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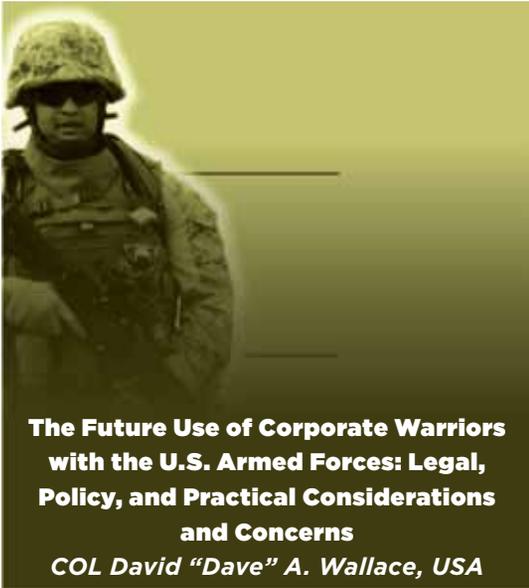
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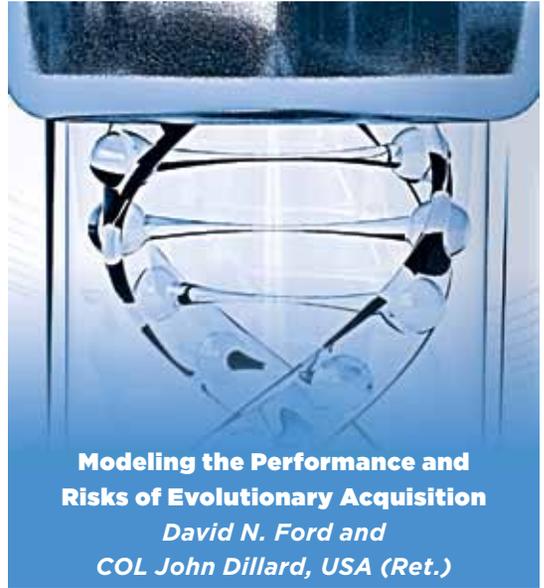
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The privatization of warfare has led to many interesting and complex issues. Among the myriad of issues is what role, if any, private security contractors should play in augmenting the U.S. armed forces future force structure. Against this backdrop, the article highlights certain considerations policymakers, military leaders, and force planners should balance when analyzing the future use of private security contractors. To make a proper determination on the future use of private security contractors, decision makers must weigh the benefits associated with the capabilities and characteristics of private security contractors with the costs of using such private actors. In that context, the article addresses several overarching legal policies, practical concerns, and risks associated with their future use.

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Evolutionary acquisition mandates incremental development for all programs. This policy seeks to improve development project performance, but may increase some risks. Computational modeling using systems dynamics reveals that evolutionary acquisition can increase concurrency and the need for coordination. The result is earlier delivery of the first increment, but later and more costly delivery of subsequent increments than in a single-step methodology. Modeling reveals and explains how deliberate work deferral reduces the initial increment's cost and schedule, but rework and transaction costs cause inefficiency in successive increments. Program managers must be aware of the risks of evolutionary acquisition and take additional steps to mitigate them with disciplined change-control measures, organizational accommodations, and accountability for configuration management.

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**Transferring Conventional Munitions
Industrial Base Capabilities
to the Public Sector**
COL John G. Ferrari, USA

The conventional munitions industrial base today is a declining industry for which 56 percent of the end items have no peacetime demand, capital assets have been allowed to deteriorate, and 70 percent of the firms have exited leaving over 300 critical single points of failure. J. Taggart's economic framework, published in *Strategy formulation in declining industries: A Biology Paradigm (1995)*, makes the case that the rational behavior of the private sector (leadership, niche, harvest, and quick disinvestment) renders the current business model ineffective. The conventional munitions industrial base requires an updated vision that emphasizes the primacy of wartime effectiveness and the conversion of capabilities from the private sector to the government. The munitions sector is one of the few unique national security-related industry segments for which more government control is not only rational, but necessary.

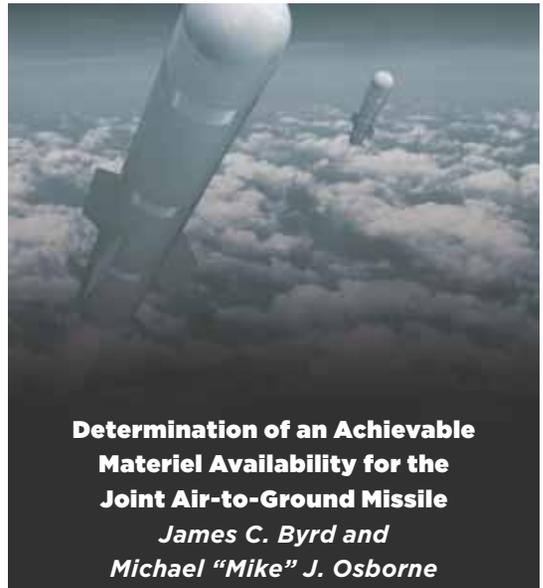


**Program Manager as Chief Executive
Officer (CEO): Leading with
Accountability and Empowerment**
Roy L. Wood

Program managers (PM) who view themselves as mere agents for the execution of program cost, schedule, and performance may be self-limiting. Rather, every PM should assume the role of Chief Executive Officer (CEO) of his or her entrepreneurial "corporation" and use the tools of upper echelon leaders to manage programs with greater accountability and empowerment.



The Chief Financial Officers (CFO) Act of 1990 requires the DoD to produce private sector-style financial statements that can win unqualified opinions from auditors. After many years of effort to comply, the department is now projecting that its balance sheets will not be ready until 2017 and is unable to predict when its income statements will be ready. Given that discouraging situation, combined with the increasingly widespread realization that external financial statements are of no practical use for internal management, the question arises whether it makes sense for the DoD to continue its pursuit of “CFO compliance.” A review of the history of the CFO strategy suggests the DoD needs to shift its efforts to the development of managerial cost accounting—not private sector-style financial accounting—if progress is to be made.



When Am (Materiel Availability), which marks a significant departure from Ao (Operational Availability), was established as a fleet-level Key Performance Parameter (KPP) by Joint Requirements Oversight Council Memorandum 161-06, issued by Navy Admiral Edmund P. Giambastiani on August 17, 2006, the Joint Attack Munitions Systems (JAMS) Project Office Logistics Directorate was tasked to develop a viable Am threshold and objective Am KPP for the Joint Air-to-Ground Missile (JAGM) system. This article describes the thought process and analyses that resulted in the JAGM Am KPP contained in the JAGM Capability Development Document (CDD) and system specification. The cause-and-effect relationships between logistics activities as well as the pros and cons of the application of Am to the JAGM system are discussed.



Twenty Minutes From Now
Mark Oehlert



YOU CAN USE

The Department of Defense (DoD) acquisition workforce is reaching a point at which change—rapid, relentless change—will become the norm. The global marketplace and the billions of consumers that make up the cyberspace called Web 2.0 will drive this change and wield influence over its features, products, and capabilities available to the DoD enterprise—capabilities represented by words such as Twitter, Wikipedia, Flickr, Firefox, RSS, or blogging. To fully realize the potential of these technologies, even within the very real boundaries of policy and technology within which the defense acquisition workforce must operate, the author advocates in this article a degree of re-thinking about how business is conducted, both internally and externally, and even what the definition of that business is.

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FROM THE EDITOR



I am pleased to announce the line-up of articles for Issue 51 of the *Defense Acquisition Review Journal (ARJ)*. In addition to six acquisition research articles, we are introducing a new section called the Technology Corner. This section is intended for general use by the DoD acquisition workforce and provides *ARJ* subscribers and readers with a look at some advanced educational/communications technologies being developed for DAU learning products. Finally, we present a letter to the editor where a reader responds to a recently published article.

The first article, “The Future Use of Corporate Warriors with the U. S. Armed Forces: Legal, Policy, and Practical Considerations and Concerns” by COL David Wallace, USA, describes the role of private security contractors in augmenting the U.S. military force structure. This article highlights some key considerations that policymakers, military leaders, and force planners should balance when analyzing the future use of private security contractors. Wallace addresses overarching legal policies, practical concerns, and risks associated with their future use.

The next article by David Ford and COL John Dillard, USA (Ret.), is titled “Modeling the Performance and Risks of Evolutionary Acquisition.” The authors use computational modeling to analyze the implementation of Evolutionary Acquisition (EA) in several DoD programs. Their analysis revealed that EA may likely result in earlier delivery of the first increment with reduced costs; however, this approach may also cause inefficiencies in successive increments. Program Managers must be aware of the risks of EA and take appropriate steps to mitigate them.

The third article is “Transferring Conventional Munitions Industrial Base Capabilities to the Public Sector” by COL John Ferrari, USA. The author established the current status of the conventional munitions industry in the United States today and provides an economic theory for reviving this declining, but important industry.

The fourth article by Dr. Roy Wood, “Program Manager as Chief Executive Officer (CEO): Leading with Accountability and Empowerment,” provides an entrepreneurial “corporate” view of program management. The author asserts that program managers who view their role merely as agents for program execution may be self-limiting. In this case, the external forces on the program are likely to contribute to disempowerment and reactive decision-making primarily focused on addressing immediate hot-topic issues. To counter this, a program manager should adopt a more long-term strategic view of the position as equivalent to a CEO of his or her own company. Operating within this framework is likely to contribute to behaviors that will be more effective, strategic, and empowering.

The fifth article is “Financial Accountability at the DoD: Reviewing the Bidding” by Christopher H. Hanks. The author makes the case that despite the good faith efforts over the last 20 years to institute the financial accounting and reporting prac-

tices required by the Chief Financial Officers (CFO) Act of 1990, the DoD has still not succeeded in full “CFO compliance.” This article reviews the history and conceptual underpinnings of the CFO Act to analyze what may be possible. Based on the acknowledgement of the primacy of the budgeting process in the relationship between DoD and Congress, the author suggests one possible new approach.

The next article is “Determination of an Achievable Materiel Availability for the Joint Air to Ground Missile” by James Byrd and Michael Osborne. In this article, the authors trace the development of the materiel availability Key Performance Parameter (KPP) for the Joint Air-to-Ground Missile (JAGM). When the materiel availability KPP was established by the Joint Requirements Oversight Council in 2007, the Joint Attack Munitions Systems (JAMS) Project Office Logistics Directorate was faced with the task of developing a viable materiel availability KPP (threshold and objective) for the JAGM. This article describes the thought process and analysis that resulted in the JAGM materiel availability KPP contained in the JAGM Capability Development Document and System Specification.

The last article represents the kick-off of a new series of ARJ articles called the Technology Corner. This article, “Twenty Minutes From Now,” is written by Mark Oehlert. Oehlert describes advanced communications technologies within the DoD enterprise, which are rapidly changing our professional and personal behavior. Oehlert works for the Research and Development Branch of the eLearning Technology Center at DAU.

