

**COMMERCIAL-OFF-THE-SHELF (COTS):
*DOING IT RIGHT***

by

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**CENTER FOR PUBLIC POLICY
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Executive Summary

Introduction

In the twenty-first century, the United States will likely encounter a wide-range of threats, such as those posed by terrorists, rogue states and other non-state actors—all of whom are taking full advantage of globally available, high-tech commercial systems (e.g., from night vision devices, through secure cell phones, to satellite photos). At the same time, technology is changing more rapidly than ever before, and the DoD must learn to embrace the fact that it no longer holds a monopoly on all military-relevant technology (many of the information-intensive innovations result from commercial activities). Furthermore, the rising costs of domestic commitments, such as Social Security and Medicare, coupled with the growing budget deficits, will create an inevitable downward pressure on the DoD budget. These changes have created an urgency for transformation within the defense establishment.

We believe this necessary defense transformation will be heavily dependent upon the development of net-centric systems-of-systems; the determination to achieve lower costs, faster fielding and better performance; and a realization of the potential benefits of globalization and use of commercial technology.

Greater use of Commercial-Off-The-Shelf (COTS) systems and components is one strategy that can enable achieving the required DoD transformation, and help to ensure American military success in the twenty-first century. Commercial-Off-The-Shelf (COTS) is a term for software or hardware that is commercially made and available for sale, lease, or license to the general public and that requires little or no unique

government modifications to meet the needs of the procuring agency. Because of their rapid availability, lower costs, and low risk, COTS products must be considered as alternatives to in-house, government-funded developments.

For forty years, there have been many recommendations made from inside the government to further encourage the use of commercial goods in federal acquisitions—yet adoption often continues to meet resistance. We believe that expanding the use of COTS will help the military to transform more quickly, using proven technology adapted from the commercial marketplace—allowing for substantial cost savings, with fewer schedule delays, and improved performance characteristics, across numerous programs, DoD-wide.

COTS Policy

Although, there are examples of COTS being used as far back as the 1970s, the advent of the information age (with the explosion and widespread use of commercial technological advances) and the growing DoD emphasis on information systems heralded a shift in acquisition policy to one that strongly favors the use of COTS products. Considered a seminal document in setting recent COTS policy, the “Perry Memo” was written in 1994 by the then-Secretary of Defense, William J. Perry. In the memo, Perry called for the military to increase the purchase of commercial items and systems. He also called for the increased use of commercial practices and specifications. The requirement to consider and use COTS was officially enacted into law as part of the *Federal Acquisition Streamlining Act (FASA)* in 1994, and is also addressed in the *Clinger-Cohen Act*. COTS and COTS policies are also contained in the *Federal Acquisition Regulation*, the *Defense Federal Acquisition Regulation*, the basic DoD Acquisition Policy (5000 series), and several other Instructions, Directives, and statutes.

Cases

We examine several cases that include using COTS as major sub-systems, as weapon systems, and, finally, within large enterprise business management systems.

- **Acoustic Rapid COTS Insertion program.** The A-RCI program, designated AN/BQQ-10, was a four-phase program for transforming legacy submarine sonar systems (AN/BSY-1, AN/BQQ-5, and AN/BQQ-6) to one using a more capable and flexible COTS/Modular Open System Approach (MOSA). The A-RCI program addressed the challenge of modernizing the Navy's sonar capability while under severe budgetary pressure. With an innovative approach, the Navy was able to significantly improve the fleet's sonar performance by leveraging the rapid advances in computer technology, while at the same time reducing development and support cost.
- **E-2 Hawkeye Early Warning Program.** The Navy began the E-2 Mission Computer Upgrade (MCU) program in 1992; the objective was to reduce the space and weight requirements for the mission computer so these could be used for other sensor upgrades. The program office selected a COTS approach, opting to replace the existing mission computer with a state-of-the-art, open architecture system. The use of COTS has provided many benefits to include: enabling a large reduction in procurement times, lower development cost, greater capability, and lower logistics costs.
- **Light Utility Helicopter.** The Army's procurement of a commercial aircraft for this mission aircraft was intended to significantly shorten the acquisition cycle, eliminate development costs, lower acquisition costs, as well as reduce lifecycle logistics and support costs. After reviewing four competitive proposals, the Army selected the UH-145, proposed by European Aeronautic Defence and Space Company North America, (EADS NA) in late June 2006, as its next-generation LUH. Using COTS in this instance was a major paradigm shift for the Army. With this COTS strategy, the program was limited to procuring that which was already available from commercial sources. The Army demonstrated that these aircraft could meet all the mission requirements, with minimal modifications—and at a fraction of the cost of developing a new helicopter.

- **Defense Integrated Military Human Resources System (DIHMRS).** The DIMHRS program’s objective is to streamline pay and personnel systems, using an enterprise-wide approach, for all uniformed members. It is intended to be an integrated, all-Service, all-Component, military personnel and pay system that will support military personnel throughout their careers and into retirement, in both peacetime as well as war. The program uses a COTS human resource software application as its base. DIHMRS has faced, and continues to face, many challenges. These include dealing with the individual cultures of the four Services, the scale of the implementation (an order-of-magnitude larger than previous similar systems), and the program’s ambitious “Big Bang” approach (vs. an evolutionary one).
- **Business System Modernization (BSM).** The Defense Logistics Agency’s (DLA) objective, when developing the BSM program, was to transform how DLA conducts its operations in five core business processes: order fulfillment, demand and supply planning, procurement, technical/quality assurance, and financial management. DLA made the decision to use a COTS-based solution, to leverage commercial development and future upgrades, as well as, to the extent possible, use the commercial best practices embedded in the software. The BSM program has been a success for the Defense Logistics Agency. BSM was the catalyst for this dramatic change that revolved around information technology but truly encompassed all elements of business transformation. The enabling COTS technology was a critical element.

Findings

With the advent of the information revolution, the commercial marketplace—not the DoD—drives the direction and rate of innovation and development of many technologies that are critical to modern weapon systems and business systems. As a result, in many cases, if the DoD is to deploy state-of-the-art systems, DoD programs must use these commercial systems. This fact has long been recognized by DoD senior leadership, legislation, and policy.

The major programs we examined have generally been successful in building systems that realized the benefits of using commercial items. The implementation, however, takes careful planning and requires changes throughout the acquisition cycle; the subject of Commercial-Off-The-Shelf (COTS) remains complex and faces the following challenges:

- COTS vendors are driven by today's fast-paced market, characterized by highly volatile business strategies and market positions—not the Program Office, which may have little, if any impact. As a result, change is a constant. This can result in inconsistent and short-term availability, obsolescence of components, and unplanned integration and testing requirements.
- COTS hardware may not be designed to meet all military environmental requirements.
- With commercially developed software, program staff may have a lack of insight into the code details and, as a result, may have less understanding of the code than they would have with internally developed software, creating potential integration and security concerns.
- “Color of money” conflicts can create problems. For example, COTS modifications may be bought with procurement dollars, but may need some developmental testing, and the developer is not able to use procurement dollars for Developmental Test and Evaluation.
- COTS may lock the user into a proprietary technology. For example, if an organization adapts a commercial ERP system, transitioning to another developer’s ERP may be very costly, limiting the options and reducing the competitive pressure on the provider.
- The last challenge relates to the culture of the DoD acquisition community, both within the government and the private sector. In many cases, implementing a COTS solution fundamentally changes the work of a system’s development teams

(both government and contractor), and how they do it—resulting in a natural resistance to the acceptance and use of COTS.

Recommendations

In spite of these challenges, using COTS is clearly worth the organizational, cultural, and procedural changes required to include COTS products in defense acquisitions. More specifically, these benefits include:

- **COTS products provide improved performance on an accelerated schedule.** By implementing a COTS solution, these programs were, in general, able to demonstrate significantly shorter development schedules, resulting in accelerated implementation and faster fielding. This resulted in being able to use the latest commercially available technology, with significantly reduced lead times. Then, by leveraging the commercial market, the programs were able to get upgrades and keep pace with technological changes through successive updates.
- **Reduced Acquisition Cost.** The high volume and market competition of COTS offers not only faster response and friendly user interfaces, but **lower costs**. This is made possible because the development, manufacturing, and support costs can be amortized over a much larger customer base. This reduces startup costs, unit costs, as well as logistics and support costs.
- **Greater use of commercial development tools.** When programs use COTS hardware, they can exploit commercially developed (or open-source) operating systems, device drivers, and libraries of applications. This software is generally proven and well-tested, and programmers can then spend more time focusing on the development of the mission-specific application.
- **Improved logistics support.** COTS products, by virtue of their broader customer base, can provide greater availability of logistics support throughout the product's lifecycle.

- **Increases opportunities for competition.** Developing, manufacturing, and integrating COTS components is within the capability of a much greater number of smaller firms—firms that normally could not overcome the high barriers-to-entry into the defense industry. This has the effect of creating a much broader business base (permitting the purchase of systems and equipment from a larger number of vendors). This competitive environment will increase innovation, as well as help to ensure continuous price competition.

Conclusions

Although COTS is not the answer to every DoD acquisition, as these cases demonstrate there is a broad range of possibilities for using COTS. With COTS, programs can leverage the massive technology investments of the private sector and reap the benefits of reduced cycle times, faster insertion of new technologies, lower lifecycle costs, greater reliability and availability, and support from a robust industrial base. The requisite policies are in place to mandate the consideration of COTS solutions. However, DoD leadership must work to mitigate the impact of the challenges in order to make the DoD more COTS friendly—such as realigning budgets to the realities of implementing COTS solutions. They must also continue to change the culture of the acquisition community to one that embraces the insertion of COTS products. The DoD cannot afford to allow the system to slide back to the old ways. The Nation’s future security depends upon not letting this happen.

I. Introduction

The end of the Cold War and the dawn of the twenty-first century have brought about major changes within the security environment, and, consequently, have created urgency for transformation within the defense establishment. Following the end of the Cold War, the Department of Defense (DoD) made significant budget cuts throughout the 1990s. Recognizing that projected defense expenditures would not be able to sustain the existing industrial base, the DoD determined that declining defense spending required consolidation of the defense industry. The DoD achieved industry consolidation through incentivizing mergers and acquisitions by reimbursing firms for the costs of merging. The end result was a consolidation of over fifty firms into the four that exist today.

The new security environment poses distinctive operational challenges, making it hard for a Cold-War-planned military, with the now consolidated defense industry, to meet twenty-first century national security and industrial needs. In this century, the United States will likely encounter a wide range of threats, such as those posed by terrorists, rogue states and other non-state actors. In addition, for the first time, the military is being asked to undertake such unique missions as providing humanitarian assistance, disaster relief, drug interdiction, border patrol, and nation building. It is likely that a continuation of irregular threats and conflicts will continue to occur; accordingly, a twenty-first century military must be capable of taking action under a variety of circumstances. Now, and in the future, adaptability is key to being prepared and responding to this range of rapidly evolving threats.

To address this reality, the DoD has adopted a capabilities-based approach to planning. The capabilities-based planning methodology allows the military to be flexible and to adapt to various threats it may encounter, independent of particular adversaries. To accomplish this strategy, the military must maintain readiness across a wide range of capabilities. However, in its effort to modernize, the DoD is encountering numerous factors that are strongly influencing the state of the security environment and the DoD's ability to plan—the most influential of these factors is globalization. Globalization has helped promote economic and security-based relations around the world, even among

nations and corporations that a decade ago were unaware of what the other had to offer. There has been a steady increase in the influence of globalization as a part of the private and commercial activities within the United States; this increase directly influences the DoD and its quest to modernize. Moreover, development in information technology and the propagation of related products have given the world access to information and have stimulated innovation (by dispersing the knowledge needed to research, develop, construct and sell goods and services), while permitting a global understanding of the rewards available to those who embrace free-market economics.

An additional influential factor is that technology is changing more rapidly than ever before; therefore, the DoD must learn to embrace the fact that it no longer holds a monopoly on all military-relevant technology. Many firms in the aerospace and defense industries are now working hard to transform themselves into IT companies—a natural offshoot from defense. As DoD systems become more dependent upon IT and networks, it is likely the line between the defense industry and the IT industry will become virtually indistinguishable. The trend of accelerating technological change has had, and will continue to have, a major impact on the nature of the defense industry.

As globalization persists, the growth of advanced technology and expansion of industry around the world will continue; and, it is likely that many of the advancements will occur outside US borders. The DoD's reliance upon future advanced technologies has significant implications for the defense industry; it must quickly provide the most advanced weaponry feasible. The DoD must enable the defense industry to be more responsive than it is now and to adequately provide equipment and services in the quickest and most efficient way possible. Advanced information systems of the future, and the push for integrated "network-centric" systems, will create a whole new host of challenges because of the drastically different nature of these acquisitions from those of the past.

The DoD can also anticipate budgetary challenges as a result of domestic commitments, such as Social Security and Medicare. The rising costs of these mandatory entitlement programs, coupled with the enduring projected budget deficits, will create an inevitable

downward pressure on the DoD budget. Even though defense budgets are currently well above the Cold War average (as shown in Figure 1), they will likely decline significantly based on past historic trends and on growing requirements outside of defense. This decline will serve to constrain the funds available for recapitalization, modernization, and transformation of the military. Future DoD budgets will require hard decisions; they will be dependent on a reengineering of processes and the efficient use of resources as a source of funds for these requirements.

