	November 15, 2004
July–September 2005	Air Force Standardization	February 15, 2005

If you have ideas for articles or want more information, contact the Editor, *DSP Journal*, J-307, Defense Standardization Program Office, 8725 John J. Kingman Road, Stop 6233, Fort Belvoir, VA 22060-6221 or e-mail DSP-Editor@dla.mil.

Our office reserves the right to modify or reject any submission as deemed appropriate. We will be glad to send out our editorial guidelines and work with any author to get his or her material shaped into an article.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