We wrap up this issue with a Letter to the Editor called “Show Me the Money.” The author of this letter is Bill Fournier, a former professor of systems engineering at the Defense Systems Management College. Fournier wrote this letter in response to a recent article published in the ARJ. He explains how incentive and award fee contracts can have unintended consequences, and that while some *incentive* approaches appear positive, they can actually be misleading.



Dr. Paul Alfieri
Executive Editor
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THE FUTURE USE OF CORPORATE WARRIORS WITH THE U.S. ARMED FORCES: LEGAL, POLICY, AND PRACTICAL CONSIDERATIONS AND CONCERNS

 **COL David “Dave” A. Wallace, USA**

“How is it in our nation’s interest to have civilian contractors, rather than military personnel performing vital national security functions ... in a war zone?”¹

U.S. Senator Carl Levin (D-MI)

The privatization of warfare has led to many interesting and complex issues. Among the myriad of issues is what role, if any, private security contractors should play in augmenting the U.S. armed forces future force structure. Against this backdrop, the article highlights certain considerations policymakers, military leaders, and force planners should balance when analyzing the future use of private security contractors. To make a proper determination on the future use of private security contractors, decision makers must weigh the benefits associated with the capabilities and characteristics of private security contractors with the costs of using such private actors. In that context, the article addresses several overarching legal policies, practical concerns, and risks associated with their future use.

Keywords: *Private Security Contractor, Outsourcing, Force Planning, International Humanitarian Law, U.S. Military, Armed Conflicts*

Future Utilization of Private Security Contractors vs. Military Soldiers



Private Security Contractors

Military Soldiers

As U.S. force planners and policymakers assess our future security needs, establish the resulting military requirements, and weigh and make choices within a resource-constrained environment (Bartlett, Holman, & Somes, 2004) to find the right capabilities, size, and mix for the *U.S. military* 15 to 20 years from now, a critical consideration will be what, if any, role *private security contractors* should play in augmenting that future force on the battlefield (Owens, 2004). This article asks whether the U.S. military and other federal entities that accompany the armed forces during future *armed conflicts* should contract for security services in light of several critical policies, as well as legal and practical risks and concerns.

The article is divided into a three-part analysis. First, it frames the comprehensive context by a) considering the historical use of private security contractors; b) defining private security contractors in the context of the nature and scope of the services they provide; and c) exploring an appropriate paradigm for future U.S. *force planning*. Second, it considers several overarching legal policies, practical concerns, and risks associated with the future use of private security contractors. Finally, it discusses the way ahead by advocating a coordinated, collaborative, and concentrated effort by both the legislative and executive branches to address the underlying question.

FRAMING THE ISSUE: USE OF PRIVATE SECURITY CONTRACTORS DURING WARTIME

HISTORICAL USE OF PRIVATE SECURITY CONTRACTORS

In every conflict since the American Revolution, the U.S. military has always relied heavily upon civilian contractors for the provision of goods and services (Davidson, 2000). Civilian contractors have supported our nation's fighting forces with a wide array of service support, primarily in rear areas away from hostilities in a war zone (Industrial College of the Armed Forces, 2007). Although, the employment of civilian support contractors by the U.S. armed forces is certainly not new, the proliferation and expanded use of armed civilian contractors performing vital security functions in the combat zones of Iraq and Afghanistan that are, in many cases, indistinguishable from missions performed by their uniformed counterparts, is the latest chapter in a recent and growing worldwide phenomenon that began in the late 1980s and early 1990s (Rosen, 2005; Singer, 2003, pp. 49-55). In other words, the current use of contractors in security roles, rather than simply providing supply and logistics support, contrasts with the historical use of contractors.

The end of the Cold War, coupled with the broader governmental trend in privatization and reinventing government, marked a profound change in the evolution of warfare with the emergence and ever-increasing reliance upon so-called private security contractors (Mlinarcik, 2006). The confluence of these dynamic forces led to and helped shape this new market for armed security services from the private sector not only in the United States, but also in coun-

tries spanning the globe. According to P.W. Singer, an expert on the private security industry, the collapse of the Berlin Wall and the close of the Cold War created a “security vacuum” (Singer, 2003, p. 49). In order to reap a “peace dividend,” nations, including the United States, began to downsize their armed forces (Singer, 2003, pp. 49-50). The United States, for example, decreased the size of its military by 40 percent beginning in the late 1980s (Adams, 2002). Accordingly, this dramatic reduction in force structure led to an inevitable pool of experienced, ex-military personnel available to contract out their services (Avant, 2007).

THE NUMBER OF CONTRACTORS USED BY THE
U.S. GOVERNMENT IN IRAQ AND AFGHANISTAN
IS REMARKABLE.

United States Naval War College Professor Larry McCabe observed that an economic aspect to the emergence of private security contractors concerned the transition in the 1990s to a greater high-tech service economy (personal communication, February 16, 2008). More specifically, many former military personnel were unprepared and did not have the requisite skill sets necessary to make the transition into the new economy. Naturally, former military personnel were attracted to those jobs for which they were trained.

Against this backdrop, a growing number of smaller, but arguably strategically important conflicts emerged around the world. Put differently, the global security environment shifted dramatically during this period with the eruption of small, nationalist, and independence movements—movements in small countries without standing security forces, government or private. For example, during the 1990s the United States placed an emphasis on American-led peacekeeping, peacemaking, and nation-building operations that found our downsized forces participating in military operations in conflicts like Bosnia, Haiti, Somalia, and Kosovo.²

The *outsourcing* of security services continued unabated post-9/11 by the U.S. military and other related federal agencies during armed conflicts, a fact largely unknown to the public and even to some of our federal elected representatives. The killing and mutilation of four Blackwater private security contractor employees in Fallujah and the ensuing media attention revealed the extensive use of such “private soldiers” (Cameron, 2006).

The number of contractors used by the U.S. Government in Iraq and Afghanistan is remarkable. A recent congressional report estimated the total number of private contractors, including subcontractors, working in Iraq pursuant to U.S. Government-funded contracts at approximately 182,000³ or 10 times as many per military soldier as the 1991 Gulf War (Quirk, 2004). Of that number, approximately 20 to 30 thousand individuals are performing protective security functions for private firms pursuant to U.S. Government contracts in Iraq.⁴ The rest perform myriad functions, including logistical support for U.S. forces, execution of major reconstruction projects, translator support, consulting for the

U.S. command, and advisory operations for Iraqi army and police units. Even though this article is limited to security contractors, there is significant debate and controversy regarding the use of contractors in the area of logistics, reconstruction, and capacity building because of the resources devoted to those efforts. Additionally, in relative terms, the number of security contractors is relatively small in relation to number of contractors engaged in logistical support, reconstruction, and capacity building.

PRIVATE SECURITY CONTRACTORS: DEFINITION AND SCOPE OF SERVICES

Private business organizations providing professional services that are linked to warfare are referred to as “privatized military firms” (Singer, 2003, p. 8); “private military companies” and “private security companies” (Gillard, 2006; Perry, 2007); other less flattering names such as “mercenaries,” “whores or dogs of war,” or “shadow soldiers” (Zabci, 2007); “private soldiers”; and “contract or corporate warriors.” The most important consideration, however, is not what these individuals and the firms that employ them are called, but rather what they are doing in the combat zone.

For the purpose of this analysis, the term, “private security contractors” refers to those actors who perform a wide range of security-related tasks that include, but are not limited to: protecting people (including military personnel, State Department officials, and other high-value targets); guarding facilities; escorting convoys (considered to be among the most dangerous jobs in Iraq); staffing checkpoints; and training and advising security forces (Singer, 2007, p. 3).

In an effort to explain the role and nature of private security contractors in Iraq and Afghanistan, former Secretary of Defense Donald Rumsfeld told Congress that private security contractors were hired only to provide defensive services (Rumsfeld, 2004). In making any meaningful distinction between offensive and defensive operations, the challenge, of course, lies in the nature of the environment, the enemy, and some of the tasks and functions private security contractors are performing. The environment is a complex battlespace that is highly ambiguous and fluid. There are no positional front lines or rear areas like some traditional armed conflicts. Sporadic but intense fighting is happening everywhere. The enemy is mixing with the civilian population and using tactics, techniques, and weapons to engage our forces (including private security) in hostilities, usually at the time and place of the enemy’s choosing. Although all insurgencies are inherently complex and ill-structured, the fighting in Iraq is further complicated by sectarian violence coupled with nascent and relatively weak governmental security forces. Moreover, Department of Defense guidance specifically provides, “Contracts for security services shall be used cautiously in contingency operations where major combat operations are ongoing or imminent” (DoDI 3020.41, 2005).

Given the prospective nature of the overarching question, it is important to understand and appreciate that many other countries have and continue to use

private security contractors in a far more expansive way than the United States. In fact, armed security actors have been significant and, in some cases, the determinative players in conflicts (Singer, 2003, p. 9). For example, in Angola, the government hired Executive Outcomes (EO), a South African private security firm, to retrain their armed forces and lead them into battle. In the course of the conflict, EO employees piloted Angolan Air Force planes and participated in commando raids (Singer, 2003, p. 9). In another well-known example from Africa involving EO, the government of Sierra Leone contracted with the firm to quell a rebellion and establish order in the West African, diamond-rich nation (Adams, 2002, p. 57). In describing the profound impact EO had in driving the rebels back from an assault on Freetown, McIntyre & Weiss (2007, p. 73) cited Singer (2003, p. 4):

When the rebels approached within 20 kilometers of the capital of Freetown, fears that the war would end in a general massacre grew. Most foreign nationals and embassies hurried to evacuate the country. The situation appeared hopeless. Almost immediately, though, the circumstances completely reversed. A modern strike force quickly deployed and hammered the rebel forces with precision air and artillery strikes.

In sum, whether one views the roles and missions performed by private security contractors through a U.S. perspective or an international lens, clearly these corporate warriors are engaged in military duties that are, in many circumstances, identical to their counterparts in national armed forces. Conventional distinctions such as offense vs. defense, uniformed vs. nonuniformed, or public vs. private fade away amidst the fog and friction of combat.

FUTURE FORCE PLANNING

The perspectives, on an appropriate framework for determining future U.S. force structure and capabilities, are as varied as the number of strategic thinkers and planners considering the issue. Planning first requires a strategy—an articulation of national goals and objectives, and the allocation of the national elements of power to achieve that strategy's aims. Assuming military force is required to meet the strategic aims, planners must next ask what characteristics should the required force possess; how much force is necessary; and what risks are associated with the force and how such forces can be managed (Naval War College Professor L. McCabe, personal communication, January 28, 2008). Accordingly, a logical first step in an analysis of future U.S. force structure involves consideration of potential security environments in which the U.S. military may operate. The current National Security Strategy (NSS), the National Defense Strategy (NDS), the National Military Strategy (NMS), Quadrennial Defense Review (QDR), and the Capstone Concept for Joint Operations (CCJO) envision the United States facing a number of dangerous and pervasive worldwide threats in the future that generally fall into four categories or challenges: irregular,⁵ catastrophic,⁶ traditional,⁷

and disruptive challenges.⁸ Within this context, the U.S. strategic objectives include: securing the United States from direct attack, securing strategic access and retaining global freedom of action, strengthening alliances and partnerships, and establishing favorable security conditions (DoD, 2005a).