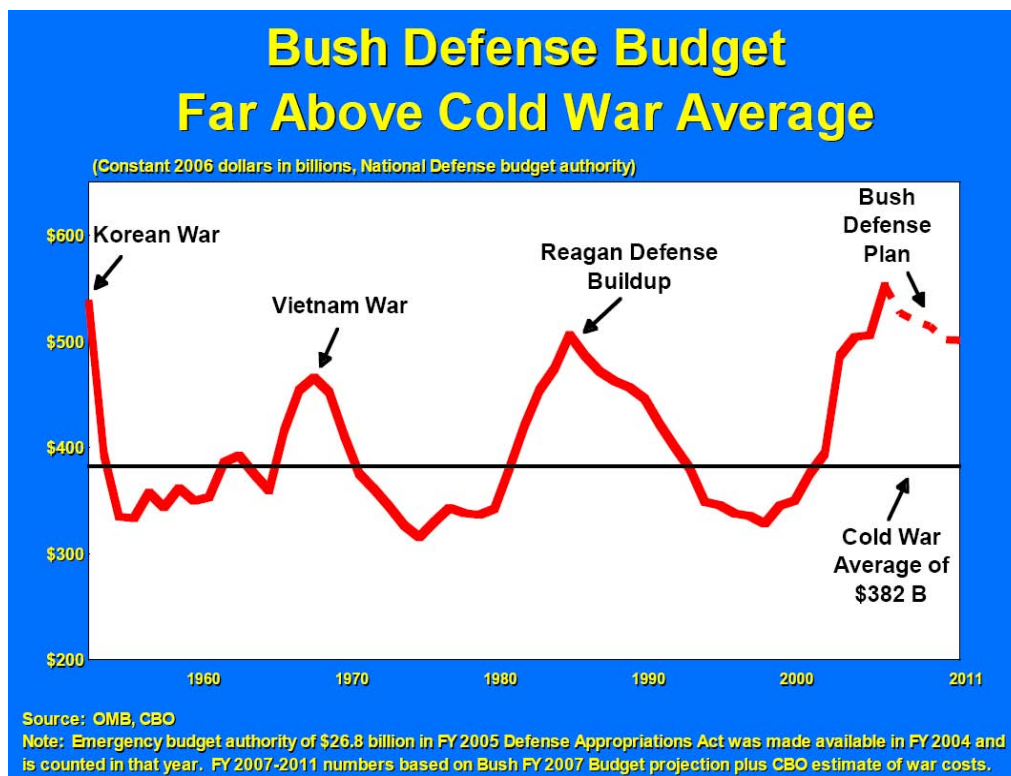


Figure 1. Current Defense Budget (Senate Budget Committee 2006).

Additionally, Operations and Maintenance (O&M) funding currently represents nearly two-thirds of the DoD budget, while resources devoted to modernization represent only one-third. The Congressional Budget Office forecasts significant increases in spending on personnel and O&M, which are projected to rise 30% and 20% respectively by 2024. During this same period, funds invested in research, development, testing & evaluation (RDT&E), are expected to decline by roughly one-third—which will negatively

contribute to innovation and, consequently, modernization within the military (Congressional Budget Office 2006).

Despite these budget issues, new military missions and requirements will continue to emerge as the security environment evolves through the remainder of the century. However, funding for equipment, personnel, operations & maintenance (O&M) and homeland security will likely be dependent on the crisis of the moment; thus making long-term planning quite problematic. More importantly, the US may be unable to accomplish the required future military missions, thus placing American national security in jeopardy.

We believe the necessary defense transformation will be hinged upon the following: the development of net-centric systems-of-systems; the determination to achieve lower costs, faster fielding and better performance; and a realization of the benefits of globalization. Greater use of Commercial-Off-The-Shelf (COTS) systems and components is one strategy that can enable achieving these objectives and can help to ensure American military success in the twenty-first century.

When DoD decision-makers purchase COTS, they are taking advantage of items that currently exist in the commercial markets. The *Federal Acquisition Regulation (FAR)* defines “commercial item” in part as “that is of a type customarily used by the general public or by non-governmental entities for purposes other than governmental purposes” (*Federal Acquisition Regulation (FAR)*, Subpart 2.101 2007).¹ Use of these commercially developed goods offers opportunities to reduce development time, insert new technology faster, and reduce lifecycle costs. In addition, by using mature commercial technology, program costs, schedule, and performance requirements can be projected and maintained more easily. COTS can be used when procuring supplies, components, major subsystems, software, services or even entire weapons systems (DAU 2004).

¹ The FAR definition of commercial item is comprehensive and include has eight subsets, to include commercial services.

In some cases, to make the COTS item compatible with the rest of the system or to be able to function within a militarized environment, modifications are necessary (of course these should be kept to a minimum to obtain the maximum benefits). In these cases, the item would be adapted from a COTS item into Modified-Off-the-Shelf (MOTS), Government-Off-the-Shelf (GOTS), or Non-Developmental Item (NDI)².

The thrust for the expanded use of commercial goods in the federal government is not a new phenomenon. In fact, since the 1960's, the government has often made efforts to bring goods from the commercial marketplace to the forefront of federal acquisitions. In 1969, the congressionally established "Commission on Government Procurement" recommended that the government take steps to promote the economy, efficiency, and effectiveness in procurements by the Executive branch. In a subsequent report by the same Commission, it was highlighted that to accomplish these goals, the government could benefit from the broader acquisition of commercial items in government procurements. Because of the high cost of products that were specifically designed for use by the government, the Commission encouraged Congress to refocus its acquisitions to commercially developed products. In 1978, the DoD released the *Acquisition and Distribution of Commercial Products (ADCOP)* directive, which specifically sought to facilitate the acquisition of commercial products via the elimination of unique government specifications and contract clauses that were not reflective of commercial practices. In 1986, the Blue Ribbon Commission on Defense Management further recommended that the DoD expand its use of commercial products and processes. In this case, the Commission suggested the abolition of barriers that discouraged the application of innovative technology in DoD contracts (Acquisition Advisory Panel 2007). All of these events were influential in developing the current policies, which have continued to emphasize greater consideration of the use of COTS within the DoD.

For forty years, there have been many recommendations made from inside the government to further encourage the use of commercial goods in federal acquisitions—

² The term nondevelopmental is used to describe an item that was previously developed, and can include commercial items. Commercial items and NDI are separate by definition in the FAR, and the preference for commercial items over all others in defining defense requirements is reiterated in FAR Part 11 (Defense Standardization Program 2008).

yet adoption often continues to meet resistance. We believe that expanding COTS will help the military transform more quickly using proven technology adapted from the commercial marketplace—allowing for substantial cost savings, fewer schedule delays, and improved performance characteristics across numerous programs, DoD-wide.

Roadmap

Section Two of our report will begin with extensive details on the various law, policy documents, and directives that currently provide guidance on the use of COTS. Section Three of the report will examine the use of COTS as elements of major sub-systems within two major defense programs: the Acoustic Rapid COTS Insertion Program and the E-2 Hawkeye aircraft. Section Four will examine an Army program, the Lakota Light Utility Helicopter (LUH), which is a COTS weapon system. Section Five will assess COTS as used within major software systems, including the Defense Integrated Military Human Resource System or DIHMRS, and the Defense Logistics Agency's (DLA) Business Systems Modernization (BSM) program. Section Six will conclude with our findings and conclusions.

II. COTS Policy

Although there are examples of COTS being used as far back as the 1970s, the advent of the information age (with the explosion of commercial technology advances and their widespread use) and the growing DoD emphasis on information systems heralded a shift in acquisition policy to one that strongly favors the use of COTS products. There were numerous reasons for this policy shift; however, a critical factor was the growing cost of building and maintaining Government-unique systems, when systems with similar capabilities were available in the commercial marketplace—generally at a far lower expense. A number of guidance documents—to promulgate this new emphasis on COTS products—have been issued in the form of memorandums, letters, and regulations.

A. The Perry Memo

Considered a seminal document in setting COTS policy, the “Perry Memo” was written in 1994 by the then-Secretary of Defense, William J. Perry. In this memo, Perry wrote, “greater use of performance and commercial specifications and standards is one of the most important actions that the DoD must take to ensure we are able to meet our military, economic, and policy objectives in the future.” Performance and commercial specifications were to be used in lieu of MIL-SPECS and MIL-STDs. The memo stressed that the DoD not only needed to increase its use of commercial items, but also its use of commercial practices as well. Based in large part on the Vice President’s National Performance Review, it was recommended that acquisitions avoid government-unique specifications and rely, to a far greater extent, on the commercial marketplace. This new policy stated that military-specific specifications were now only to be used as a last resort in new programs, and would require a waiver authorizing their use from the Milestone Decision Authority (MDA) (Perry 1994).

The “Perry Memo” also recognized that there was a cultural problem within the DoD in terms of its organizational approach to acquisition, and outlined several changes to overcome this difficulty. Specifically, the problem is rooted in acquisition requirements, “because the problem of unique military systems does not begin with the standards. The

problem is rooted in the requirements determination phase of the acquisition cycle.” The memo also called for the establishment of a Standards Improvement Executive. This executive would be responsible for coordinating and overseeing reform activities, particularly in regard to the standardization of specifications. Other changes included increased training and education for incorporating commercial specifications and emphasizing that program reviews consider the extent that streamlining was pursued.

B. *Federal Acquisition Streamlining Act (FASA)*

The requirement to consider and use COTS was officially enacted into law as part of the *Federal Acquisition Streamlining Act (FASA)* in 1994. In addition to clarifying the definition of commercial items, the Act mandated the use of COTS items in the procurement of government items.

FASA was the first to use the term “non-developmental item.” The document defined it as:

- “Any commercial item;”
- “A previously developed item of supply that is in use by a department or agency of the United States, a State or local government, or a foreign government with which the United States has a mutual defense cooperation agreement;”
- “Any item of supply described in subparagraph (A) or (B) that requires only minor modification or modification customarily available in the commercial marketplace in order to meet the requirements of the procuring department or agency;”
- Any item of supply currently being produced that does not meet the requirements of subparagraph (A), (B), or (C) solely because the item is not yet in use” (United States Congress 1994).

In the mandate, the *FASA* stated that heads of agencies would “to the maximum extent practicable”:

- “Acquire commercial items or non-developmental items other than commercial items to meet the needs of the agency;”
- “Require prime contractors and subcontractors at all levels under the agency contracts to incorporate commercial items or non-developmental items other than commercial items as components of items supplied to the agency;”
- “Modify requirements in appropriate cases to ensure that the requirements can be met by commercial items or, to the extent that commercial items suitable to meet the agency’s needs are not available, non-developmental items other than commercial items;”
- “State specifications in terms that enable and encourage bidders and offerors to supply commercial items or, to the extent that commercial items suitable to meet the agency’s needs are not available, non-developmental items other than commercial items in response to the agency solicitations;”
- “Revise the agency’s procurement policies, practices, and procedures not required by law to reduce any impediments in those policies, practices, and procedures to the acquisition of commercial items;”
- “Require training of appropriate personnel in the acquisition of commercial items” (United States Congress 1994).

C. The Clinger-Cohen Act (CCA), Public Law 104-106

The CCA was enacted in 1996 as Public Law 104-106, and was designed to improve the way the Federal Government acquires and manages information technology. The Act contains several guidelines and directives regarding commercial items and practices. Section 5201, Procurement Procedures, states that “The Federal Acquisition Regulatory Council shall ensure that, to the maximum extent practicable, the process for acquisition of information technology is a simplified, clear, and understandable process that specifically addresses the management of risk, incremental acquisitions, and the need to

incorporate commercial information technology in a timely manner” (United States Congress 1996).

Additionally, *Clinger-Cohen*:

- Amended the commercial item exception to the requirement that contracting officers obtain certified cost or pricing data to substantiate price reasonableness determinations. This amendment broadened the exception to apply to all commercial items (Sec 4201);
- Allowed COTS purchases to be made under the simplified acquisition procedures of *FAR* Part 13 (Sec 4202);
- Required organization to use modular contracting vehicles for IT systems. Under modular contracting, a system is acquired in successive acquisitions of interoperable increments. The *CCA* is concerned with modular contracting to ensure that each increment complies with common or commercially acceptable standards applicable to Information Technology (IT), so that the increments are compatible with the other increments of IT comprising the system (Sec 5202).

D. *Federal Acquisition Regulation (FAR)*

The *FAR* defines a “commercial item” as one “that is of a type customarily used by the general public”(Federal Acquisition Regulation (*FAR*), Subpart 2.101 2007). The *FAR* also states the intent of the *Federal Acquisition Streamlining Act (FASA)* is to establish “acquisition policies more closely resembling those of the commercial marketplace and encouraging the acquisition of commercial items and components” (*Federal Acquisition Regulation (FAR)*, part 12 2007). A primary theme across the regulation is the leveraging, to the maximum extent, the commercial marketplace for the procurement of available systems.

Specifically, part 12 of the *FAR*, designed to implement the *FASA*, mandates that agencies:

- “Conduct market research to determine whether commercial items or non-developmental items are available that could meet the agency’s requirements;
- Acquire commercial items or non-developmental items when they are available to meet the needs of the agency; and
- Require prime contractors and subcontractors at all tiers to incorporate, to the maximum extent practicable, commercial items or non-developmental items as components of items supplied to the agency”(Federal Acquisition Regulation (*FAR*), Subpart 12.101 2007).

Thus, the *FAR* now requires all federal agencies to consider and use commercial items to the maximum extent possible.

E. DoD Directives and Instructions

DoD Directive 5000.1 applies to all DoD acquisition programs. It requires PMs to examine and adopt commercial best practices and electronic business systems that reduce cycle time and cost. The directive also requires program managers to consider and use performance-based strategies to enable greater flexibility in capitalizing on commercial technologies, in order to reduce costs (Department of Defense 2003a).

DoD Instruction 5000.2 requires that during the Concept Refinement stage, existing COTS items and systems should be considered. DoD components are also directed by the Instruction to ask if COTS technologies have been considered to the maximum amount possible when the program is progressing from Concept Refinement to Technology Development (Milestone A) (Department of Defense 2003b).

F. COTS Policy Conclusion

The laws, regulations, and policies governing the use of COTS span numerous documents. Although there is some minor difference in wording, they are all consistent in requiring or at least strongly encouraging the use of commercial items, commercial best practices, and commercial standards in government acquisitions.

III. COTS Integrated into Major Weapon Systems

The move to integrate COTS into weapon systems is not just a technology issue. More accurately, it requires business process and cultural changes for both the customer and contractor. In order for this transition to be successful, these stakeholders must understand the new business model, new approaches to product support, and the criticality of configuration management. The Acoustic Rapid COTS Insertion Program and E-2 Hawkeye Airborne Early Warning Aircraft are two examples of successful COTS implementations.

A. Acoustic Rapid COTS Insertion Program

Background

During the 1990s, the US Navy's submarine force lost "acoustic superiority" and no longer had a superior capability to detect and track foreign submarines. This was due in some measure to the advanced quieting technology employed by other countries in their newer diesel-electric submarines. The Navy, as a



result of the so-called "peace dividend," was also forced to reduce funding for research and development (Kerr 2004). Developing unique systems that met military specifications would have cost \$1.5 billion dollars in development and \$90 million per ship-set for implementation—figures that were deemed unaffordable. Consequently, the Navy chose a different path. The MITRE Corporation conducted a study of the issue for the Director of Submarine Warfare in September 1995 and recommended replacing the legacy sonar systems with COTS-based processors. As an interim fix, operating forces began using carry-on commercial systems in an effort to regain some of their previous advantages. These "black boxes," however, were not fully integrated with the ship's combat system, limiting their effectiveness (Kerr 2004).

The Chief of Naval Operations (CNO) Submarine Acoustic Master Plan stated a vision for the acoustic capability of Navy submarines: *“Aggressively incorporate flexible, affordable and innovative technologies to restore and maintain acoustic advantage, ensuring tactical control, maritime battlespace superiority, and comprehensive undersea surveillance”* (Rosenberger 2005b). Naval Sea Systems Command (NAVSEA) was tasked with and began developing an acoustic system based on commercially available hardware and software, designated the Acoustic Rapid COTS Insertion (A-RCI) sonar system. Key improvements of this sonar implementation included a larger acoustic aperture with precision-matched acoustic channels, an expanded outboard pressure-tolerant electronic component configuration, and the ability to pass element-level data inboard (Applied Research Laboratory 2006).

By using commercial, state-of-the-art systems and advanced signal processing algorithms, the Navy was able to improve their capabilities and exploit the much quieter acoustic signatures of the target submarines. This improved capability had the added benefit of reducing the ship-set cost down to approximately \$10 million. Furthermore, by introducing commonality into submarine sonar systems, the Navy was also able to reduce its support infrastructure (Kerr 2004).

Program Description

The A-RCI program, designated AN/BQQ-10, was a four-phase program for transforming legacy submarine sonar systems (AN/BSY-1, AN/BQQ-5, and AN/BQQ-6) to one using a more capable and flexible COTS/Modular Open System Approach (MOSA). This approach yielded many benefits in addition to providing the submarine force with a common sonar system. These included: added ease of update for technical improvement, reduced operations and support costs, improved competition, and increased software portability (Boudreau 2006).

The A-RCI program allows the Navy to update the hardware and software on a two-year cycle using a spiral development approach. The software itself is updated on an annual cycle to create a new software baseline. Now, the Navy can efficiently leverage the rapid

commercial advances in the dynamic commercial technology market to consistently provide the fleet with near-state-of-the-art processing capability (Rosenberger 2005a).

The A-RCI initial technology insertions were made to the hardware baseline to eliminate most of the custom cards used in the initial system configuration, as well as to provide improved display performance. Replacing these custom cards reduced system cost and improved system reliability. Additionally, instead of having to code at an assembly level to discrete hardware components, the code could be written in a higher-level language, making the software programming easier and faster. This allowed the programmers to spend more time writing better code and debugging problems instead of dealing with the details of the hardware interface. With increases in processor capability, the A-RCI program was able to migrate signal processing applications to Intel's x86 family of processors (using the Linux operating system)—further reducing acquisition costs (Kerr 2004).

The continued technology insertions in 2002 and 2004 transitioned the program to mainstream COTS hardware, the Intel XEON-based servers running at higher clock speeds. In addition, both the display and signal processing servers were using a common hardware baseline, making data transfer more straightforward and simplifying software development (Kerr 2004).

The use of COTS technology has also been leveraged to help meet supportability needs. The Navy put in place an extremely effective Performance-Based Logistics (PBL) contract with the system developer. Leveraging the two-year upgrade cycle, the contractor has developed an innovative approach to minimize the required inventory while exceeding the fleet's requirements and steadily reducing the costs of repair. The average cost of a repair was reduced by an estimated 32% based on the then-current costs (Gansler 2006).

Results

Through 2004, A-RCI COTS technology insertion enabled a 10x increase in system throughput and an 86% reduction in hardware cost per billion floating point operations per second, in a six-year period (Kerr 2004). More importantly, based on the increasing reliability of the COTS equipment, the Navy was able to put in place a pilot program to test the concept of a Maintenance Free Operating Period (MFOP) on A-RCI. The program goal was to eliminate the need for underway maintenance of the A-RCI system, deferring all maintenance to the next in-port period. The test, completed in 2005, was very successful. Four submarines participated in the testing over the course of one year; no maintenance was required in any of the four—an outcome exceeding everyone's expectations. Furthermore, system operational availability improved. The mean-time-to-repair decreased by an order of magnitude—from 20 minutes to 2 minutes, using the embedded spares approach (Kerr 2006).

With the scheduled periodic updates, this capability began to be installed in the submarines with a 2004 or newer hardware baseline, based on the assumption that the test would succeed (this feature could be activated upon approval). Based on decreasing hardware prices, this approach was actually less expensive (Kerr 2006).

The A-RCI program addressed the challenge of modernizing the Navy's sonar capability while under severe budgetary pressure. With an innovative approach, the Navy was able to significantly improve the fleet's sonar performance by leveraging the rapid advances in computer technology; at the same time, it was able to reduce development and support cost. This required a retreat from MIL-SPECs, the adoption of open systems architecture, and most importantly, a major cultural change both in industry and the Navy.

B. E-2 Hawkeye Airborne Early Warning Aircraft

One of the most prominent examples of the use of COTS as subsystems of a major weapon system is within the E-2 Hawkeye aircraft. The E-2C contains three COTS systems that were included as part of the Mission Computer Upgrade (MCU)—the Mission Computer, the Advanced Control Indicator Set, and the Data Loader Recorder (United States Navy 2007).



Background

The US Navy's E-2C Hawkeye is a carrier-based, airborne early-warning platform,³ and is the only carrier-based system of its kind. It is designed to provide real-time threat warning and tactical analysis to the battle group commanders and to perform in a battle-management role (directing the tactical response platforms and weapons to assigned targets). Additionally, the E-2C aircraft can serve in a surveillance mode,⁴ assume search and rescue duties, and assist civilian authorities when needed (Defense Industry Daily 2007). The first Hawkeye was initially produced in 1961 and was designated the E-2A. It was updated and redesignated as the E-2B in 1969. The most robust Hawkeye, the E-2C, was first delivered to the Navy in 1973. The aircraft has been produced in many different configurations and has had several modifications to incorporate updated electronics and subsystems.

The most significant E-2 upgrade was initiated in 2000 and was known as the HE2K. With this upgrade, the Hawkeye received numerous additions, including hardware,

³ The E-2 is the Navy equivalent to the Air Force's Airborne Warning and Control System (AWACS)

⁴ The E-2 can monitor as much as six million cubic miles (Radar Systems Forecast—E-2C Hawkeye - RS13441 2004).

software, and electronics (Defense Industry Daily 2007). Key among the advances was the MCU with its advanced control indicator set workstations. The MCU is a smaller, lighter, more powerful mission computer that allows even more capabilities, such as the Cooperative Engagement Capability (CEC) upgrade. The CEC upgrade enables the Hawkeye to serve as the fleet's information hub, fusing and distributing information from sources such as satellite and ship-borne radar. This change enables the Hawkeye to “see” what the rest of its deployment group could see electronically. Additionally, since information flows both ways, the accompanying ships can also see what the Hawkeye is displaying (Defense Industry Daily 2007). Finally, the CEC also gives the Hawkeye an increased role in sea-based Theater Ballistic Missile Defense (also referred to as Theatre Air and Missile Defense) (United States Navy Fact File 2004).

COTS is Introduced

The Navy began the E-2 MCU program in 1992; the objective was to reduce the space and weight requirements for the mission computer so these could be used for other sensor upgrades. The program office selected a COTS approach, opting to replace the existing mission computer with a state-of-the-art, open architecture system. COTS would leverage the ongoing rapid commercial IT development and would only need to be “ruggedized” to meet the Navy’s environmental requirements (Mohler 1997).

This was a major COTS implementation—using very sophisticated hardware and software components—which is very different than, for example, just using a commercial Intel chip. This upgrade replaced the existing legacy Litton L-304 processor (used in the Group II aircraft since the late 1960’s) with COTS central processor units (Digital Equipment Corporation (DEC) 64-bit 333 MHz); these were repackaged to fit the existing volume, but did not require any other design changes from their commercial counterpart. The new computer was half the weight and a third the size of the replaced system, with an order of



magnitude improvement in performance. Some of the other COTS implementations included:

- The Advanced Control Indicator Set (ACIS). This is a new, state-of-the-art, COTS tactical workstation using technology based on an existing, high-resolution, flat-panel display system.⁵ It is set up to be the primary display and interface with the weapons systems and connects to the Mission Computer using LAN technology (United States Navy 2007);
- The MCU operating system. The MCU uses a COTS UNIX operating system to host the Operational Flight Program (OFP) software. The implementation requires two distinct OFPs for both the mission computer and advanced control indicator set (Campbell 2000);
- The Data Loader Recorder (DLR). The third part of the MCU was the DLR, which uses a removable COTS nine gigabyte media cartridge (similar to an ordinary computer disk drive).

Group II Mission Computer Replacement Program (GrIIM RePr)

In 2000, the Navy assembled an Integrated Product Team (IPT) to develop an E-2C Group II Mission Computer Replacement Program. This program became known as GrIIM RePr (pronounced “grim reaper”). This upgrade also used available COTS technology; the goal was to improve the E-2Cs reliability (and, as a result, mission readiness) and its growth potential while reducing the Navy’s total ownership costs. With this upgrade, the Navy also attempted to minimize hardware, software, and integration costs by reusing the E-2C flight software. Northrop Grumman was selected in 2001 to provide the COTS computer hardware.

The Navy introduced a Mission Computer Replacement for the E-2C Group II in the Fall of 2004. The new mission computer is easier to maintain, with a predicted Mean-Time-Between-Failure (MTBF) of more than 10,000 hours. This MTBF is attributed to its

⁵ Systems in the Lockheed Martin Q-70 family of workstations are state-of-the-art tactical workstations configured using high-performance COTS modules housed in militarized enclosures.

state-of-the-art manufacturing techniques, integration of operationally proven components and a hardware suite that provides 98.7% fault detection, and reporting capabilities. Aircraft ground and flight-testing, which included carrier suitability flight-testing and electromagnetic compatibility, were successfully completed by October 2004.

This computer upgrade also used existing E-2 software, reducing the costs of integration and causing no changes in aircraft configuration. Maintenance costs were reduced, as demonstrated by the 10,000 hour MTBF. The “Open Architecture” framework of the software now allows for uninhibited expansion and future growth of both the software and hardware components (Navy Newsstand 2004).

Single Board Upgrade

A follow-on computer upgrade uses a COTS single-board computer (SBC) to improve the processing power of the mission system and to decrease operating and procurement costs. The SBC architecture incorporates a COTS Pentium single-board computer and uses the Linux operating system. The SBC upgrade makes available more computer-processing throughput. It also allows the E-2C to provide greater battlespace management to the carrier strike group, joint and coalition force commanders. The computers can be upgraded more rapidly and frequently as both technology and mission requirements evolve (Scott 2006).

Program Impacts

The Program office estimates “40 to 60 times more performance” at comparable costs.

While E-2C program data does not show that using COTS has reduced the program’s lifecycle cost, the real benefit has been that COTS provides better quality products for the amount of money spent, making it a better value. The program impacts are detailed in Figure 2.

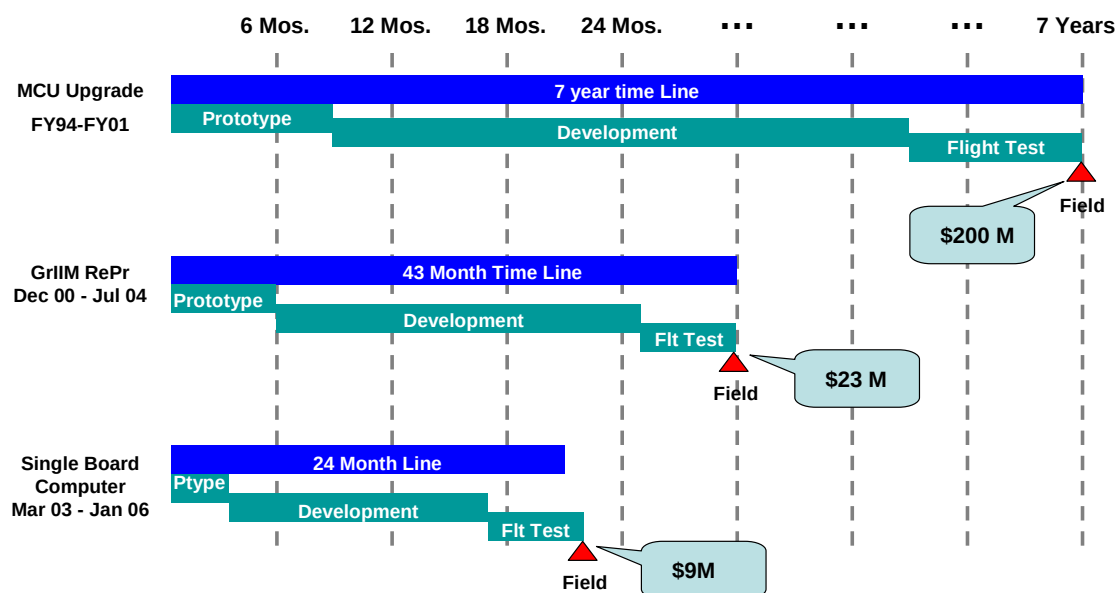


Figure 2. E-2C MCU COTS Insertion Cycle Times (Defense Acquisition University 2007).