The second step in an analysis necessitates adopting an appropriate strat-

HIGHLY SKILLED CONTRACTORS CAN BE RETAINED
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 RANGING ARRAY OF SECURITY CONCERNS.

egy to address the security environment, national interests, and objectives. Since the end of the Cold War, such strategies have included: a two-military-theater-of-war approach, a 1-4-2-1 paradigm, and the current 1-1-1 construct.⁹ Such paradigms require war planners to balance obligations and capabilities of the American military to defend the United States while simultaneously being able to respond to multiple worldwide contingencies. Given the frequency of change in these strategies, such paradigms will likely continue to evolve, but with many of the elements that are common to the previous strategies.

The next step will consider the capabilities and characteristics of the future forces. The Department of Defense adopted a capabilities-based (versus a requirements-based) planning focus (DoD, 2005a). Among the desired operational capabilities of a future force are the ability to protect critical bases of operation, improving proficiency against irregular challenges, and increasing the capabilities of our security partners.¹⁰ The future force must have certain key characteristics or attributes, including: knowledge empowered, networked, interoperable, expeditionary, adaptable/tailored, enduring/persistent, precise, fast, resilient, agile, and lethal (DoD, 2005b, p. 20).

It is apparent that private security contractors possess a number of these important capabilities and characteristics. In terms of attributes that would make them a force multiplier for future conflicts, private security contractors can be adaptable/tailored, precise, fast, agile, and lethal. The government, for example, can expand, shrink, and refine the contractor workforce structure very quickly by means of solicitation and statement of work process. Highly skilled contractors can be retained to execute a contract on an ad hoc basis in whatever numbers the government needs to accompany the armed forces or other government entities to address a wide ranging array of security concerns. Additionally, procurement officials may use a variety of legal authorities and contract types to award such contracts quickly and efficiently, and terminate them immediately at the conflict's end, with no back-end retirement or medical costs to the government. Within the military force structure, however, it often takes years to make significant changes.

After consideration of the nature of the future security challenges (i.e., ir-

regular, disruptive, traditional, and catastrophic), it does not take much imagination to envision how private security contractors could augment U.S. forces in a variety of scenarios. The United States could, for example, use armed contractors with the appropriate skill sets to provide a continuum of services. For example, contractor personnel could serve as peacekeepers or peacemakers (e.g., support U.S. efforts in conflicts like Darfur); locate, tag, and track terrorists; secure critical infrastructure, lines of communication, and potential high-value targets; and assist in foreign internal defense. Moreover, private security contractors could arguably be used as a constabulary force during a military occupation or during stability and support operations. Given that a number of private security firms employ highly skilled former special operations personnel, it is readily foreseeable that contractors could add value to special operations forces as they work to meet the challenges of irregular conflicts or catastrophic challenges.

Furthermore, in a resource-constrained environment, private security contractors have an intuitive appeal. The government can hire the armed security contractors only when needed. Their services can be terminated at the convenience of the government when the contingency ends; contractors can also be terminated for default if they fail to perform. The contractual agreements can specify the skill sets necessary to satisfy the government's requirements. In sum, security contractors offer important capabilities and attributes that potentially make them an attractive option for future strategic planners. There are, however, significant risks and concerns associated with using private security contractors to augment the future force.

RISKS/CONCERNS REGARDING THE FUTURE USE OF PRIVATE SECURITY CONTRACTORS

The first issue involves highly skilled military personnel leaving the armed services and joining the ranks of private contractors. Private security contractors have and will likely continue to draw heavily from the ranks of U.S. armed forces, active and retired, particularly special operations forces (Whitelow, 2007).

The Government Accountability Office (GAO, 2005, p. 36) reported, in part:

Servicemembers with Special Operations background are often hired to fill key positions, such as security advisors and project managers, and to provide personal security to high-ranking government officials. These positions may pay as much as \$33,000 a month. Other servicemembers may be hired to provide security to civilians in vehicle convoys with salaries between \$12,000 and \$13,000 per month, while some may be hired to provide site security for buildings and construction projects at somewhat lower salaries.

In testimony before the United States Senate, Defense Secretary Robert Gates was so concerned over the lure of high salaries by the private security sector, he directed Pentagon lawyers to explore putting “non-compete” clauses into contracts with security companies that would limit their recruiting abilities. He stated, in part, as follows: “My personal concern about some of these security contracts is that I worry that sometimes the salaries they are able to pay in fact lures some of our soldiers out of the service to go to work for them” (Burns, 2007, p. 1). In sum, the use of private security contractors creates a secondary labor market for special operations personnel and other highly skilled members of the armed forces that compete against the military’s retention effort.¹¹ Also, the government is ultimately paying the costs of training for many of these personnel, as they are generally veterans of elite military units.

ALSO, THE GOVERNMENT IS ULTIMATELY PAYING THE COSTS OF TRAINING FOR MANY OF THESE PERSONNEL, AS THEY ARE GENERALLY VETERANS OF ELITE MILITARY UNITS.

The next issue involves developing a coherent legal framework that not only holds private security contractors accountable for their misconduct and ensures their rights are adequately protected, but also complies with the letter and spirit of *International Humanitarian Law*. Broadly speaking, the legal architecture governing security contractors must have a domestic component (i.e., U.S. federal, host-nation law, and perhaps even occupation regulations) and an international one (i.e., International Humanitarian and Human Rights Law). As we pull lessons learned forward from the War on Terror to better guide our planning for the future, strategists and planners can learn from the missteps and misjudgments made in attempting to craft a normative patchwork of legal authorities to govern private security contractors.

In terms of domestic law, private security contractors may fall under the law of the nation where they are performing their services. In Iraq, however, Ambassador L. Paul Bremer, in one of his final official acts at the Coalition Provisional Authority, issued an order that provided blanket immunity from prosecution for private security companies for potential crimes while they are operating in the country (Bremer, 2004). That order remained in effect even after the transfer of sovereignty to the Iraqi Government because it was adopted by the Iraqi Government (with much pressure from the U.S. Government). The blanket immunity provision created a great deal of controversy because the private security contractors involved in the September 2007 shooting at Nisour Square in Baghdad were protected by it (Dickinson, 2007).

Corporate warriors are, under certain circumstances, subject to the U.S. Federal Criminal Law via three vehicles—federal Special Maritime and Territorial Jurisdiction (CFR, 2004a), the Military Extraterritorial Jurisdiction Act (MEJA) (CFR, 2004b), as well as the recently amended Uniform Code of Military Justice. All three legal regimes, however, are limited in their application thus raising seri-

ous concerns about their effectiveness to regulate private security contactors (Dickinson, 2007). In their current form, these legal regimes effectively amount to a Venn diagram whose circles don't fully overlap.

In addition to the criminal jurisdiction, there is also a growing amount of domestic civil litigation associated with the conduct of private security contractors on the battlefield—primarily of two types: contractor personnel suing their former employers for tort or contract damages and overseas victims attempting to sue contractors for acts committed overseas. Neither type of litigation has met with a great deal of success, due in large part to substantial defenses available to contractors such as the political question doctrine and “government contractor” defense.

Regarding International Humanitarian Law, concerns are widespread that such private actors engage in combatant-like activities. Journalists, scholars, international lawyers, human rights organizations, nongovernmental organizations, the United Nations, and others have expressed their concerns that armed civilian contractors have been and continue to take a direct or active part in hostilities. Such conduct arguably violates one of the core tenets of International Humanitarian Law—distinction.

Having private security contractors engage in combat and combat-like activities on complex and ambiguous battlefields of today and tomorrow raises concerns that such actors are either unlawful combatants or mercenaries¹² under International Humanitarian Law, thereby compromising their status as civilians. A well-known example from Iraq occurred in 2004 when a small group of private security contractors and U.S. forces fought hundreds of Iraqi militiamen in Najaf, Iraq. In the course of the intense firefight, the private security contractor used one of its helicopters to provide ammunition for the battle and transported a wounded Marine for medical treatment. Accordingly, such security contractors are at risk of prosecution for their war-like acts (i.e., not having combatant immunity), jeopardizing their status as potential prisoners of war under the Third Geneva Convention (DoDI 3020.41, 2005).

The third risk or concern is whether contracting out such critical security functions may create dependency by the U.S. military and other related federal agencies on private security contractors. The classic example of a related federal agency is the Department of State (DoS). Private security contractors have protected diplomats and other DoS personnel in the battlespace during recent armed conflicts. In terms of government officials, private security contractors have regularly provided protection for visiting members of Congress and other dignitaries.

A respected scholar noted, “reliance on a private firm puts an integral part of one's strategic plans at the mercy of a private agent” (Singer, 2003, pp. 158-159). A good illustration of this point involves the September 2007 gun battle at a busy intersection in Baghdad in which heavily armed Blackwater Corporation contractors shot and killed 17 innocent Iraqi civilians (Singer, 2007). The shooting prompted the Iraqi government to insist that Blackwater leave their country (CNN.com/World, 2007). The State Department, whose diplomats and other personnel were protected by Blackwater, halted all diplomatic travel outside

other “cowboy-like behavior” (Singer, 2007, pp. 5-6). Moreover, some private security contractors may not be the least bit concerned with the second- or third-order effects of their behavior. They are focused on getting their principal or “package” off the “X” and protecting him or her with deadly force, if necessary. Blackwater representatives, for example, boast that no American official under their protection has been killed in Iraq (Mulrine, 2007). That is what they are obligated to do under the agreement with the U.S. Government, and that is how they are evaluated and rewarded (e.g., receiving future contracts).

By contrast, in the context of a counterinsurgency, occupation, stability and support operations, or other military engagements in which “winning the hearts and minds of the population” is central to successfully accomplishing the mission, such behavior by agents of the U.S. Government is counterproductive and inflames the populace. In these security environments, arguably, the local population is the critical center of gravity (HQDA, 2006). Accordingly, it is vital for military commanders to adopt appropriate and measured levels of force that accomplish the mission without causing unnecessary loss of life or suffering. Thus, the use of overpowering and intimidating tactics by private security contractors, who are focusing on their contract obligations at the expense of the greater mission, may alienate civilian populations and ultimately undermine the efforts of the military. To further reinforce this point, in many such operations, the local populace does not distinguish between military and contract personnel. Both are Americans. The conduct of the contractors is imputed to the military (Mulrine, 2007). It is a debatable point whether this problem can be solved by contract. Is it possible to draft a statement of work that balances these competing imperatives and enforces through regular contractor remedies, oversight, and incentives? Alternatively, is there something about private security contractors, per se, which creates this risk? In either case, it is an issue that must be explored when considering the use of private security contractors in the future.