Performance of COTS within the E-2 Hawkeye

Because of the ease with which the Hawkeye’s COTS technology can be upgraded, the performance of its components has generally met or exceeded expectations. Use of COTS has provided the following benefits:

1. Faster Introduction

The use of COTS enabled a large reduction in procurement times. As Figure 2 demonstrates, when the initial MCU COTS upgrade was developed and implemented in FY94, the process took seven years to be completed (from prototype to the end of flight testing). While development took over three years to complete, it was still completed faster than a unique development. The development timeframe was

significantly reduced with the latest COTS upgrade, the Single-board Computer. The total time for the implementation was approximately 20 months, with a development time of only 12 months. COTS enabled more frequent and timely technology insertion by leveraging the rapid innovation from the commercial sector.

2. Lower Development Cost

In addition to reductions in time, the cost for each insertion cycle decreased significantly. The initial MCU COTS upgrade cost \$200 million; the last insertion cost only \$9M. These lower costs are a result of reusable software and system components in which the majority of the design, development and testing had already been accomplished (and thus paid for outside of the Navy's procurement process). This key feature of COTS products has made them an attractive alternative to traditional, tailor-made technology. Furthermore, use of COTS increases the possibility of competition between suppliers, in which components with similar capabilities and interfaces are available from a greater number of vendors. The increased competition can reduce the cost of the components necessary for upgrades.

3. Earlier Upgrade at Lower Cost

The timeframe for replacements, refreshments, and/or upgrades has been reduced (upgrades may take as little as a year in the future), and can keep pace with rapid technological innovation.

4. Greater Capability

With the more frequent technology insertions, the systems are able to provide greater capability and performance for the funds invested.

5. Lower Logistics Costs

Using commercially available components allows the Navy to leverage the commercial supply chains that support significantly larger numbers of systems, thus reducing support costs.

C. Lessons Learned

Incorporating COTS within these two programs required many changes—particularly to the military’s acquisition strategies and industry’s business models—while concurrently, it posed both technical and cultural challenges. Here are the key lessons learned:

Using COTS (and ultimately, MCOTS) for portions of the E-2 Hawkeye systems had advantages as well as drawbacks. Program dollars were saved with MCU upgrades, along with development time. The concept of “Open Architecture” was brought to the forefront in helping with the success of COTS. But many components still had to be “ruggedized,” and system testing required several attempts to be successful. E-2 COTS demonstrated a recurrent problem—that COTS components will continue to evolve outside of the military acquisition process, which can lead to issues with compatibility and limit ease of replacement. This emphasized an increased need for developing relationships with vendors.

- **"Open Architecture" is a Key Enabler for Integrating COTS into Weapon Systems.**

The Office of the Secretary of Defense (OSD) defines “Open Architecture” (OA) as “a multi-faceted strategy providing a framework for developing joint interoperable systems that adapt and exploit open-system design principles and architectures.” OA has several goals, according to the OSD—for instance, to “yield systems that are easily developed and upgradeable” and to “achieve component software use” (United States Navy 2006). Thus, the Services can take advantage of more COTS products by moving towards an OA framework. OA also makes use of the Modular Design Concept, an approach in which systems are developed using separate, self-contained units. These units are assembled and connected in a way that the replacement of one component has a minimal effect on the other units in the system. Both programs recognized that too many constraints on the details of implementation would have slowed the programs down and cost more money.

- **Benefits of Leveraging Commercial Systems.**

Using COTS means that technology used by the military is more similar to commercial, state-of-the-art systems than was ever possible with MIL-SPEC systems. In many cases, this allows the military user to employ more advanced algorithms, such as computation-intensive signal processing, as well as interface with other commercial components, such as displays. Additionally, since in many cases commercial operating systems, device drivers, and libraries can be used, development efforts are reduced—allowing system developers to focus on the applications versus the support software. These critical applications can still be developed using secure facilities (Kerr 2004).

- **Potential for Greater Competition.**

Providing and integrating COTS components is within the capability of a greater number of firms (formerly only traditional major defense contractors had the means to upgrade/modify weapon systems). This broader business base provides constant competitive pressure throughout the system's lifecycle. This competition, as well as the non-proprietary nature of the components, also helps foster increased innovation.

- **COTS = Change.**

Since COTS components react to market forces and vendors' perceptions of what will sell to the largest number of customers, they can change very quickly—almost too quickly. Vendors commonly implement enhancements, and on occasion incorporate features which are not needed nor currently used by the military (Bluetooth features are one example). These frequent, marketplace-driven changes do help to manage system obsolescence, but also enable the program to synchronize capability updates with the inserted technologies. On the downside, a vendor may remove DoD-required capabilities or functions, stop production of a component, or change a supplier of a component. Vendors also,

not infrequently, “turn over” and stop producing various product lines. Then, when replacements, upgrades, or spares are needed, a different vendor has to be used. This means components could be (and oftentimes are) different than those that are currently being used (Campbell 2007).

With COTS, the customer doesn’t always set the requirements. Additionally, COTS is always changing; therefore, to the extent possible the system must be developed with a plan to accommodate these changes. However, even with the most careful planning, programs cannot always anticipate these changes and must develop a strategy to deal with them (Campbell 2007).

- **Unanticipated Changes can Create a Budgetary Challenge.**

These unplanned and unanticipated changes in COTS products can create a funding challenge. Even small COTS software patches/updates can bring about large testing and integration costs and programs when being integrated into a weapon system. The E-2 program eventually moved to a “Technology Insertion” funding line. In addition, there is little history to go on when it comes to estimating the amounts actually needed for a COTS refresh. The E-2 program office has used a combination of estimates for past years, the number of changes anticipated, and some ideas for maintenance costs. But overall, cost estimating for COTS requirements remains challenging (Campbell 2007).

- **System Testing.**

It is easy to underestimate the impact of COTS on the testing program. When a program incorporates COTS components, it may be required to conduct some level of testing to ensure that the items can perform in an operational military environment. At times, vendors use inconsistent environmental standards; this often leads to additional testing when replacing components. Additionally, if the COTS item has been modified, testing may be required to ensure that the modification does not change the performance of the system. As a complicating factor, when COTS components are involved, figuring out exactly what needs to

be tested is often difficult. There may have been a change in a component at “level 4,” but the published testing only proceeds to “level 3” and, therefore, does not adequately test to the level where something is different. New publications and/or documentation may be needed in order to investigate further, and these updates are not always readily available. This activity can add both cost and time to the overall technology insertion effort (Campbell 2007).

- **Configuration Control is Critical.**

Different vendors may have a different understanding of what COTS components are, and may have different implementations of environmental standards. When coupled with the many different permutations possible with these COTS implementations, configuration control becomes critical for operational as well as for supportability issues (Campbell 2007).

- **Requirements and Procurement Specifications Must be Negotiable.**

The specification of system requirements, prior to considering the capabilities available in the marketplace, does not work well when developing systems that incorporate COTS. It is unlikely that any commercial item will fully suit a program’s needs without some flexibility in requirements. As a result, in these cases, requirements were modified or even deleted all together to accommodate an existing COTS product. In the case of the E-2, the COTS hardware could not meet the requirement to isolate faults down the board level (not a commercial requirement) (Campbell 2007).

Since COTS items were not designed to operate in a military environment (for example, the E-2C operates in an environment with high humidity, ocean spray, and 20g-load requirements), numerous E-2 components had to be “ruggedized” in order to bring them up to military standards (Campbell 2007). And in the case of the A-RCI, modifications were required to provide environmental isolation and cooling, since the hardware was not built to sit within a watertight cabinet (Kerr 2004). To gain the maximum benefit from the use of COTS, products require a

high degree of requirements flexibility. When requirements are rigidly fixed, fewer COTS products can be used.

- **COTS Implementation can Span Several Development Phases, and Can Create “Color of Money” Issues.**

A COTS implementation effort can span from systems development through sustainment and disposal, and can include everything in between. However, different program phases use different types of appropriated funds, e.g., RDT&E, and Procurement (“colors of money”). Funding in mature programs can be an issue when the RDT&E money is not available to do the required integration and testing of COTS components (Campbell 2007).

As a model for the future, these two programs could enable the services to take advantage of the commercial-sector technology and related R&D efforts. Although not without some challenges, these programs have proved that COTS components can be successfully integrated into weapon systems, providing rapid system updates, improving operational capabilities, and driving down recurring costs.

IV. A COTS Weapon System—Light Utility Helicopter (LUH)

In this case, we examine the Army’s acquisition of an unmodified, commercial helicopter to fill a mission support role.

A. Introduction



As the Cold War wound down, the Army had a fleet of nearly 9,000 helicopters. Although the Army has reduced its fleet over the past 20 years to its current size of approximately 3,500 aircraft by eliminating many of its older helicopters, most of the remaining helicopters either exceed, or soon will reach ages

greater than the Army considers practical. The Army has embarked on a modernization plan to address this critical need that will replace or significantly upgrade nearly every helicopter in the fleet by 2030.

In 2003, the Chief of Staff of the Army directed a review of Army Aviation, and the future appeared bleak. Over 120 helicopters had been lost in military operations in Iraq and Afghanistan—proving they are under-powered for hot weather and high-altitude flying. At the same time, the Comanche helicopter program was experiencing significant cost growth, and would deliver only a fraction of the aircraft needed to recapitalize the Army's rotary-wing fleet (Axe 2006).

In February 2004, the Army opted to cancel the RAH-66 Comanche armed reconnaissance helicopter. At the time, the Army had already spent approximately \$8 billion; the unit cost of the helicopter had grown from \$12 million to almost \$60

million each (the total program would have cost the Army almost \$40 billion). This was after the procurement was reduced to 650 helicopters, down from more than 5,000 originally planned. (CNN.com 2004)

With more than \$14 billion in reprogrammed Comanche funds, the Army launched a pair of new acquisition programs: the Armed Reconnaissance Helicopter, or ARH, and the Light Utility Helicopter, or LUH. The ARH program was intended to replace aged, underpowered OH-58D Kiowa Warrior scout choppers that have suffered nearly 30 losses in Iraq with 369 new aircraft worth more than \$2 billion. 322 LUHs costing \$1.7 billion would replace the last of the service's Vietnam-era Bell UH-1 Huey transports and Bell OH-58A/C observation birds and free up Blackhawks for combat missions. (OSD Comptroller i-center 2007; Axe 2006)

The Army then decided to reprogram some of the remaining funding to begin replacing its utility helicopters (utility helicopters are smaller, used primarily for transport, and are broadly distributed across the Army's force structure). Approximately half of all the Army's helicopters are utility helicopters. More than 1,600 of that group are the newer UH-60A and UH-60L Blackhawks; the rest are various versions of the Vietnam-era UH-1s (the infamous Huey). The objective of this program was to replace these old UH-1s along with the OH-53C Kiowa observation helicopter, both of which were being retired. Thus, program change from the Comanche also included procuring 322 LUHs (Barrie, Butler, and Wall 2006). The Army National Guard will receive the majority of the 322 new aircraft. The UH-72A Lakotas will replace UH-60 Black Hawks; these aircraft will be transferred to the National Guard for operational missions. To meet the short timeline available, the Army opted for a COTS solution.

B. The Acquisition

The mission for the LUH was to conduct general (light) support, civil search and rescue, personnel recovery, medical evacuation (medevac), casualty evacuation, limited civil command-and-control operations in the conduct of



homeland security, and counterdrug operations. The LUH is intended to perform these functions only in permissive, non-hostile, noncombat operational environments (Gourley 2008). The procurement of a commercial aircraft was intended to significantly shorten the acquisition cycle, as well as eliminate development costs and reduce lifecycle logistics and support costs.

Early on, the Army decided that a key requirement was for the aircraft to maintain its FAA-certification. This means that the flight crews and maintainers will need to be FAA certified. This is generally not an issue for flight crews (they generally can receive their FAA certification based on their military ratings), but may mean additional training and testing for maintainers. FAA certification also required the aircraft to meet a host of standards which focus on occupant safety and aircraft survivability. Since the Lakota would only fly in permissive environments, these were deemed sufficient by the Army. These requirements include crashworthy seats, restraints, fuel systems, noise reduction, dual redundancy of critical systems, and Instrument Flight Rules (IFR) certification. Moreover, FAA certification will mean that the Army will exchange military and commercial parts, and, as a result, be able to leverage within the commercial global supply chain (Hutcherson 2007). The US announced its intention to issue a draft request for proposal for a full and open competitive procurement that satisfied its requirement for a light utility helicopter in late 2004.

C. The LUH Contract Award

After reviewing the four proposals⁶, the Army selected the UH-145—proposed by European Aeronautic Defence and Space Company North America (EADS NA) in late June 2006—as its next-generation LUH. As an in-production helicopter with FAA IFR certification, the UH-72A met the Army's COTS acquisition strategy for LUH. The initial order covered only eight helicopters, but if all 322 aircraft were procured, the potential total program lifecycle value was more than \$2 billion.

⁶ The other competitors included MD Helicopters/DynCorp (the MD Explorer), AgustaWestland/L-3 Communications (the US139), and Bell Helicopter Textron (the 412EP), after Lockheed an MDHI found that a combined bid would not meet the Army's price targets, and the partnership was dissolved (Phillips 2006).