In addition to the preceding examples, there are other significant concerns regarding the use of private security contracts. For example, how well can they be integrated into the force structure with communication impediments, security clearance issues, high personnel turnover, and multiple contractors in an area? Is there sufficient governmental oversight to ensure compliance with their contracts? Which functions are inherently governmental, and which functions are appropriate for performance by contractors in an area of combat operations? Are there some regions or cultures that are more conducive to private security contractors than others? Will strategic communications suffer by using such contractors on the battlefield? As the phenomena of using armed security contractors develops further, more concerns will likely emerge.

THE WAY AHEAD

The answer to whether the U.S. military and other federal entities that accompany the armed forces during future armed conflicts should contract for

security services in light of several critical policies, as well as legal and practical risks and concerns depends upon carefully weighing or balancing the benefits of using such private actors to augment our future force structure versus the risks and concerns associated with such a course of action. Some members of Congress have already made up their minds. For example, in November 2007, Congresswoman Janice Schakowsky introduced H.R. 4102—The Stop Outsourcing Security Act. The purpose of the proposed legislation is to phase out the use of private security contractors. If adopted, such legislation would, in my opinion, truncate valuable discussion and analysis regarding the use of private security contractors.

From my perspective, a better approach would involve a more thorough and deliberate consideration of all the issues, either directly or indirectly, related to the benefits and risks associated with the use of private security contractors in the context of future force planning. The framework for such an approach can be found in the 2008 National Defense Authorization Act. As part of that legislative package, Congress created a “Commission on Wartime Contracting Establishment Act.”¹⁴ The commission is a venue to study and investigate wartime contracts and contracting processes in Operations Iraqi Freedom and Enduring Freedom. As part of this effort, the commission will consider many, if not all, of the issues outlined in this article regarding the use of private security contractors on the battlefield. Likewise, governmental entities in support of Congress like the Congressional Budget Office and the Government Accountability Office have done excellent work in helping to frame the issues for the debate (Congressional Budget Office, 2008, p. 11).

Through a coordinated, collaborative, and concentrated effort by both the legislative and executive branches, a way ahead can be forged. If after careful consideration and deliberation, the decision is made to use private security contractors to augment the future force, the political branches of the U.S. Government each have certain institutional roles and competencies they can leverage to forge and shape the future force. For example, the executive branch should adequately consider and then address the use of security contractors (as well as other contractors, more generally) in the NSS, NDS, NMS, QDR, and CCJO. Current strategy documents largely gloss over their use. Of course, the use of contractors on the battlefield is a much larger issue than just security or even intelligence contractors. When the United States is using a number of contractors that is roughly equivalent to the number of uniformed personnel in theater, the ramifications of that approach need to be thoroughly considered.

The legislative branch should create and shape the legal architecture for the legal accountability of contractors in the operational environment. As mentioned previously, the current legal regimes are disconnected and ineffective. Furthermore, do we really want to prosecute contractors under the Uniform Code of Military Justice? Likewise, contractors engaged in commercial activities under hazardous conditions are a recipe for time-consuming and expensive civil litigation that often detracts from mission performance. Accordingly, in crafting an appropriate legal regime, Congress must not only balance the systemic concerns related to the protection of the rights of contractors who are operating in

very challenging, uncertain conditions, but also hold contractors accountable for the same or similar misconduct as their military counterparts.

Both branches must address the issue of what tasks or functions are inherently governmental in nature (under domestic laws and regulations). In doing so, special attention must be paid to ensure taking a direct or active part in hostilities, thereby violating International Humanitarian Law. In many respects, it is this issue that will be the most difficult challenge that law and policymakers face in grappling with the way ahead for a couple of reasons. First, concepts like “inherently governmental activities” and “taking a direct part in hostilities” are vague and very difficult to define. Second, the concepts are at a confluence of legal regimes—one domestic, i.e., public procurement or contract law; and the other international, International Humanitarian Law. The experts who are attempting to craft a solution are rooted in either one disciplinary background (i.e., public contracts or international law) or the other and do not necessarily understand and appreciate the nuances of the companion body of law.

THROUGH A COORDINATED, COLLABORATIVE, AND
CONCENTRATED EFFORT BY BOTH THE LEGISLATIVE
AND EXECUTIVE BRANCHES, A WAY AHEAD CAN
BE FORGED.

Lastly, in terms of a way ahead, law and policy makers should think carefully, but creatively about the range of options and the opportunities and risks associated with each option. By way of illustration, security contractors could be retained to perform passive security or training functions when serving in a theater of operations with U.S. forces. They could, for example, guard infrastructure or perform important training functions. In a combat zone, convoy or personal security would be left to members of the armed forces or the diplomatic security services. Alternatively, there may be significant opportunities for security contractors to provide assistance in a peacekeeping or peace enforcement role, as well as protecting nongovernmental organizations as they provide humanitarian aid. Such contractors could be trained and certified by internationally recognized standards and perhaps operate under the auspices of the United Nations. The advantage of such an approach includes lessening the burden on our armed forces to provide such support.

Assuming, for the sake of argument, that the legislative and executive branches agree that these private actors may have the requisite characteristics and capabilities to support the U.S. military and defense strategy under certain circumstances, those decisions should be carefully tested and fine-tuned through war-gaming and appropriate exercises, and adjusted or amended accordingly as the United States proceeds to build its future force.

CONCLUSION

Unquestionably, the role private security contractors should play in augmenting the future force on the battlefield is a complex and challenging issue that law and policy makers must grapple with in the coming years. To properly address the issue, decision makers in both the legislative and executive branches must weigh the benefits associated with the capabilities and characteristics of private security contractors with the costs or risks of using such contractors. Additionally, when making such a calculation, it is important to think creatively and not be overly constrained by past practices in the context of Operations Iraqi Freedom or Enduring Freedom. Only by engaging in such a process can a sound decision be made about the use of private security contractors in future operational environments.

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ENDNOTES

1. This quotation from U.S. Senator Carl Levin appears in the beginning of an article written by Deborah Avant entitled, Think Again: Mercenaries, originally published in *Foreign Policy* (134) in the July/August 2004 ed. (pp. 20-28).
2. In an article entitled Hegemony on the cheap: Liberal Internationalism from Wilson to Bush, published in the *World Policy Journal* (Winter 2003/2004, p. 6), Colin Dueck posits that against this strategic backdrop—the imposition of congressionally mandated force caps—the shifting of key support capabilities to the Reserve Components made it politically easier to contract for support functions.
3. In Jennifer K. Elsea's Congressional Research Service Report for Congress, RL32419, *Private security contractors in Iraq: Background, legal status, and other issues*, updated July 11, 2007, and retrieved January 21, 2008, from <http://www.fas.org/sgp/crs/natsec/RL32419.pdf>, she notes that the 182,000 is based upon news reports. Moreover, of the 182,000, 127,000 are DoD contracts, and a little over 2,500 were Department of State.
4. In an article entitled Private Military Contractors, published September 2004 online by *The Atlantic.com* and retrieved January 29, 2008, from <http://www.theatlantic.com/doc/200409/quirk>, Matthew Quirk also notes that there are a little over 2,500 individuals performing such work for the U.S. Department of State with a great majority of the remainder likely being performed for the Department of Defense.
5. Irregular challenges, as defined in *The National Security Strategy of the United States of America* (March 2006, p. 44), employ methods such as terrorism and insurgency to counter our traditional military advantages, or engaging in criminal activities such as piracy and drug trafficking that threaten regional security.
6. Catastrophic challenges, as defined in *The National Security Strategy of the United States of America* (March 2006, p. 44), involve the acquisition, possession, and use of Weapons of Mass Destruction by state and non-state actors; and deadly pandemics and other natural disasters that produce WMD-like effects.
7. Traditional challenges, as defined in *The National Security Strategy of the United States of America* (March 2006, p. 44), are posed by states employing conventional forces in well-established military competition.
8. Disruptive challenges, as defined in *The National Security Strategy of the United States of America* (March 2006, p. 44), involve state and non-state actors who employ technologies and capabilities in ways to counter the military advantages the United States currently possesses.
9. The so-called 1-1-1 approach frames the strategy around the U.S. forces at steady-state and surge operations in the context of homeland defense, irregular warfare, and conventional campaigns. Moreover, it considers "tailored deterrence" and a two-war capacity.
10. In addition to the operational capabilities, *The National Security Strategy of the United States of America* (March 2006, pp. 12-16) also cites strengthening intelligence, operating from the global commons, projecting and sustaining forces in distant anti-access environments, denying the enemy sanctuary, and conducting network-centric operations.
11. A recently released Congressional Office report took a different view while acknowledging a lack of supporting data on the question of the number of contractor personnel who are former U.S. military or U.S. government civilians. The report, in citing DoD officials, stated that the hiring of experienced military and government personnel by contractors was not causing a significant shortage of certain categories of military personnel at this time. The report, *Contractors' support of U.S. operations in Iraq* (August 2008, p. 11), published by the Congressional Budget Office, was retrieved August 13, 2008, from <http://www.cbo.gov/doc.cfm?index=9688>.
12. In the context of International Humanitarian Law, the most definitive definition of "mercenary" can be found at Article 47 to Additional Protocol I of the Geneva Convention of 1977. It provides as follows:
 2. A mercenary is any person who:

- (a) Is specially recruited locally or abroad in order to fight in an armed conflict;
 - (b) Does, in fact, take a direct part in the hostilities;
 - (c) Is motivated to take part in the hostilities essentially by the desire for private gain and, in fact, is promised, by or on behalf of a Party to the conflict, material compensation substantially in excess of that promised or paid to combatants of similar ranks and functions in the armed forces of that Party;
 - (d) Is neither a national of a Party to the conflict nor a resident of territory controlled by a Party to the conflict;
 - (e) Is not a member of the armed forces of a Party to the conflict; and
 - (f) Has not been sent by a State which is not a Party to the conflict on official duty as a member of its armed forces.
13. Certainly, concerns about dependency and reliability are not limited to security contractors. There are a number of critical battlefield functions that create vulnerabilities when they are outsourced to private actors. For example, having private contractors performing the maintenance and repair of complex weapon systems and aircraft would certainly fit into that category of risk.
14. The Commission on Wartime Contracting Establishment Act, retrieved January 22, 2008, from <http://thomas.loc.gov/cgi-bin/query/z?c110:S.1825>, states that the development of any regulatory scheme will not happen in a vacuum. There is an ever evolving web of legal authorities, international and domestic, regulations, industry standards, and other pre-existing guidelines governing private security contractors that will also help shape the debate. Additionally, the Commission shall be commissioned of eight members broadly appointed by the Senate Majority leader (2 members); the Speaker of the House of Representatives (2 members); one each of the respective minority leaders from the Senate and House; as well as appointments from the Department of Defense and State.