The EADS NA-led team included four primary partners: its American Eurocopter business unit, which would handle the helicopter's production, assembly and delivery; Sikorsky Aircraft, to manage contractor logistics support; WestWind Technologies, for systems integration and engineering support; and CAE, to supply UH-145 cockpit procedural trainers. EADS NA announced that industrial activity for UH-145 will be centered at the expanded American Eurocopter's Columbus, Mississippi, facility. "The Production line of the UH-145—a version of Eurocopter's EC145 multi-mission helicopter, currently built in Germany—will be duplicated in Columbus through a series of steps that begins with partial assembly, followed by full assembly and the subsequent US manufacture of major subsystems." (Gourley 2008; EADS North America 2006a) EADS NA officially delivered the US Army's first UH-72A Light Utility Helicopter on December 11, 2006, four months ahead of schedule (EADS North America 2006c).

In early November 2006, EADS NA announced that the US Army ordered 34 additional UH-145 Light Utility Helicopters, bringing the total number of aircraft purchased by the Army to 42. The value of the new order is \$170 million (EADS North America 2006b). Later, on May 22, 2007, EADS achieved the "first unit equipped" milestone. This was accomplished by providing six helicopters to the National Training Center Air Ambulance Detachment at Fort Irwin, CA (Staff 2007). Finally, on August 23, 2007, following a review of program management, production, manpower, logistics and other aspects of the UH-72A program, the Army approved full-rate production for the UH-72 Lakota. Through that date, the company had delivered 10 UH-72As, all of which had been delivered ahead of schedule (EADS North America 2007).

The procurement also has a "staggered" delivery schedule during the first ten scheduled years. The number of aircraft was determined based on the minimum the Army needed balanced against what the contractor could provide. These requirements produced a schedule of 44 helicopters in FY2008, approximately 40 in FY2009, 26 in FY2010, 19 in FY2011, and 43 in FY2012 (Hutcherson 2007).

The award to EADS North America and its Eurocopter division was significant for several reasons. First, it was a large commercial buy of an Army weapon system

(although the UH-72 is not the first government-related helicopter contract for EADS—they currently supply rotorcraft to the Coast Guard and the US Customs Service). Second, the contract was awarded to a foreign-owned company; programs that were, in the past, the exclusive ground of US suppliers are now opening to overseas competitors—providing welcome competition to the narrow base of the remaining US defense firms (Barrie, Butler, and Wall 2006). Although, the aircraft and all supporting equipment could be produced in Europe, to comply with the *Buy American Act*,⁷ the final assembly would be done at the EADS Mississippi facility (Hutcherson 2007). Third, the program leverages the strength of US firms, Sikorsky Aircraft Corporation, teamed with EADS to provide logistics support for the LUH program (Barrie, Butler, and Wall 2006).

The program was to be structured in such a way that the winning contractor would supply engineering support, training and procurement services, and parts and depot maintenance. This enabled the Army to leverage the extant commercial resources, which should reduce cost and turnaround times and free up the Army personnel to focus on high-priority mission areas. The contract was structured to provide two types of contractor logistics support (CLS). With the full CLS, the contractor is responsible for all maintenance and supply support. The other variation is a hybrid CLS, in which the contractor is responsible for supply support while the Army is responsible for aircraft maintenance. With either of these options, the aircraft would be returned to the contractor for the required depot maintenance. The contractor would also develop and conduct the required aircrew and maintenance training (Hutcherson 2007).

D. Lessons Learned

- **COTS procurement meets cultural resistance.**

There still remains resistance to the procurement of a COTS helicopter. Much of the difficulty was the result of the decision to maintain the FAA certification. This meant that the Army's Airworthiness Directorate was, for the most part, bypassed. The provision of training by the contractor and the requirement for

⁷ The *Buy American Act* was passed in 1933 by the US Congress, mandating preferences for the purchase of domestically produced goods in direct procurements by the United States government.

FAA certification meant the training staffs had less input. Training had to accommodate both Army needs, as well as those of the civilian students that would sit in class, side-by-side with the Army's students. The Army could have the contractor bid on "Army-only training," but this would increase the time required, the amount of preparation, and the resources needed. Finally, all modifications must obtain a Supplemental Type Certificate (STC) from the FAA. These new processes modified long-term, well-established procedures, and naturally met with cultural resistance and organizational resistance.

The fact that the UH-72A was based on a design by a European-based company created a level of resistance on a different level. Representative Duncan Hunter (R-CA), a long-time advocate of Buy-American legislation, urged the Secretary of the Army to kill the program when some minor technical issues were identified with the initial aircraft. He believed that the Army would be better off if it purchased additional Blackhawk helicopters. Hunter stated in a letter to the Army Secretary, "In my view we would be well advised to terminate the planned buy of 322 Lakota helicopters and purchase instead additional Blackhawk helicopters" (Pahilajani 2007). The Army opted to just fix the problem and proceed as planned.

- **Acquisition policies are not structured to buy COTS.**

The LUH experience highlighted issues with the acquisition policies with regard to procuring major COTS systems. The then-Assistant Secretary of the Army for Acquisition, Technology, and Logistics, Claude Bolton, went so far as to admit that the Army has "no policy for buying COTS today." For example, once the decision was made to go with a COTS aircraft, the requirements had to reflect aircraft that were currently being produced, so users could not ask for capabilities beyond those of helicopters in production (Morris 2007).

Another example was the challenge of acquiring this system using the Joint Capabilities Integration Development System (JCIDS) process, which this program followed. The LUH's Capability Development Document was approved

in June 2005, and received Milestone C approval in June 2006. However, for the program to move past Low-Rate Initial Production (LRIP) required a “beyond LRIP report.” The foundation for the “beyond LRIP report” is the System Evaluation Report. However, this report is a product of Initial Operational Test and Evaluation (IOT&E), and requires a safety confirmation. To get a safety confirmation requires developmental testing. But, since the LUH was commercially produced, it was not a developmental system, and shouldn’t have required developmental testing. However, the program had to do some developmental testing to gain all the requisite approvals and move forward, since Army officials would not “sign off” until all the requirements were fulfilled (Brashears 2007).

One of the prominent themes is how the COTS items or systems are purchased, because money is assigned a certain “color.” Similar to what was discovered with the E-2 Hawkeye, COTS-type systems tend to span several phases of procurement and, therefore, have to be paid for with different types of acquisition money. This includes development dollars, testing dollars, logistics support dollars, etc.

- **Eliminating system development saved significant time and budget.**

A clearly unique feature of the LUH program was the delivery time. By procuring a COTS helicopter, the Army significantly shortened the acquisition cycle time, eliminating the expensive development phase. The first UH-72As were delivered to the Army less than six months after contract award with a total RDT&E cost of \$3.3 M (the UH-60 took over 6 years to develop with an RDT&E cost of \$1.698 B in 2007 dollars) (EADS North America 2006c; CBO 2007). The second delivery was on December 20; the third was on January 30, 2007. The second and third helicopters were also delivered three months ahead of schedule (EADS North America February 6, 2007). The initial rate of production was scheduled to be one helicopter per month. This was to increase to two per month, and peak at five per month in 2009 (Roosevelt 2007). Evidence that the program was reliable occurred when the Army granted EADS the ability to go to

full-rate production on 23 August 2007. Up through that time, the Army had ordered 42 of the helicopters; ten had already been delivered, all ahead of schedule (Roosevelt 2007).

The shortened timeframes also reduce costs. Additionally, when the decision is made to go with COTS, and if the program stays with COTS, the development costs are known and are paid for up-front.

- **Buying COTS leverages commercial logistics support/capabilities.**

Maintaining the FAA certification will permit the Army to leverage the global commercial supply chain and support structure. If, for example, a transmission is returned to the contractor for a rebuild, it can be sold to any user. If this wasn't the case, the Army would have to maintain its own inventory of Army-only transmissions. During the system's lifecycle, using commercial parts and commercial suppliers should result in improved availability and significant cost savings.

- **Buying COTS requires flexibility and prioritization of requirements.**

The intent of the LUH program was to replace several different utility helicopters that included, primarily, the OH-58 A's and OH-58 C's (3,200 pounds max gross weight), some UH-1's (9,500 pounds max gross weight), and in some cases, Blackhawk helicopters (22,000 pounds max gross weight) (Brashears 2007). The competition for the LUH included aircraft with a maximum gross take-off weight that ranged from 5,000 pounds up to 14,000 pounds. Some of the aircraft initially proposed had features that weren't required, such as a retractable landing gear. Consequently, when buying a COTS system, the program has to prioritize and maintain the maximum amount of flexibility of the user's requirements in order to include as many competitive systems as possible.

Furthermore, when considering changes to the baseline aircraft, the program office, to the maximum extent possible, must look to commercially available modifications. When, for example, the need for floats was identified, the program

found that commercial floats were available that did not require any development. Secure communications was one exception, since civilians don't do secure communications; consequently the Army's ARC-231⁸ radio was added.

Since the aircraft wasn't built to military specification, some minor issues were discovered during testing. In November 2007, the Lakota helicopter experienced problems operating in high temperatures. Flight tests of six of the Lakotas in Southern California showed that the temperatures in the helicopter's cockpit rose to 104 degrees (although the outside air temperature was in the 80s). Although no cockpit equipment failed during the nearly 23 hours of testing, the Army concluded that the aircraft "is not effective for use in hot environments." The Army will remedy the issue by retrofitting the aircraft with air conditioners at cost of approximately \$10 million (Davis 2007).

UH-72A Conclusion

Although the operational effectiveness of the UH-72A is still being demonstrated, (since it has just recently been delivered to operational units), from an acquisition standpoint, the experience with using COTS has been very positive—especially in light of the fact that the Army was able to get them so quickly. Moreover, since all four teams offered helicopters that were capable of fulfilling the mission requirements, the competitive pressure enabled the Army to obtain the best-value solution.

Using COTS in this instance was a major paradigm shift for the Army. With this COTS strategy, the program was limited to procuring that which is already available from commercial sources. These aircraft were not designed to meet peculiar military specifications. But rather, as the Army demonstrated, the aircraft could meet all the mission requirements with minimal modifications—and at a fraction of the cost of developing a new helicopter.

⁸ AN/ARC-231 is an airborne Very High Frequency (VHF), Ultra High Frequency (UHF), Line-of-Sight (LOS) and Demand Assigned Multiple Access (DAMA) Satellite Communication (SATCOM) communications system.

V. Major COTS Software Systems

The Department of Defense is in the midst of a massive transformational effort to upgrade and modernize its business systems and data. Although some of these initiatives are limited to a single system, in many cases, organizations have found that to “transform” they had to address changes on an enterprise-wide level, using “enterprise resource planning” (ERP) systems. These systems, developed commercially, use multiple software and hardware components to integrate an organization’s business data and processes into one system. They are particularly desirable in that they automate end-to-end business process execution—not just individual functions that then must be integrated with other systems, but complete end-to-end processes. As a result, they simplify synchronization of data across an enterprise. The DoD’s ERP implementations are among the largest and most complex ever undertaken, with an unprecedented size and scale.

As these two cases will illustrate, even with the advantages that COTS systems have to offer, implementing large-scale ERP’s can be very challenging.

A. Defense Integrated Military Human Resources System (DIHMRS)

Background



The 1991 Persian Gulf War highlighted many problems with the military services’ personnel systems. The services were using a hodgepodge made up of hundreds of 20- to 30-year-old legacy personnel and pay systems that were not integrated or were non-interoperable.

This inefficient and out-of-date method for processing and sharing information

created many problems. In general, the military services were unable to provide timely or accurate data on deployment mobilization and in-theater assets. Joint operational commanders were unable to get information on the location of deployed military personnel, making it difficult to assess operational capabilities or to effectively select people with needed skills. Individual service members had to deal with inaccurate and often incomplete personnel records. These errors and omissions often generated errors in pay, benefits, and service credit—especially for reserves as they mobilized to active duty (Defense Science Board 1996a). In the Army, for example, multi-component units (those made up of soldiers from active duty, the National Guard, and the Army Reserve) had to deal with six different personnel systems and three pay systems. Differences in processes and data made, and continue to make, oversight and management difficult at all levels (Swatloski 2007).

The Under Secretary of Defense for Acquisition, Technology, and Logistics convened a Defense Science Board Task Force in February 1996 to advise the Secretary of Defense on the best strategy for supporting military personnel and pay functions (Kaminski 1996). The Task Force concluded that the DoD multiple, Service-unique military personnel and pay systems caused significant functional shortcomings (particularly in the joint arena), and excessive development and maintenance costs. To address these shortcomings, the Task Force recommended that the DoD transition to a single, all-Service and all-component, fully integrated personnel and pay system—one with a common-core software built on a COTS human resource software application base (Defense Science Board 1996a).

The Task Force was tasked to analyze several items; one of the study areas was examining the feasibility of reengineering one of the Services' existing systems and adopting it as the standard in lieu of pursuing a COTS-type solution. However, the Task Force eventually came to the conclusion that pursuing a COTS-based solution was the best choice because it was supposed to serve all branches of the military. The Task Force also pointed out that, while the essential requirements have to be fulfilled, the final product would include modified items “without adversely impacting the function.” The Task Force estimated that using a COTS-based system would bring about some of the

usual COTS-results, including ease of maintenance, the potential for future development, and the use of best practices to produce efficiencies. Costs would also be reduced (Defense Science Board 1996b).

At the time, several Service branches were either completing or planning upgrades to their own personnel systems. The Air Force was engaged in modernizing its current system, one that was partially based on COTS. It could potentially be utilized in the “objective” system. The Navy and Marine Corps were both planning upgrades, and the Army had completed the development phase to its infrastructure upgrade (Defense Science Board 1996b).