MODELING THE PERFORMANCE AND RISKS OF EVOLUTIONARY ACQUISITION

 *David N. Ford and COL John Dillard, USA (Ret.)*

Evolutionary acquisition mandates incremental development for all programs. This policy seeks to improve development project performance, but may increase some risks. Computational modeling using systems dynamics reveals that evolutionary acquisition can increase concurrency and the need for coordination. The result is earlier delivery of the first increment, but later and more costly delivery of subsequent increments than in a single-step methodology. Modeling reveals and explains how deliberate work deferral reduces the initial increment's cost and schedule, but rework and transaction costs cause inefficiency in successive increments. Program managers must be aware of the risks of evolutionary acquisition and take additional steps to mitigate them with disciplined change-control measures, organizational accommodations, and accountability for configuration management.

Keywords: *Evolutionary Acquisition, Spiral Development, Computational Modeling, Simulation*

Evolutionary Acquisition Spiral Development



PROBLEM DESCRIPTION

Our case studies and other anecdotal data indicate that significant project performance risks are inherent in spiral/incremental development and that these risks affect project planning and execution decisions. Solutions are not obvious, largely because the evolutionary process as a program strategy is more complex overall and is comprised of many more interdependent activities than a single-step to full-capability approach. Some of these relationships are easy to recognize, such as the impact of delaying the start of a second development block until the delivery of the initial block. But many relationships and their impacts are difficult to recognize and predict, such as the impacts of the concurrency of a second development block with the first and the amount of rework generated by different amounts of overlapping. Our case study research and *computational modeling* indicate that these hidden, secondary impacts of EA can have more significant influence on project performance and risk than revealed in EA policy. Thus, we must recognize and describe the EA relationships that drive performance and risk to understand their impacts.

Single-block development to full requirements is a traditional and relatively well-understood acquisition approach that can provide a baseline for the evaluation of evolutionary development. Therefore, the current work focuses on two questions, which contrast evolutionary development and single-block development:

- What are the impacts of an evolutionary development approach in contrast to a traditional single-block development strategy?
- How might successful evolutionary development project performance differ from the successful management of single-block development projects?

A DYNAMIC MODEL OF EVOLUTIONARY DEVELOPMENT

Evolutionary development is a complex process that evolves over time and can be better understood through formal modeling of the most important components and relationships that drive performance and risk. The formal model structure and rigor of calculations can simulate and forecast performance and risk better than informal tacit predictions by humans due to the number and complexity of the components and their relationships. Therefore, we applied a computational experimentation approach to investigating acquisition projects, integrating theory and practice in a computational tool that allows controlled experimentation through *simulation*. The current work reflects project, product development, and management theories. We also reflect practice in the model through the use of a case study to build and validate the model structures and model calibration and testing. We applied the system dynamics methodology for model development and use. System dynamics uses a computational experimentation approach to understanding and improving dynamically complex

systems. The system dynamics perspective focuses on the roles of accumulations and flows, feedback, and nonlinear relationships in managerial control. The methodology's ability to model many diverse system components (e.g., work, people, money), processes (e.g., design, technology development, quality assurance), and managerial decision-making and actions (e.g., forecasting, resource allocation) makes it useful for investigating acquisition projects. Forrester (1961) develops the methodology's philosophy and Sterman (2000) specifies the modeling process with examples and describes numerous applications. System dynamics has been applied to projects for several decades and has built a collection of validated development project structures (Lyneis & Ford, 2007), several of which are used in the current work.

The authors based the model on previously developed system dynamics models of product development in several industries and the military—models that have been developed and tested over several decades (e.g., Cooper, 1980; Abdel-Hamid, 1988; Ford & Sterman, 1998; 2003). Thus, the model is founded on well-established and tested components. Although these previous models have developed structures for many components and aspects of acquisition, they have not yet been used to investigate acquisition approaches such as spiral/incremental development as used by the DoD.

A CONCEPTUAL MODEL OF EVOLUTIONARY DEVELOPMENT

In the model, four types of work flow through each block of an acquisition project: requirements, technologies, product component designs, and products. Within a development block, each type of work flows through a phase in which developers complete a critical aspect of the project: 1) develop requirements, 2) develop technologies, 3) design product components (advanced development), and 4) manufacture products. Requirements also flow through the final phase: 5) user product testing. Development phases and information flows in a single-block structure (as depicted in the model) are shown in Figure 1. Arrows between phases indicate primary information flows. The beginning of all phases—except the development of requirements—is constrained by the completion of previous (“upstream”) phases. Figure 1 also identifies the five major reviews within a single acquisition block.

Development processes are constrained by both the physical and information relationships among the activities and phases within a development block. These constraints include development activity durations and precedence relationships, information dependencies leading to iteration (Smith & Eppinger, 1997), the availability of work (Ford & Sterman, 1998), coordination mechanisms (Hauptman & Hirji, 1996), the characteristics of information transferred among development phases (Krishnan, 1996), and the number, skill, and experience of project staff (Abdel-Hamid, 1988).

FIGURE 1. INFORMATION FLOWS IN A SINGLE-BLOCK ACQUISITION PROJECT

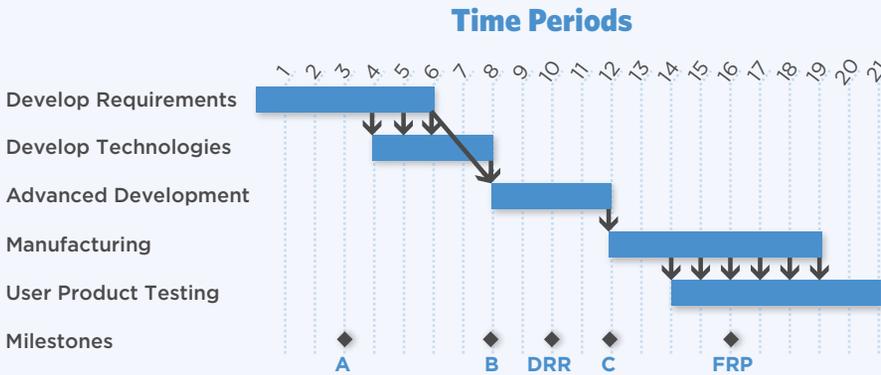
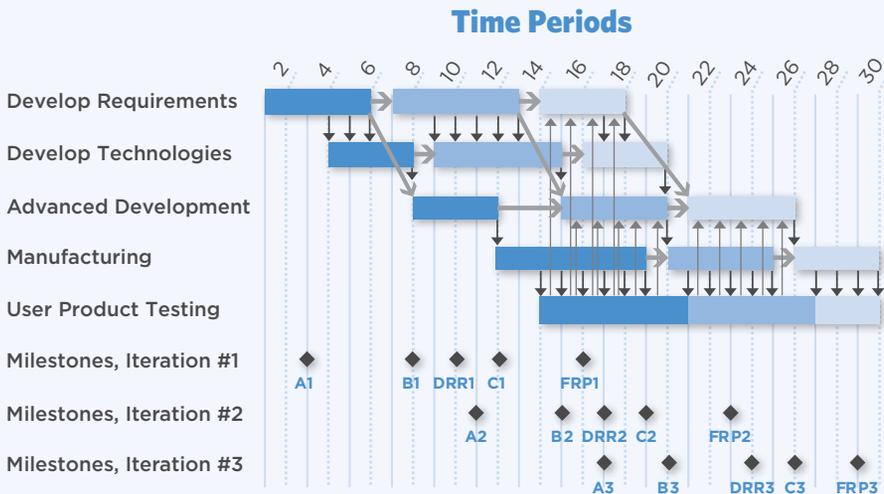


Figure 2 depicts an acquisition project with multiple increments or blocks. The first block is the same as in Figure 1. Subsequent blocks have the same basic information flow, but can also be delayed by the completion of phases in previous blocks or constrained by the progress in their own blocks. Importantly, in addition to the flow of information downstream through phases (downward pointing arrows in Figure 2), multiple iteration acquisition also provides opportunities for information to flow upstream—such as from User Product Testing of an earlier iteration to Develop Requirements or Advanced Development in a subsequent iteration (upward pointing arrows in Figure 2).

FIGURE 2. INFORMATION FLOWS IN A SPIRAL DEVELOPMENT PROJECT: A CONCEPTUAL MODEL



In the model, the structure of each block is the same, although parameter values are varied to reflect different acquisition projects and strategies. For example, all phases include start-up work that is not directly applied to generating development products. Each phase also includes the requisite decision review

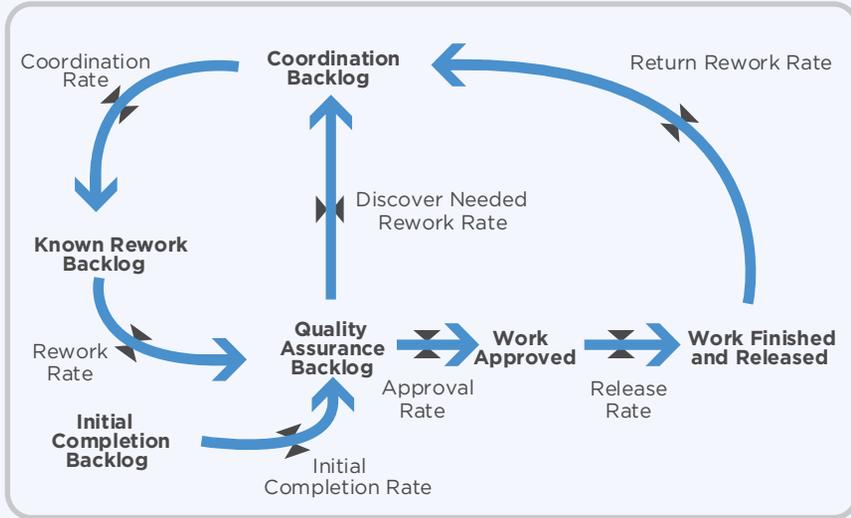
work that also does not directly generate product. This is consistent with Government Accountability Office recommendations and DoD policy to manage and oversee each development block like an individual project (Milestone B to Milestone C). One impact of this requirement for each phase to include start-up and review work when multiple development blocks are used is a significant increase in the total amount of work required to provide a given set of requirements to warfighters. As will be shown with the model, this work has a significant impact on project performance that may impact the types of projects in which evolutionary development can be effective.

A FORMAL MODEL OF EVOLUTIONARY DEVELOPMENT

The conceptual model described above was used to build a formal computer simulation model of an acquisition project that can reflect traditional and evolutionary development strategies. The model represents workflows through a project phase as a value chain of alternating backlogs and development activities with two rework cycles (Figure 3). The value chain is described with the boxes and pipes with valves along the bottom of Figure 3. The value chain passes from the Initial Completion Backlog through the Initial Completion Rate into the Quality Assurance Backlog, through the Approval Rate into the stock of Work Approved, and through the Release Rate to the accumulation of Work Finished and Released. The rework cycle is inherent in development projects and has been modeled and used extensively to explain and improve project management (Lyneis, Cooper & Els, 2001; Ford & Sterman, 1998; Cooper & Mulen, 1993; Cooper, 1980; 1993a, b, c, 1994). Each phase includes an intra-phase rework cycle from quality assurance through coordination, rework, and back to quality assurance. Development blocks also include inter-phase rework cycles from quality assurance through work approved, work finished and released to downstream phases, rework discovery in downstream phases (not shown in Figure 3 for clarity), the return of information on work to be reworked, coordination, rework, and back to quality assurance.

Given the arrangement of development activities in a phase described above, progress is constrained by the rate at which work packages move through the flows that connect the stocks. Four development activities and several development features control rates. The initial completion, quality assurance, coordination, and rework rates are each constrained by the rate allowed by the availability of work or the rate allowed by the resources applied (described later). The rates allowed if the development process has infinite resources (i.e., uncapacitated conditions) are described with an average processing time assuming all labor, equipment, knowledge and understanding are available. Project progress depends largely on how much work gets trapped in the rework cycles versus how much “leaks out” of the rework cycles through approval. The fraction of work discovered to require rework is used to model project complexity. More complex projects are assumed to require more iterations for completion.

FIGURE 3. WORK BACKLOGS AND FLOWS THROUGH A DEVELOPMENT PHASE



The model, shown earlier in Figure 2, simulates two types of development resources. Either resource type can constrain progress by limiting the development rate. Direct resources are the people and associated equipment required to perform the development work, i.e., to develop requirements, develop technology, design products, manufacture products, and test requirement satisfaction for use. Indirect resources perform project management and associated work that support and facilitate development. Total direct resources are assumed fixed and allocated based on the backlogs of work available to be developed (the stocks represented as boxes in Figure 3). In contrast, indirect resources (also assumed fixed) serve the performance of activities (the development rates, the pipes with valves in Figure 3) and are distributed proportionately based on the size of those development activities.

Projects are measured in three dimensions: schedule, cost, and performance risk. Schedule performance is measured in the time required to have a given number or fraction of requirements tested and approved by users. Cost is measured in dollars based on the size of direct and indirect work forces and the duration of phases and blocks. Performance risk is measured with the average percent of the requirements provided (approved by users) at any given time. This average reflects the combination of multiple requirements. Some of the requirements may have binary performance, i.e., they work or they don't work. Other requirements may have discrete steps or continuous performance relative to requirements, such as weight or unit manufacturing cost. All the requirements can be considered met completely when the average percent of the requirements provided is 100 percent for a development block.

MODEL CALIBRATION AND TESTING

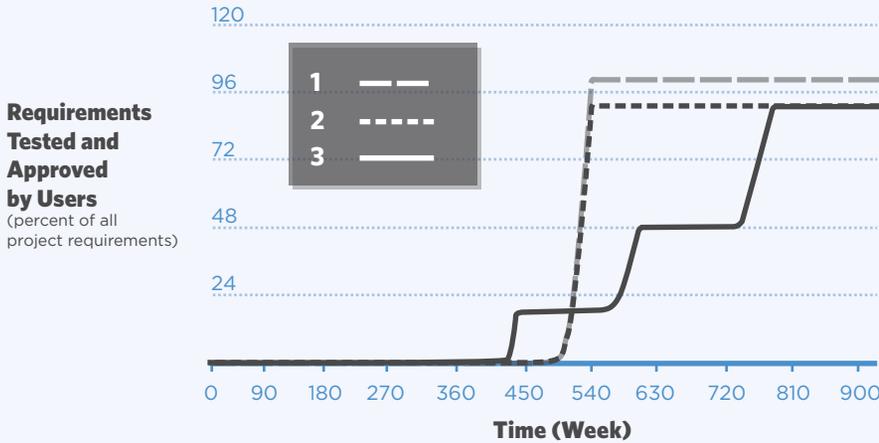
The formal model was calibrated to the Javelin project described in Dillard and Ford (2007). Basing the model on previously validated models, the literature and data collected about acquisition projects improve the model's structural similarity to actual acquisition projects as practiced. Model behavior was tested with extreme input values, such as no discovery of errors and very large resource quantities and productivities, as well as more typical conditions. Model behavior remained reasonable across wide ranges of input values, including extreme values. These tests increase confidence that the model generates realistic project behavior patterns due to the same causal relations found in the type of projects investigated (i.e., generates "the right behavior for the right reasons").

The model also reproduces the known system behavior. The simulated behavior of the Javelin project is consistent with the phase durations provided by the project manager, supporting the ability of the model to reflect the dynamics of the Javelin project. The simulated cost of the Javelin project (\$722 million) is also consistent with the data provided by the project manager, supporting the ability of the model to reflect the Javelin project's cost performance. As an additional test of model usefulness, the size of the development staff was doubled for the Javelin calibration project. If the model reflects actual projects, this change should speed up development but increase costs, as more resources generate products faster but at much higher cost. Doubling the number of developers saves 30 weeks (100 percent of requirements satisfied in week 491 instead of week 521) but increases costs dramatically from \$722 million without the larger development staff to \$1,327 million (an 83 percent increase). Based on these and additional tests, the model is considered useful for the investigation of the impacts of acquisition strategies on project performance.

MODEL USE

We investigated the impacts of evolutionary development on acquisition project performance by simulating the same project using a traditional single-block development strategy and an incremental development strategy, and by comparing and contrasting the behavior of the two projects. The calibration project case (Javelin) fully satisfied all its requirements. However, not satisfied, or partially satisfied requirements reflect the project's risk and are, therefore, important performance measures. Therefore, to facilitate the comparison of project performance using different strategies, a Base Case project was created that does not fully satisfy all requirements. Figure 4 on Page 152 shows the Performance Risk Profile of three project simulations: 1) the Javelin calibration project (wide dashed line #1), 2) the Base Case project (Javelin without 100 percent satisfaction) using a single-block strategy (narrow dashed line #2), and 3) the Base Case project using an incremental development strategy, with the requirements and work distributed evenly across three development blocks (thick solid line #3).

FIGURE 4. PERFORMANCE RISK PROFILE OF A CALIBRATION, BASE CASE, AND EVOLUTIONARY PROJECT



The Table compares the performance of these three simulated projects. The first two performance measures reflect schedule performance, with the project duration required to satisfy the first requirement and the project duration required to satisfy all the requirements. The third performance measure reflects cost performance with the estimated development cost. The last two performance measures reflect project risk, with the percent of the total project requirements satisfied by a specific deadline. For the Table, the deadline was chosen to be the time when the Base Case project using the traditional strategy satisfied all of the project’s final requirements.

TABLE 1. PERFORMANCE COMPARISON OF THREE SIMULATED ACQUISITION PROJECTS

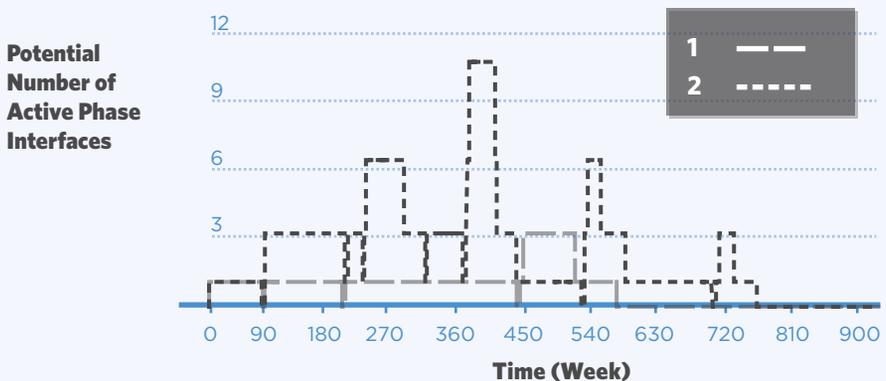
Performance Measure	Units of Measure	Project Scenario		
		<i>Javelin</i>	<i>Base Case Traditional</i>	<i>Base Case Spiral</i>
Duration to first requirement satisfied	Weeks	471	470	397
Duration to maximum requirements satisfied	Weeks	520	518	762
Total development cost	\$1.0 million	722	719	1,555
Requirements satisfied by deadline	Percent	100	91	18
Final requirements satisfied	Percent	100	91	91

The results in the Table identify important impacts of incremental development on acquisition project performance when compared to a traditional single-block strategy. Underlined bold values in the Table indicate the best performance among the three projects for each performance measure. Values in italics indicate the worst performance among the three projects for each performance measure. Notice that the Base Case, spiral project is best in only one performance measurement (Duration to first requirement satisfied) but is worst in three other performance measurements (Duration to max. requirements satisfied, Total development cost, and Risk—requirements satisfied by deadline). These data demonstrate the ubiquitous tradeoffs in performance that different strategies present. If all performance measures were valued equally, evolutionary development would appear to be a poor choice as an acquisition strategy. However, not all performance measures are of equal value in all acquisition projects. These model results identify the one performance measure that must be most important for an evolutionary development strategy to improve total project performance—Duration to first requirement satisfied.

The first step in improving the management of evolutionary development is to understand the managerial implications inherent in such development. Phases must be coordinated with external stakeholders and other development phases. Each pair of concurrent phases creates a potential interface that requires coordination. Coordination needs of traditional versus evolutionary development were contrasted using the active development phases of the Base Case project, first assuming that a single development block was used and then assuming that evolutionary development was used. Figure 5 shows an estimate of the phase interfaces that must be managed based on the number of active phases in the simulation described previously.

Although the number of interfaces with external stakeholders and between development phases is project-specific, the impact of evolutionary development on project management requirements is clear. Evolutionary development (narrow dashed line #2 in Figure 5) requires significantly more coordination than single-block development (wide dashed line #1 in Figure 5).

FIGURE 5. POTENTIAL COORDINATION REQUIREMENTS WITH SINGLE-BLOCK AND EVOLUTIONARY DEVELOPMENT

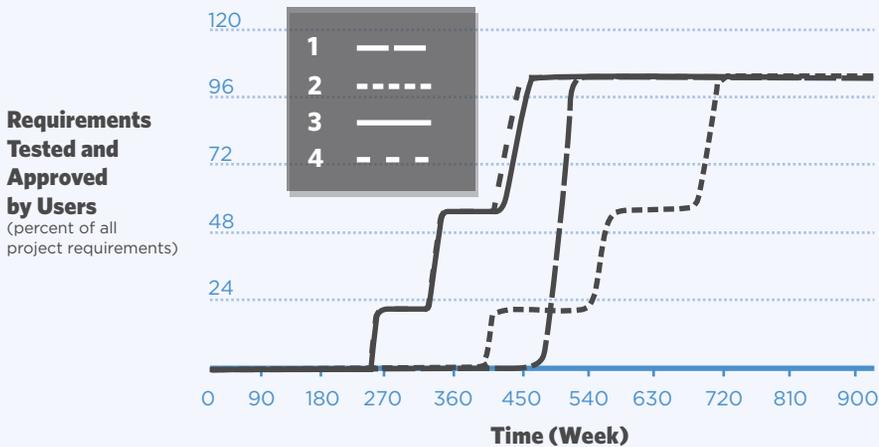


THE CRITICAL ROLE OF PROGRESS BOTTLENECKS

The management of the constraints on development progress is critical to evolutionary development project success. Bottlenecks that constrain development progress can be caused by several different parts of a development project and can be located in many different places. This can be illustrated by simulating projects using evolutionary development with different amounts of resources—a common project-management tool. To investigate the impacts of different resource policies on project bottlenecks and progress, we simulated the Javelin Project assuming four conditions:

- a single-block approach (wide dashed line #1 in Figure 6)
- an evolutionary approach (narrow dashed line #2 in Figure 6)
- an evolutionary approach and additional developers (solid line #3 in Figure 6)
- an evolutionary approach with additional developers and additional project management (medium dashed line #4 in Figure 6).