The Task Force concluded several things about the underlying components of the system, one large concern being adequate infrastructure. The infrastructure includes hardware, the data, the networking, and the operating system. The Task Force determined that:

- “all components must comply with the Defense Information Systems Agency (DISA)-specified Common Operating Environment (COE) guidelines;
- hardware and components must be platform independent;
- DoD standard data definitions must be used;
- Commercial Off The Shelf (COTS) support software and tools should be used whenever possible, in addition to applications; and
- software development must be modular.”(Defense Science Board 1996b)

In response to this mandate, the Joint Requirements and Integration Office (JR&IO), (now Personnel and Readiness Information Management), and the Joint Program Management Office (JPM), (now Enterprise Program Management Office (EPMO), were tasked to manage the requirements and implementation of the new system, named the Defense Integrated Military Human Resources System (DIMHRS). DIMHRS was viewed as an opportunity to plan, develop, and implement military personnel and payroll modernization with the overall DoD objective of establishing an integrated military personnel and pay system.

This system would be used by all the Services and provide both personnel and pay services using a simple, efficient capability that would be available to all individual Service members. This capability would be in addition to advancing headquarters functionality. The initial operating capability (IOC) was scheduled for 2003, with an emphasis on purchasing a COTS-type product (DIMHRS Initial Analysis Team 2001).

The Mission Needs Statement for this integrated system was approved by the Under Secretary of Defense for Personnel and Readiness on February 24, 1998. It addressed a single, fully integrated, all-Service, all-Component, military personnel and pay management system (DoD IG 2003). The DIMHRS program's objective was to streamline pay and personnel systems, using an enterprise-wide approach, for all uniformed members. It is intended to be an integrated, all-Service, all-Component, military personnel and pay system that will support military personnel throughout their careers and into retirement, in both peacetime as well as war. The program would use a common-core software, built on a COTS human resource software application base.

In March 2001, PeopleSoft was competitively selected as the COTS platform for the DIMHRS implementation. Then, five \$1 million firm-fixed-price contracts were awarded to the following firms for formulating plans and submitting them: Computer Sciences Corp., Falls Church, VA; IBM Corp., Bethesda, MD; Northrop Grumman Information Technology, McLean, VA; Lockheed Martin Systems Integration, Owego, NY; and PricewaterhouseCoopers Consulting, Fairfax, VA., in September 2002 (Dorobek 2002). Finally, in September 2003, Northrop Grumman won a competitive contract worth \$281 million to provide the Services with a single, integrated, human resource management system to support 3.1 million Service personnel. The DoD was committed to using the COTS product without modification, except where necessary to meet mission-essential requirements. Northrop Grumman would offer alternatives and recommendations for addressing functional "gaps" (requirements not supported by PeopleSoft). When operational, DIMHRS would replace or subsume approximately 80 legacy personnel and finance systems (Jackson 2003).

The program was extremely ambitious, with a scale not fully appreciated; as a result, it encountered technical, cost, and schedule issues. During July 2005, the Office of the Secretary of Defense (OSD) leadership team initiated a strategic pause, along with a “red team” review, to determine the program’s feasibility. In December 2005, the red team concluded that the DIMHRS program was viable and should proceed (DoD IG 2003). In December 2005, the Deputy Secretary of Defense decided to continue the program, but also reassigned it from the Navy to the newly formed Business Transformation Agency (BTA) (For a summary timeline, see Figure 3).

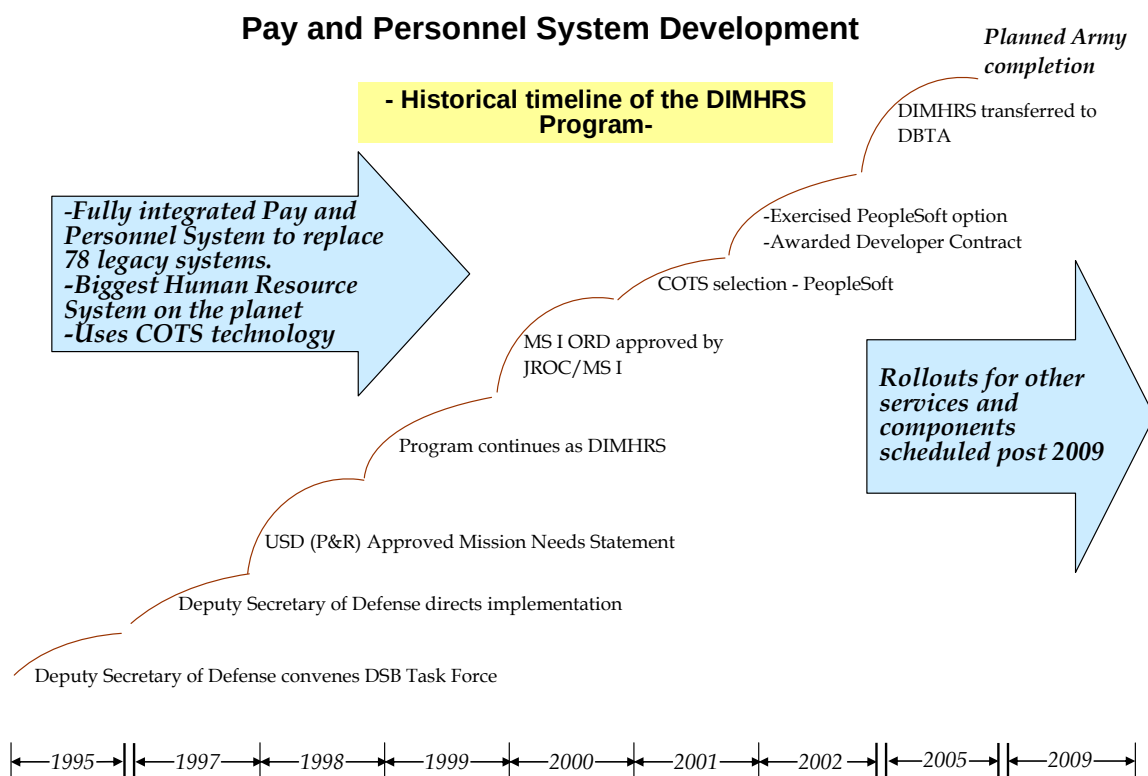


Figure 3. DIMHRS Timeline.

In January of 2006, the BTA began re-evaluating whether one single HR system was the best solution for the military (Tiboni 2006). While the Army and the Air Force believed DIMHRS would meet their needs, the Navy continued to implement its own system. In

June 2006, after completing a feasibility assessment, the Navy expressed a preference to use Marine Corp's Total Force System (MCTFS) rather than DIMHRS. The Defense Business Systems Management Committee (DBSMC), however, decided that it was in the best interest of the DoD "for the Navy to join the other services in migrating to DIMHRS."

The first phase of DIMHRS is scheduled to roll out in mid-FY 2009 for the Army, Army National Guard, Army Reserve, Air Force, Air Force National Guard and Air Force Reserves (Swatloski 2007).

System capabilities

When implemented in FY 2008, DIMHRS will provide each Service member with a single, comprehensive record-of-service which can be updated by him or her. These records can also be viewed 24 hours a day, 7 days a week, by Service Personnel Chiefs, Combatant Commanders, military personnel, and pay managers. A user will be able to initiate requests for assignments, training, retirement, record updates, and many other personnel and pay actions—without the need for traditional, time-consuming and costly written or verbal processes. The system will provide for real-time functionality in a paperless environment.

DIMHRS will have a core system (comprised of software and databases) that provides support to processes that are common to all components and services (See Figure 4). This core system will collect, store, pass, process, and report personnel and pay data for all DoD Active Duty, Reserve, Guard, and retired personnel. PeopleSoft provides the COTS product that serves as the foundation of DIMHRS. "The Pentagon has resisted efforts to tweak the DIMHRS code to its own specifications, which means that the application will be a true commercial system," BTA Director Fisher said (Sprenger 2007).

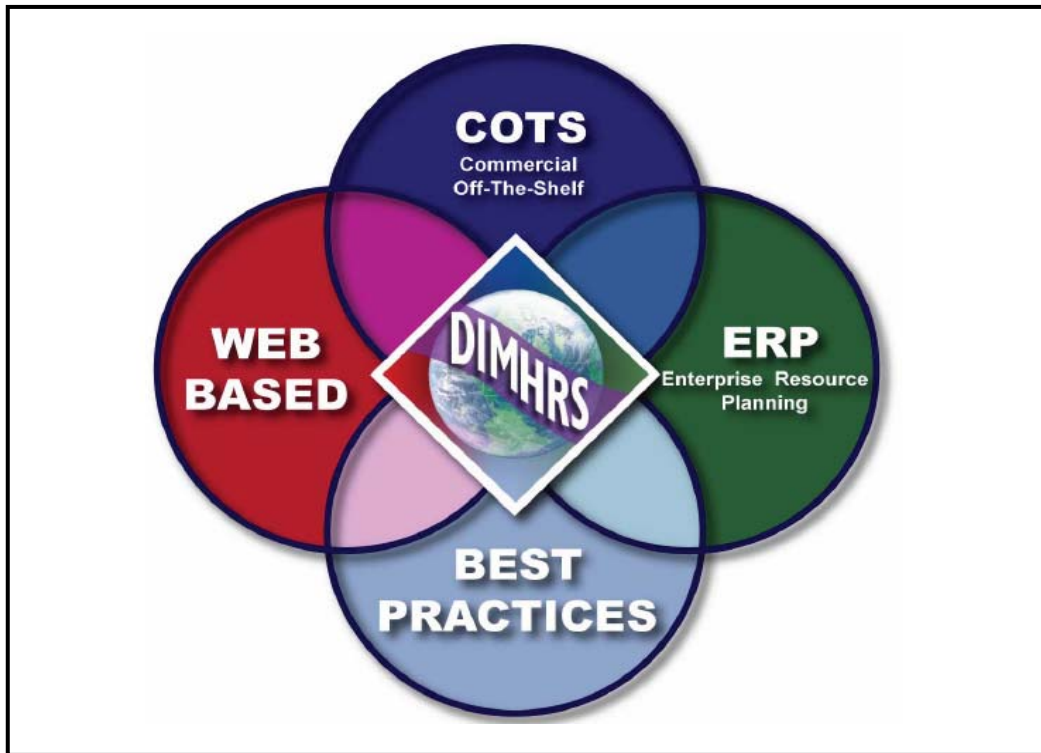


Figure 4. Enterprise-wide Design Methodology. (Swatloski 2007)

Program Management

Implementation of the program is the responsibility of the DoD's Business Transformation Agency (which operates under the authority of the Under Secretary of Defense for Acquisition, Technology and Logistics (USD (AT&L)), Defense Business Systems Acquisition Executive (DBSAE) (Office of the Under Secretary of Defense for Personnel and Readiness 2007). As explained above, PeopleSoft, recently purchased by Oracle, was selected to provide its Human Capital Management system as the COTS application, and Northrop Grumman was selected to provide systems integration.

Results

When fully implemented, DIMHRS will provide significant benefits to the Service members, their families, the Services, as well as the Combatant Commands. Among these are, first, significantly reducing the occurrence of human errors and lost records,

thus improving the overall quality of service the military members and their families receive (Swatloski 2007).

Second, the system will allow Service members to serve anywhere, with any branch of the Service, and still have the ability to handle the administrative functions of their personnel records as if they were serving on their home base (Swatloski 2007).

Third, Service members who move from one Service to another will find that DIHMRS eliminates the inefficient, error-prone Service processes through which data are manually reentered into a new component system (Hopkins 2006). Moreover, in multi-component units (active duty, reserve, and national guard), personnel officers may have to deal with as many as six different personnel systems and pay systems—DIMHRS would cut the interface to one.

DIMHRS Summary	
<i>“The particular system will be the largest rollout in the history of the planet...”</i> MGen Carlos “Butch” Pair, Business Transformation Agency	
Functionality	Implementation
a. DIMHRS is a fully-integrated personnel and pay system b. DIMHRS offers Web-based, 24/7 accessibility c. Improved customer service d. Offers combatant commanders seamless strength management and accounting e. Allows greater flexibility through self service capabilities f. DIMHRS will subsume multiple legacy systems and databases g. All Business Processes were completely redesigned to eliminate redundant workload and provide the desired results	a. DoD-directed implementation; Army is first--This turn-key implementation is scheduled to take place in March, 2009 using a Big Bang approach (i.e., the entire Army will implement at one time) b. Simultaneous, multi-component fielding of the system c. Commercial product that uses commercial terms, not military (e.g., Soldier = employee) d. Air force initial operating capability later in 2009

Figure 5. DIMHRS Summary.

Fourth, it will help the war planners. Commanders will not only be able to look to a single source for reports and analysis, but will also have the ability to locate soldiers with special qualifications, initiate real-time requests and determine where they have served, particularly in joint combat environments (Swatloski 2007). For example, a commander may want to locate a soldier qualified with Stinger missiles or one that is proficient in Pashto. Finally, from an enterprise perspective, DIMHRS will allow the incorporation of commercial best practices, accelerating the transformation of the critical human capital function (Swatloski 2007).

Key Challenges

Cultural Issues

Because DIMHRS will support all branches of the military, the system integrators have to work with all the Services and their components, all with their own cultures, to create a successful, integrated system. Besides the implementation issues, there are many skeptics that still believe that DIMHRS will not be successful. At an Armed Forces Communication and Electronics Association (AFCEA) conference in Washington, DC, in January 2006, Paul Brinkley (the BTA Director) asked how many believed that DIMHRS would succeed. No one in the audience raised his hand (Tiboni 2006). The BTA stakeholders will need to sponsor training and use all available change management techniques to promote the necessary cultural change within the military services.

Scale

The DIMHRS implementation will be an order-of-magnitude larger than previous similar systems. The largest PeopleSoft implementation through 2003 had 300,000 individuals' records. By contrast, when fully operational, DIMHRS will maintain the records for 3 million people (Washington Technology October 1, 2003).

Comparative Size of Initial DIMHRS

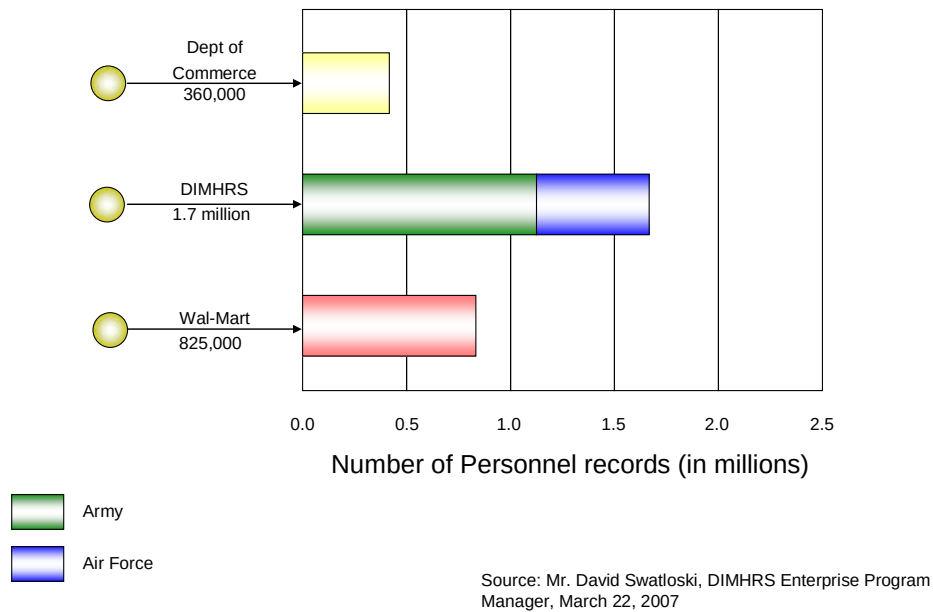


Figure 6. Comparative Size of DIMHRS with Just Army and Air Force Implementation.

Moreover, an inventory of human resource business systems in February 2005 identified the total number of 713 systems (GAO 2005). At that time, the plan was to partially or fully replace 113 of these systems—integrating that number of legacy systems into one core-operating platform is a significant challenge. Now, the current enterprise transition plan states that DIMHRS will subsume or interface with over 290 information systems in the first phase across the Army, Air Force and Defense Finance and Accounting Service (US Department of Defense 2007) (Swatloski 2007) (see Figure 6). This level of integration creates many known and unknown problems and presents a significant challenge.

Scope Creep

Other lessons learned from DIMHRS are that the requirements should be constantly monitored to avoid “scope creep.” Also, a project on the scale of DIMHRS requires large

amounts of commitment among all of the stakeholders involved. More results on the DIMHRS use of COTS will become available as the system is deployed over the next five years.

Ambitious “Big Bang” Approach

The DIMHRS implementation, with an objective of trying to replace all personnel systems with one single “mother” system, is extremely challenging and ambitious. Since it was to be a COTS-based system, it was also assumed implementation would be quicker. In 2001, it was assumed that the system would be deployed by 2003 at a cost of \$ 6.5 million. However, in 2003, when Northrop Grumman was awarded the contract for development and implementation, it was expected to last through 2013 and cost upwards of \$ 500 million. The modernization effort was not seen for what it eventually was—an extremely challenging implementation of a technology system to replace dozens of old legacy systems and create the largest pay and personnel system in the world. Referring to the business modernization effort to use a single system to replace large numbers of existing systems, Paul Brinkley remarked “We’re always trying to hit a home run” (Tiboni 2006). Part of this approach to transformation has now been modified with the BTA’s new, “small milestones” strategy. But, goals and schedule are still very ambitious, and the program will have to be aggressively led and managed.

B. Business Systems Modernization

The Defense Logistics Agency (DLA) is the combat support agency responsible for the distribution, reutilization, marketing, disposal, tracking, and storing of over five million items of inventory that supply the military services and several civilian agencies with the critical resources they need to accomplish their worldwide missions. The DLA is tasked to provide this wide-ranging logistical support



during peacetime, for emergency preparedness and humanitarian missions, and most importantly for wartime operations. The DLA currently handles 54,000 requisitions per day that support 1312 weapon systems. During FY 07, the DLA provided more than \$35 billion in goods and services worldwide (DLA 2008). In short, DLA logistics support is a huge component of everything the Department of Defense accomplishes.

In 1999, about the same time corporations were beginning to see the significant gains that could be achieved by improving logistical processes, the DLA tasked itself with completely renovating its logistics system—the result was the Business System Modernization (BSM) Program.

The BSM program sought to replace mainframe-based legacy systems. It now allows the DLA to track product deliveries, budgets, demand projections, and supply schedules in real-time. The DLA's vision was to provide the material that its military customers actually need, in the amount that they need, when and where they need it.

Background

In November 1999, the DLA initiated an effort to replace its materiel management systems. The BSM initiative would replace the two legacy systems that the DLA used for over 30 years to manage its inventory—the Standard Automated Material Management System (SAMMS) and the Defense Integrated Supply Management System (DISMS). These two programs still functioned as batch systems, making real-time updates and information unavailable. By the end of the 1990s, they had become outdated and were very costly to maintain, and the DLA decided these systems could not be adequately modified for the long-term (Lucyshyn 2004). BSM is an Enterprise Resource Planning (ERP) and Supply Chain Management system that will replace the agency's legacy systems with a state-of-the-art system (both business processes and technology)—linking the entire supply chain between customer and supplier.

Obsolete, legacy computer systems were not the only issues the DLA was facing. Its own processes, prior to the BSM reengineering, contributed to its inefficiencies. At that time, when dealing with customers, the DLA maintained an “arms-length”-type

relationship with its customers. The agency organization and focus was centered on supply items that were grouped into Federal Supply Classes. These items were ordered, stored, and managed by item managers. The DLA's focus was concentrated on the supply items, rather than on the needs of the customers. Estimates, or orders placed, were done by "item managers" based on history and what was on hand, not on future requirements. Furthermore, customers were not charged until items were requisitioned and delivered and, consequently, did not suffer any penalty for inflated requests. These processes resulted in the stockpiling of items, which then had to be stored and warehoused by the agency. In the 1990's, DLA officials began to acknowledge that they had to find a better way to service their customer's real requirements (Lucyshyn 2004).

The DLA viewed this not only as an opportunity to upgrade its technology, but also as a catalyst to transform the DLA by fielding "best practices." BSM was intended to transform how the DLA conducts its operations in five core business processes: order fulfillment, demand and supply planning, procurement, technical/quality assurance, and financial management. It was also believed that BSM would improve the DLA's capability to manage its supply chain (factory to foxhole); improve its service by focusing on customer and supplier relationships; and, at the same time, provide the training, experience, and opportunity to its employees so they could succeed in this new environment (DLA 2002).

The DLA made the decision to use a COTS-based solution, to leverage commercial development and future upgrades as well as, to the extent possible, to use the commercial best practices embedded in the software. The new system was also to be based on several COTS systems. The first was an Enterprise Resource Planning (ERP) system developed by SAP. This would be responsible for fulfilling orders, procuring the supply items, and managing the finances. The "add-on" COTS system—Manugistics' Advance Planning and Scheduling System (APS)—took care of the demand and supply planning. The new system also established the role of the "Demand Planner." Demand Planners were responsible for interacting directly with customers to help determine their needs. The Supply Planner was another new function and centered upon inventory analysis and planning.(Lucyshyn 2004) The commercially available business software solution makes

it possible to provide consistent and timely information for decision-making and performance measurement; automates and integrates business processes; produces and accesses data in a near-real-time environment; and shares common data across the enterprise. BSM allows the DLA to make the move from being a manager of supplies to the much more effective manager of supply chains.



The BSM program employs several concepts that help make COTS systems and components successful. These include: ensuring all those involved are supportive of using COTS products; making plans to train new users on new components and systems; and fostering partnerships during all implementation stages. The BSM

program also saves large amounts of time and money by using COTS—development is already accomplished by the vendor and, therefore, previously paid for. The system is designed to be “at the leading edge” and be flexible enough so it can be easily updated. These are staples among COTS systems and components. Previously, all DoD systems of this nature had been developed internally; procuring the BSM system in this fashion signaled a major culture shift. (Lucyshyn 2004)

Results

The initial concept demonstration of BSM was in July 2002 and included only low-volume, low-dollar value items from all non-energy categories managed by the DLA.⁹ The objective of the small deployment was to demonstrate a fully operational system, yet to be small enough to manage risk. The demonstration ended in August 2004, with 470 users and over 170,000 inventory items (General Accounting Office 2004).

⁹ BSM was deployed at the Defense Supply Center Columbus—Columbus, OH, the Defense Supply Center Philadelphia—Philadelphia, PA; the Defense Supply Center Richmond—Richmond, VA; the Defense Distribution Center—New Cumberland, PA; the DLA Logistics Information Service—Battle Creek, MI; and DLA headquarters—Fort Belvoir, VA.

In August 2004, after the Concept Demonstration phase, the DLA implemented BSM Release 2.0. This release incorporated more functional areas in the DLA's business operations; and, after the favorable results from the Initial Operational Test and Evaluation, the system reached IOC in January 2005. All initial functional requirements were operational by December 2005, and releases during the next year completed the approved BSM system. Now that it is fully operational, the DLA has approximately 8000 system users that manage more than 5.2 million DoD items of supply, accounting for more than \$18 billion in annual business (Department of Defense 2007).

Although the BSM development encountered some operational problems, such as incorrect information on customer orders, customer orders never being sent, and vendor invoices not being paid in a timely manner, the system achieved Full Operational Capability (FOC) only six months late and only 11% over its budget (\$764M to \$850M) (General Accounting Office 2004).

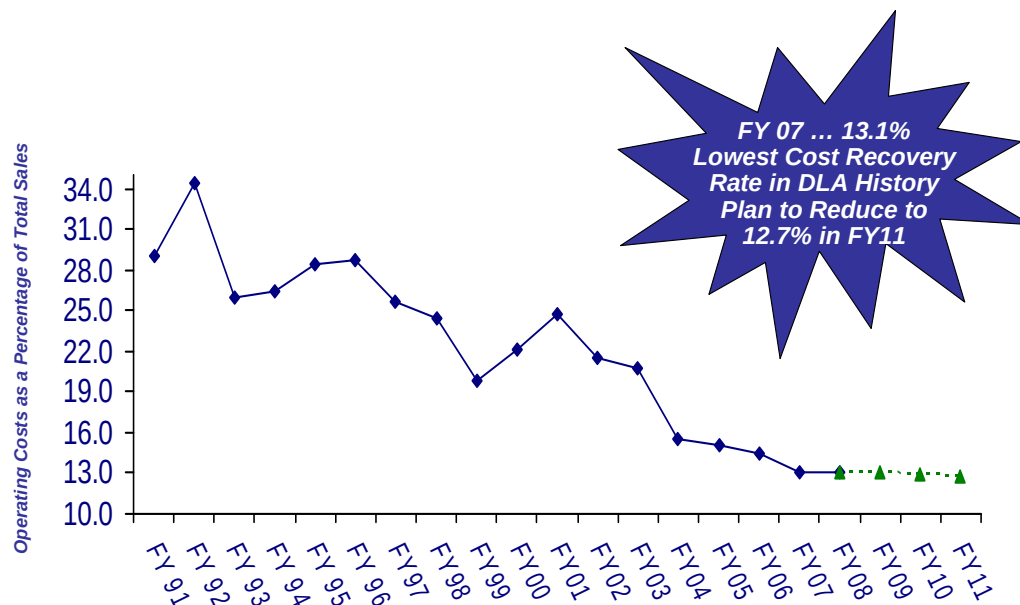


Figure 7. Cost Recovery Rates over Time (Operating Costs as a Percentage of Total Sales)

Significant achievements include:

- Cost of operations (represented in the cost-recovery surcharge to its customers) has been reduced from 22.1% in FY00 to 13.1% in FY07 (See Figure 7).
- Average order processing time has been reduced from frequently exceeding one work day in FY00 to under 4 hours in FY07.
- Overall material availability has improved from 88% in FY00 to 92% in FY07.
- End-of-year financial close-out time was reduced from 2 weeks in FY00 to one day in FY07.

Lessons Learned

- Senior leadership support was critical.

From the inception of the program, the DLA worked with all stakeholders (to include the Office of the Secretary of Defense and the Military Services) to ensure their buy-in and continued support. Additionally, to transcend the inevitable changes in the political and military leadership, much of that responsibility for the transformation was vested in the hands of the career civilian leadership that would remain in place throughout the implementation lifecycle. To achieve this end, virtually every career Senior Executive Service (SES) civilian from across the agency formed what is now called the Transformation Executive Board (TEB). During the development of BSM, the TEB met every two weeks to discuss the issues facing BSM—sometimes these meetings lasted for hours. The senior leadership was actively working to make decisions to remove roadblocks to the implementation of BSM within business units. It then became the responsibility of these SES members to implement those decisions within their local communities (Lucyshyn 2004).

- Change management was critical to a successful implementation.

From the program's inception, the DLA recognized that this effort was more than just updating technology. To be truly effective, the objective had to be to

reengineer the processes and ultimately change the culture of the organization. Their tact was to ensure the users were included as “true partners” instead of being “mere recipients of the software.” And, since this program would impact everyone’s job, involving and engaging the workforce at all levels of the organization became invaluable and absolutely necessary for success. DLA leadership recognized that all DLA employees would impact at least one subset of all processes, and that much of the success of the BSM program would depend on people using the system. To achieve this result, the agency’s leadership had to commit to provide the required training and experience for the employees to succeed with the BSM (Carlson 2008)

- The system should be deployed incrementally with lots of testing.

The program adopted the approach of developing and fielding the system in small increments to a limited number of users. This allowed the developers to test the system extensively and incorporate system changes to correct deficiencies or improve performance (based on test results and user feedback) in support of the full-fielding decision. On the surface, this may seem inefficient; however, maintaining a single design approach may keep a program on schedule in the short term, but may not deliver what the user needs and will cost more in the long run (Carlson 2008).