FIGURE 6. IMPACTS OF ADDING RESOURCES ON PERFORMANCE



The addition of developers reduces the duration of Block 2 (second and third steps are earlier), but does not significantly change the duration of the first block. This is because the first increment is constrained by process, not the number of developers. This result illustrates the importance of identifying and understanding the progress bottleneck. In this case, the addition of developers does not significantly reduce the first development block and would not be a very effective policy (or use of resources) if a project manager was attempting to accelerate the time to First Unit Equipped with the capabilities provided by the first block. Adding resources where they do not relax a progress constraint does not improve performance (an old lesson). But, the discovery of which project features constrain progress, at what points, and exploiting that knowledge is particularly difficult in evolutionary development because of the increased

the challenges and importance of identifying and understanding progress bottlenecks in evolutionary development projects.

CONCLUSIONS

A simulation model was used to investigate the impacts of evolutionary development on acquisition projects and the management of evolutionary development. Evolutionary development was found to have several important impacts on acquisition projects when compared to a traditional single-block development approach. *Ceteris paribus* (all other things held constant or equal), the model found, or supported other findings of, the following impacts:

- Incremental/spiral development can provide the First Unit Equipped with some (but not all) requirements satisfied faster than single-block development.
- Incremental/spiral development provides satisfied requirements to users in multiple steps or increments, whereas single-block development satisfies all requirements in a single step.
- Incremental/spiral development costs more than single-block development to satisfy the same requirements.
- Incremental/spiral development has a high risk of not satisfying all requirements by the time single-block development can satisfy all requirements.
- The drivers of and constraints on evolutionary acquisition project performance can be more difficult to identify than those influencing single-block development projects.

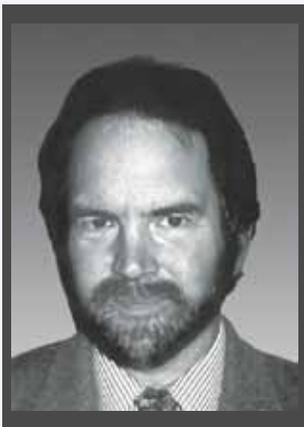
Evolutionary development was also found to have several significant impacts on acquisition project management. Investigations with the model found that (*ceteris paribus*):

- The concurrent use of multiple development blocks in evolutionary development significantly increases the number of development phases and activities that must be managed and coordinated at any given time compared to single-block development. This increases the project management needs for successful acquisition in evolutionary development projects when compared to single-block projects.
- As in single-block development, progress in evolutionary development requires the identification and understanding of progress bottlenecks. However, the concurrence and resulting complexity of development in evolutionary projects causes the types and locations of bottlenecks to vary widely and be more difficult to identify and address than those in single-block development.

- Progress bottlenecks can cause counterintuitive behavior, such as reductions in project cost by adding resources at a bottleneck. Exploiting the opportunities provided by these behaviors requires a deep understanding of the project structures and dynamic interactions that drive and constrain progress.

These results indicate that evolutionary development requires more, different, and more difficult project management than single-block development. They also suggest that project management should focus on the identification and management of causal paths, information feedback, and progress bottlenecks based on the structure of the development project. By doing so, project managers can improve the design and management of evolutionary development in DoD acquisition projects and can, thereby, capture the benefits and mitigate the risks of evolutionary acquisition.

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TRANSFERRING CONVENTIONAL MUNITIONS INDUSTRIAL BASE CAPABILITIES TO THE PUBLIC SECTOR

 **COL John G. Ferrari, USA**

The conventional munitions industrial base today is a declining industry for which 56 percent of the end items have no peacetime demand, capital assets have been allowed to deteriorate, and 70 percent of the firms have exited leaving over 300 critical single points of failure. J. Taggart's economic framework, published in *Strategy formulation in declining industries: A Biology Paradigm (1995)*, makes the case that the rational behavior of the private sector (leadership, niche, harvest, and quick disinvestment) renders the current business model ineffective. The conventional munitions industrial base requires an updated vision that emphasizes the primacy of wartime effectiveness and the conversion of capabilities from the private sector to the government. The munitions sector is one of the few unique national security-related industry segments for which more government control is not only rational, but necessary.

Keywords: *Munitions, Government-Owned, Contractor-Operated; Declining Industry, Privatization*

No Peacetime Demand!



munitions

Defense Industrial Base
to Public Sector and Back Again

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BASED ON "THE PRIMACY OF WARTIME EFFECTIVENESS AND THE CONVERSION
OF CAPABILITIES FROM THE PRIVATE SECTOR TO THE GOVERNMENT."



As shown in the Table, the reliance on the private sector—in this case both the GOCO and COCO facilities—is not just in the number of facilities operated, but also in funding where 95 percent of the production dollars are allocated to these contractor-operated facilities (Blose, 2002).

TABLE 1. PRODUCTION FACILITY BUSINESS MODEL AND DOWNSIZING OVER TIME

Type of Production Facility	Abbreviation	Number of Facilities			Production Funding
		1978	1991	2005	2005
Government-Owned, Government-Operated	GOGO	6	3	3	5%
Government-Owned, Contractor-Operated	GOCO	28	10	6	30%
Contractor-Owned, Contractor Operated	COCO	278	163	69	65%

(Goure', 2004, p. 2)

Recently, the Deputy Secretary of Defense reinforced this vision by declaring that “to the maximum extent feasible, [the Army will] transition government-owned ammunition production assets to the private sector” (Department of Defense, 2008, pp. 5–6). The 2004 Munitions Industrial Base strategic plan published by the Army clearly reinforces this notion of maximizing private sector involvement by stating the following vision: “A responsive, innovative, effective, and efficient manufacturing and logistics base, capable of meeting national security requirements while preserving critical core competencies and relying to the maximum practical extent on competition and private ownership” (Izzo & Radin, 2004, p. A-2).

As stated previously, this private sector dominant business model has not been capable of being responsive, innovative, effective, or efficient. The following discussion lays out the underlying economic theory on why this is a fundamentally flawed business model.

PRIVATE SECTOR BEHAVIOR IN A DECLINING INDUSTRY

The munitions industrial base fits the classic definition of a *declining industry* in that revenue has decreased by almost 80 percent, and more than 70 percent of the industry has disappeared from 1985 through 2001 (Taggart, 1995). Having said that, revenues have temporarily increased due to the Global War on Terror, but this increase is only temporary. Using Taggart’s framework that explains the four options for how firms behave in declining industries (Taggart, 1995), and given that this is a declining industry subject to national policy that blocks migration of this capability overseas, the military’s almost total reliance

on the private sector, as set forth in the ensuing analysis, is highly inappropriate.

LEADERSHIP

In an attempt to exploit monopoly pricing power and garner above average profitability, firms may, and often do aim to be one of the few remaining entities after the inevitable consolidation. This outcome is not advantageous to the government in that it would overpay for munitions because the firms involved would exploit their near-monopoly positions. In effect, the government becomes hostage to the few remaining industry participants. In 2006, almost 25 percent of critical munitions components had monopoly suppliers (Goure', 2004).

NICHE

Using this strategy, private firms cherry-pick and compete for the few profitable production lines. This is sub-optimal because only 76 of the 171 critical munitions are procured during peacetime (Blöse, 2002). Firms would optimize their investments for peacetime production needs, and the ability to cross-subsidize the warm-basing of wartime production lines would not be possible. At the beginning of the current war, small caliber munitions production almost failed to meet needed training and theater requirements (U.S. House of Representatives, 2008, p. 5).

HARVEST

In this case, firms practice *controlled disinvestment* by not investing in capital equipment and facility repairs. This is exactly what happened at all of the GOCO facilities where the industry partners retained their profitability by allowing the government's capital equipment to deteriorate. Today, we have a \$1.5 billion modernization backlog, (Zimmerman, 2005). While the government is currently in the midst of a multi-year recapitalization effort at these six GOCO plants, we can expect that this cycle of deterioration will occur again unless the business model changes. ATK, which operates the Radford and Lake City facilities, states that "even a modest investment is a difficult decision for private industry" (U.S. Congress, 2004, p. 9). The perfect example of this is the Army's 25-year contract with ATK to run the Lake City Ammunition Facility. The firm clearly states in its financial report to the Securities and Exchange Commission that if the production contract is not renewed, it would be relieved of its 25-year facility contract (United States Securities and Exchange Commission, 2007). Under this scenario, what kind of steward of our investments can we expect private industry to be?

QUICK DISINVESTMENT

When all else fails firms abandon the industry. In the munitions sector, over

70 percent of the firms have exited, and this has led to over 300 single points of failure in the munitions supply chain (Zimmerman, 2005). This both enables monopolistic behavior and induces a tremendous amount of supply chain risk into meeting wartime requirements.

As this framework depicts, there is simply no feasible or rational behavior by the private sector participants that will result in outcomes desired by the government. Clearly, another business model is needed.

A DIFFERENT BUSINESS MODEL

Without a new business model, the munitions industry will remain one of the *skid row* or *senile* sectors of the national security industrial base (Hillman, 1977). The munitions industry must be transformed and protected in two significant ways: a) it must clearly place effectiveness in meeting national security and surge requirements as paramount; and b) it must decrease private sector involvement from 95 percent of production to somewhere around 50 percent. The following recommendations are provided:

A NEW VISION

The new vision must reflect an emphasis on effectiveness and on a balanced capability between industry and government. The following is proposed: An effective manufacturing and logistics munitions industrial base capable of meeting national security and surge requirements by optimizing across the entire life cycle management of conventional munitions, preserving critical core competencies and intellectual property, focusing on efficient and innovative processes, and relying on a balanced partnership between government and industry.

CONVERT THE SIX GOCO FACILITIES TO GOGO FACILITIES

This is the most controversial and important recommendation and will result in an immediate rebalancing that will put the government in control of 35 percent of production capability. This is similar to the business model the government employs for the manufacturing portion of the depot-level repair capabilities that mandates a 50 percent split between the government and industry. A byproduct of this split will be that the government will get more control of the intellectual property associated with the processes involved.