- When possible, an organization should adopt the process embedded in the COTS.

When an organization decides to use a COTS-based system, it should be prepared to accept and adopt the embedded commercial best practices to the maximum extent possible. Otherwise, the software will have to be modified, increasing the development effort as well as complicating future upgrades. The organization should be encouraged to consider these commercial practices, as they can help it in its examination and reengineering of its internal processes. However, DoD developers must recognize that with some complex ERP projects, commercial practices may not always be the way to go. There are some instances, in fact, in which the government has the best practice (Falvey 2007).

The BSM program has been a success for the Defense Logistics Agency, in spite of the fact that during this major reengineering effort, the DLA had to support the military during the “Global War on Terror,” with its high operations tempo. One cannot help but conclude that the major cultural shift to a customer-centric approach has been a major contributor to the agency’s unfailing support. BSM was the catalyst for this dramatic change that revolved around information technology, but truly encompassed all elements of business transformation. The enabling COTS technology was a critical element.

VII. Findings and Conclusions

With the advent of the information revolution, the commercial marketplace—not the DoD—drives the direction and rate of innovation and development of many technologies that are critical to modern weapon systems. Greater use of these commercial technologies can enable the DoD to shorten development cycle times, reduce lifecycle cost, improve reliability and availability, as well as support a more robust industrial base. In many cases, if the DoD is to deploy state-of-the-art systems, there is no reasonable alternative—the DoD must use these commercial systems. This has long been recognized by DoD senior leadership, legislation, and policy.

The major programs we examined have generally been successful in building systems that realized the benefits of using commercial items. The implementation, however, takes careful planning and requires changes throughout the acquisition cycle; the subject of Commercial-Off-The-Shelf (COTS) remains complex and faces the following challenges:

- COTS vendors are driven by today's fast-paced market (characterized by highly volatile business strategies and market positions), not by the Program Office, which may have little, if any, impact. Commercial items and their availability are determined by profit and market share—as a result, designs and process are relentlessly changing. Moreover, the typical COTS suppliers' product lifecycle may be as short as 1-3 years, while the traditional defense system development cycle is 7-15 years. Furthermore, as a weapon system may be in the inventory for up to 40 years, there must be numerous technology refresh and insertion points. Finally, vendors may go out of business, merge with other companies, drop products—sometimes without any warning.

As a result, change is a constant. This can result in inconsistent and short-term availability, obsolescence of components, and unplanned integration and testing requirements. To cope, programs may require a separate funding line for technology updates so the program can insert newer, higher-performing,

and often less-expensive components. The rate of change, coupled with many different configuration permutations, requires that programs pay increased attention to configuration management.

- COTS hardware may not be designed to meet all military environmental requirements. Some parts may still have to be “militarized” to function properly in the required military environments or may react differently in a military environment. Additionally, after a component is qualified, vendors may substitute parts with little or no notice, thus requiring requalification.
- COTS software has some unique challenges. With commercially developed software, program staff may have a lack of insight into the code details and, as a result, may have less understanding of the code than they would have with internally developed software. Additionally, since many of these commercial software products are large and complex, they are often comprised of millions of lines of source code. This level of complexity precludes complete, unambiguous analysis of the code for security problems. Finally, COTS software products often have embedded processes; these may require process reengineering which, as the BSM case demonstrated, can actually be beneficial.
- “Color of money” conflicts can create problems. For example, COTS modifications may be bought with procurement dollars but may need some developmental testing, and the developer is not able to use procurement dollars for Developmental Test and Evaluation.
- COTS may lock the user into a proprietary technology. For example, if an organization adapts a commercial ERP system, transitioning to another developer’s ERP may be very costly, limiting the options and reducing the competitive pressure. The use of COTS items can also affect other system aspects. As illustrated by the Lakota, processes such as maintenance and training can be affected. Since the decision was made to maintain FAA

certification, the maintenance and training would have to be done in accordance with FAA, not Army, procedures.

- The last challenge relates to the culture of the DoD acquisition community, both within the government and the private sector. Most of the personnel and organizations have years of experience developing requirements-driven, specification-constrained, custom-designed and -built components and systems. Now, they are asked to incorporate constantly evolving, market-driven, commercial systems. In many cases, this fundamentally changes the work these personnel do and how they do it. In the private sector, as military-standard hardware is replaced by COTS, elements of the workforce experience increased competition from the commercial sector or may even see their job vanish as commercial items are adopted. The existing culture creates, and changes imposed by the use of COTS face, a natural resistance to its acceptance and use.

In spite of these challenges, as these cases demonstrate, using COTS can result in shorter development cycles, improved performance, and lower acquisition costs. To gain the greatest benefits from COTS implementations, as these cases demonstrate, users must maintain flexibility in their requirements and specifications. This will allow the greatest number of solutions to be considered. The concept that commercial items may actually help determine the final system configuration should also be considered. Additionally, COTS, with its inherent short lifecycles, can be coupled very effectively with a “spiral development” strategy. The product updates, thus naturally feeding subsequent cycles with improved capabilities.

Using COTS products is clearly worth the organizational, cultural, and procedural changes required to include them in defense acquisitions. More specifically, these benefits include:

- COTS provides improved performance, on an accelerated schedule.

By implementing a COTS solution, these programs were, in general, able to demonstrate significantly shorter development schedule, resulting in accelerated implementation and faster fielding. This resulted in being able to use the latest commercially available technology with significantly reduced lead times. Then, by leveraging the commercial market, the programs were able to get upgrades and keep pace with technological changes through successive updates

- Reduced Acquisition Cost

The high volume and market competition of COTS offers not only faster response and friendly user interfaces, but **lower costs**. This is made possible because the development, manufacturing, and support costs can be amortized over a much larger customer base. This reduces startup costs, unit costs, as well as logistics and support costs.

- Greater use of commercial development tools.

When programs use COTS hardware, they can exploit commercially developed (or open-source) operating systems, device drivers, and libraries of applications. This software is generally proven and well tested, and programmers can then spend more time focusing on the development of the mission-specific application.

- Improved logistics support.

COTS products, by virtue of their broader customer base, can provide greater availability of logistics support throughout the product's lifecycle.

- Increases opportunities for competition

The ability to develop, manufacture, and integrate COTS components is within the capability of a much greater number of smaller firms—firms that normally could not overcome the high barriers-to-entry into the defense

industry. This has the effect of creating a much broader business base (permitting the purchase of systems and equipment from a larger number of vendors). This competitive environment will increase innovation as well as help to ensure continuous price competition.

Conclusions

Although COTS is not the answer to every DoD acquisition, as these cases demonstrate there is a broad range of possibilities for using COTS. With COTS, programs can leverage the massive technology investments of the private sector and reap the benefits of reduced cycle times, faster insertion of new technologies, lower lifecycle costs, greater reliability and availability, and support from a robust industrial base. While there are significant benefits, these benefits can be only attained by understanding and addressing the new challenges that are created. These challenges are caused by the very fundamental difference between designing, developing and building components, subsystems, and systems; and buying commercially available items. As a result of this difference, the entire acquisition cycle is impacted—from requirements definition through sustainment; and all of these must be adjusted to gain the benefits of COTS. For many products and services, it will be very difficult to compete utilizing the traditional design-and-build approach, and the use of COTS will be unavoidable. In spite of the challenges, the benefits can far outweigh the risks.

The requisite policies are in place to mandate the consideration of COTS solutions. However, DoD leadership must work to mitigate the impact of the challenges in order to make the DoD more COTS friendly—such as realigning budgets to the realities of implementing COTS solutions. They must also continue to change the culture of the acquisition community to one that embraces the insertion of COTS products. We cannot afford to allow the system to slide back to the old ways. Our future security depends upon not letting this happen.

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Appendix – The “Perry Memo”

29 June 94

MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS

Chairman of the Joint Chiefs of Staff
Under Secretaries of Defense
Comptroller
Assistant Secretary of Defense (Command, Control, Communications, and Intelligence)
General Counsel
Inspector General
Director of Operational Test and Evaluation
Directors of the Defense Agencies
Commander-in-Chief, U.S. Special Operations Command

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

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

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

To accomplish this objective, the Deputy Under Secretary of Defense (Acquisition Reform) chartered a Process Action Team to develop a strategy and a specific plan of action to decrease reliance, to the maximum extent practicable, on military specifications and standards. The Process Action Team report, "Blueprint for Change," identifies the tasks necessary to achieve this objective. I wholeheartedly accept the Team's report and approve the report's primary recommendation to use performance and commercial specifications and standards in lieu of military specifications and standards, unless no practical alternative exists to meet the user's needs. I also accept the report of the Industry Review Panel on Specifications and Standards and direct the Under Secretary of Defense (Acquisition and Technology) to appropriately implement the Panel's recommendations.

I direct the addressees to take immediate action to implement the Team's recommendations and assign the Under Secretary of Defense (Acquisition and

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

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

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

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

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

contracts of \$500,000 or more having a substantial contract effort remaining to be performed.

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

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

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

New Directions

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

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

Obsolete Specifications: The "Department of Defense Index of Specifications and Standards" and the "Acquisition Management System and Data Requirements Control

List" contain outdated military specifications and standards and data requirements that should not be used for new development efforts. The Under Secretary of Defense (Acquisition and Technology) shall develop a procedure for identifying and removing these obsolete requirements.

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

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

Cultural Changes

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

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

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

Program Reviews: Milestone Decision Authority (MDA) review of programs at all levels shall include consideration of the extent streamlining, both in the contract and in the oversight process, is being pursued. The MDA (i.e., the Component Acquisition Executive or his/her designee, for all but ACAT 1D programs) will be responsible for ensuring that progress is being made with respect to programs under his/her cognizance.

Standards Improvement Executives: The Under Secretary the Secretaries of the Military Departments, and the Director of the Defense Logistics Agency shall appoint Standards Improvement Executives within 30 days. The Standards Improvement Executives shall assume the responsibilities of the current Standardization Executives, support those carrying out acquisition reform, direct implementation of the military specifications and standards reform program, and participate on the Defense Standards Improvement

Council. The Defense Standards Improvement Council shall be the primary coordinating body for the specification and standards program within the Department of Defense and shall report directly to the Assistant Secretary of Defense (Economic Security). The Council shall coordinate with the Deputy Under Secretary of Defense (Acquisition Reform) regarding specification and standards reform matters, and shall provide periodic progress reports to the Acquisition Reform Senior Steering Group, who will monitor overall implementation progress.

Management Commitment

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

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

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

//signed//
William J. Perry

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The Honorable Jacques S. Gansler, former Under Secretary of Defense for Acquisition, Technology, and Logistics, is a Professor and holds the Roger C. Lipitz Chair in Public Policy and Private Enterprise in the School of Public Policy, and is the Director of both the Center for Public Policy and Private Enterprise and the Sloan Biotechnology Industry Center. As the third-ranking civilian at the Pentagon from 1997 to 2001, Professor Gansler was responsible for all research and development, acquisition reform, logistics, advance technology, environmental security, defense industry, and numerous other security programs.

Before joining the Clinton Administration, Dr. Gansler held a variety of positions in government and the private sector, including Deputy Assistant Secretary of Defense (Material Acquisition), assistant director of defense research and engineering (electronics), executive vice president at TASC, vice president of ITT, and engineering and management positions with Singer and Raytheon Corporations.

Throughout his career, Dr. Gansler has written, published, and taught on subjects related to his work. Gansler recently served as the Chair of the Secretary of the Army's "Commission on Contracting and Program Management for Army Expeditionary Forces." He is also a member of the National Academy of Engineering and a Fellow of the National Academy of Public Administration. Additionally, he is the Glenn L. Martin Institute Fellow of Engineering at the A. James Clarke School of Engineering, an Affiliate Faculty member at the Robert H. Smith School of Business and a Senior Fellow at the James MacGregor Burns Academy of Leadership (all at the University of Maryland). For 2003 – 2004, he served as Interim Dean of the School of Public Policy. For 2004 – 2006, Dr. Gansler served as the Vice President for Research at the University of Maryland.

William Lucyshyn

William Lucyshyn is the Director of Research and Senior Research Scholar at the Center for Public Policy and Private Enterprise in the School of Public Policy at the University of Maryland. In this position, he directs research on critical policy issues related to the increasingly complex problems associated with improving public sector management and operations, and how government works with private enterprise.

Current projects include: modernizing government supply chain management, identifying government sourcing and acquisition best practices, and department of defense business modernization and transformation. Previously, Mr. Lucyshyn served as a program manager and the principal technical advisor to the Director of the Defense Advanced Research Projects Agency (DARPA) on the identification, selection, research, development, and prototype production of advanced technology projects.

Prior to joining DARPA, Mr. Lucyshyn completed a 25-year career in the US Air Force. Mr. Lucyshyn received his Bachelor Degree in Engineering Science from the City University of New York, and earned his Master's Degree in Nuclear Engineering from the Air Force Institute of Technology. He has authored numerous reports, book chapters, and journal articles.

Graduate Research Assistant—Steve Peishel

Steve Peishel graduated with a Master's degree in Public Policy from the University of Maryland in 2008. Previous degrees include a Bachelor of Science in Business Administration and an MBA from the University of Dayton in Ohio.

Prior to his work at the Center for Public Policy and Private Enterprise, Steve gained experience in several different industries. He started his professional career as a civilian working at Wright-Patterson Air Force Base outside of Dayton, where he did cost estimating and financial management. He later became a financial manager for Aerotherm Corporation, a small contractor performing materials research for the Air Force. In 1993, Steve joined Ameritech Cellular Services in Columbus, Ohio, as one of the two financial managers in the Ohio market.

While completing the Public Policy degree, Steve gained local government management and policy experience by working for the City of Aberdeen, Maryland, through the Maryland Municipal League Fellowship program.

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