Converting the six contractor-operated facilities to government-operated facilities has many advantages. First, since the government is not concerned with making a profit, it would become easier to optimize production capabilities for wartime requirements instead of peacetime demands. Next, when the government operates facilities, we tend to modernize them as a cost of doing business through the working capital funds. Currently, when private industry operates the government facilities, they choose to disinvest in government-owned

capital in order to maintain their profit margins. Finally, government control of these six facilities would more quickly end the long term *death-spiral* of this hybrid model of government-owned, contractor-operated munition facilities, which have gone from 28 to 6 over the past 30 years.

Some might argue for the opposite, saying that instead of making the six facilities government-operated, that the government should convert them to contractor-owned facilities and completely privatize them. While this fits the current mantra and vision of more private sector involvement, it ignores economic realities. The private sector does not operate well in unprofitable, capital-intensive markets. In fact, as Taggart's model predicts, we would expect the private sector to continue to consolidate production, focus on peacetime demand, and pass the wartime production risk back to the government. Although an army can fight a war without many capabilities, munitions remain—for now and into the foreseeable future—a *must-have* on the battlefield. For that reason, a balanced approach, where the government owns and operates about 35 percent of this critical national security industry, is recommended; this can be accomplished by converting the six GOCO facilities to GOGO facilities.

TRUE INDUSTRY PARTNERSHIPS AT THE GOVERNMENT FACILITIES

Today, the relationship is one of mutual dependency rather than a true partnership. The government and private sector each have unique capabilities. For example, we have learned from the transformation of the depot repair facilities that the government is much better at managing the facilities, equipment, and the workforce, while the private sector is much better at managing certain engineering and supply chain functions. Red River Army Depot, McAlester Army Ammunition Plant, and Naval Supply Systems Command in Jacksonville, Florida, are the best examples of how these partnerships should be structured.

DEVELOP REDUNDANT CAPABILITIES AND PROHIBIT NICHE MARKETS

The Office of the Secretary of Defense must mandate that munitions procurement by individual Services cannot bypass the organic base for what appears to be a cheaper price in the private sector. The government-controlled organic base will need to cross-subsidize inactive production lines and maintain redundant capabilities to reduce the supply chain risk associated with single points of failure.

IMPEDIMENTS TO CHANGE

Despite decades of decline, we have retained the same faulty business model, and these impediments to change remain firmly entrenched. First, the acquisition culture and processes are biased towards outsourcing, so the acceptance of a proposal to, in effect *in-source* work, will be a difficult task. Next, those private firms that remain will use their lobbying strength to protect their

monopolies and niche markets. Finally, the up-front costs required to correct the *sins of the past* in the areas of intellectual property, human resources, and equipment capitalization will need to be funded, but can be minimized if we partner correctly with the affected firms. Without strong leadership, saving the conventional munitions industrial base simply may not be possible until a catastrophic failure occurs.

CONCLUSION

The munitions industrial base today is a declining industry for which 25 percent of the critical components are produced by monopoly suppliers, 56 percent of the end items have no peacetime demand, capital assets have been allowed to deteriorate accumulating a \$1.5 billion modernization backlog, and 70 percent of the firms have exited leaving over 300 critical single points of failure. Taggart's economic framework makes the case that the rational behavior of the private sector participants (leadership, niche, harvest, and quick disinvestment) renders the current business model ineffective. There is simply no way to balance peacetime efficiency and wartime effectiveness by maximizing private sector involvement for this industry. To protect the gains made in rejuvenating this industry as a result of the current war effort and to prevent the inevitable cycle of decline that will continue, a new vision must be created that emphasizes the primacy of wartime effectiveness and a balance between government and private sector capabilities. So while the conversion of capabilities from the private sector to the government goes against decades of government policies and is the antithesis of economic theory, it must be done. The munitions sector is one of the few unique national security-related industry segments for which more government control is needed.

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ENDNOTES

1. The family of conventional munitions includes small caliber, grenades, propellant charges, pyrotechnics, mortar, artillery, tank, rocket, scatterable mines, Navy gun, and bombs.
2. For this article, we use the term *single point of failure* to define any point in the conventional munitions production process for which a single piece of equipment that, if it fails, can bring the entire production operation for a single product to a halt. Single points of failure have occurred because production quantities are so few for many items, that maintaining a second source of production is expensive. This, however, prioritizes cost efficiency over military effectiveness.
3. These reports go back to the DoD's Bottom Up Review in 1993 and include other reports from CSIS Security Research and Intelligence, Rand, the Lexington Institute, Government Accountability Office, Industrial Committee of Ammunition Producers, Industrial College of the Armed Forces industry reports, and many internal Army audits. They are near unanimous in their assessment of the problems within the industrial base. For purposes of this article, their assessments of the current problems are taken as a state of fact. For readers who desire to read more about problems within the industrial base, the preceding reference list provides a starting point, specifically, the Lexington Industry Report.
4. A declining industry can be defined as one in which "growth is either negative or is not growing at the broader rate of economic growth." This definition is from <http://www.investopedia.com/terms/d/decliningindustry.asp>.
5. This relationship was discussed in a conversation with Dr. Steven Randolph of the Industrial College of the Armed Forces. The discussion centered on other "skid row" sectors like national security industries that also have limited commercial applications such as space and shipbuilding. This comment is also a main point in the CSIS report by Dan Goure' from 1993 on *Avoiding strategic hollowness within the DoD munitions industrial base*.
6. For purposes of this article, both GOCO and COCO operations are considered private sector operations. For the GOCO plants, while the government owns the land, facilities, and much of the equipment, the operation is run by private sector companies such as General Dynamics, BAE, and Alliant Techsystems (ATK).

PROGRAM MANAGER AS CHIEF EXECUTIVE OFFICER (CEO): LEADING WITH ACCOUNTABILITY AND EMPOWERMENT

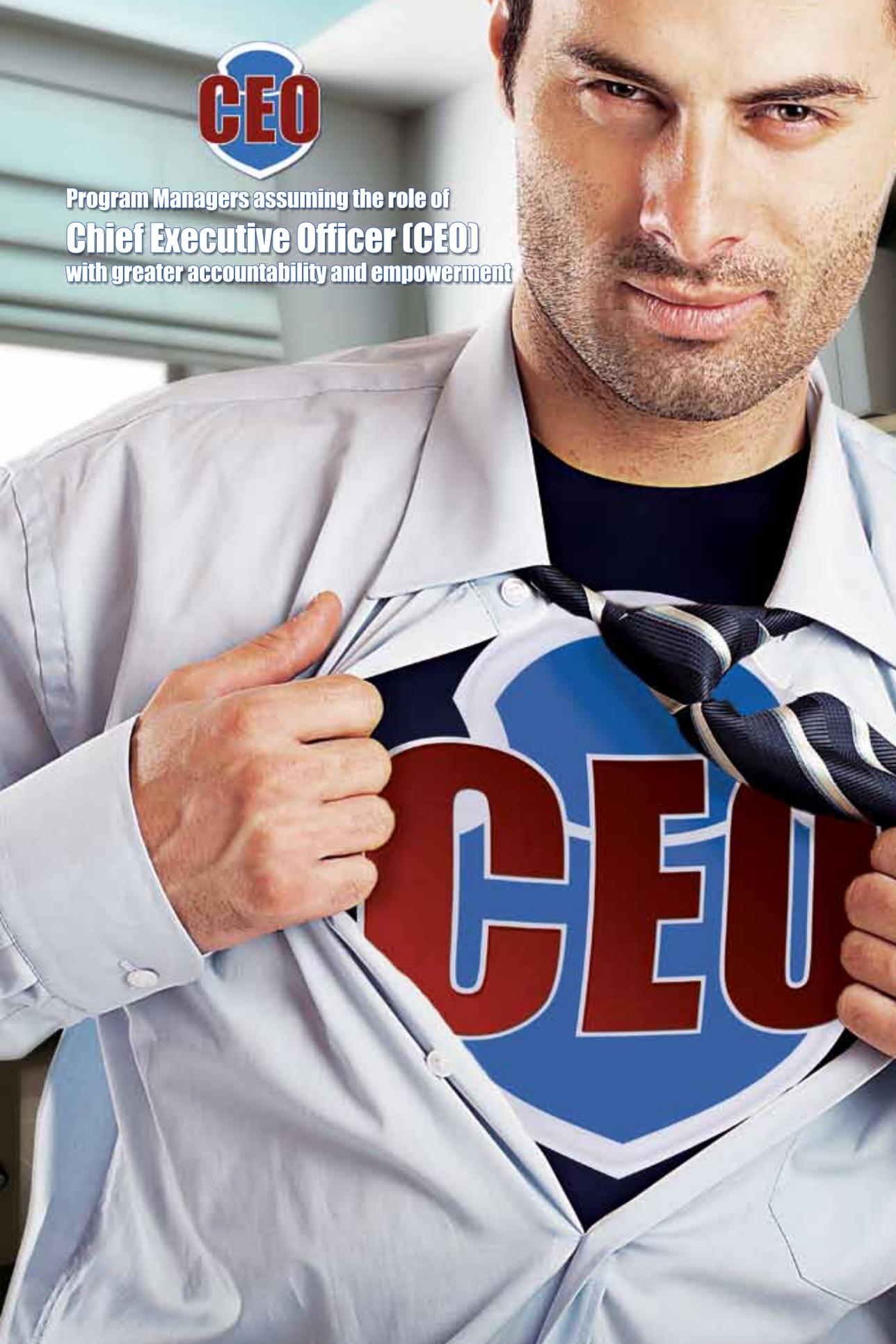
 **Roy L. Wood**

Program managers (PM) who view themselves as mere agents for the execution of program cost, schedule, and performance may be self-limiting. Rather, every PM should assume the role of Chief Executive Officer (CEO) of his or her entrepreneurial “corporation” and use the tools of upper echelon leaders to manage programs with greater accountability and empowerment.

Keywords: *Program Management, Strategic Leadership, Accountability, Empowerment, Stakeholder Management, Entrepreneurship, Executive Decision Making*



Program Managers assuming the role of
Chief Executive Officer (CEO)
with greater accountability and empowerment



BACKGROUND

Former Under Secretary of Defense for Acquisition, Technology, and Logistics John Young continues to challenge program managers (PM) in the Department of Defense to be more accountable for their program outcomes and to feel empowered to take on the challenges presented by the complex acquisition, budgeting, and requirements processes (Young, 2008). Yet, program managers may feel victimized by the myriad budget “drills,” the continual pressure to include new features and requirements in programs that are already strapped, and to navigate the labyrinthine oversight bureaucracy whose job, it appears, is to second-guess the PM at every turn. While perhaps overstated, these external forces are nonetheless among the serious systemic problems highlighted, most recently, in the Defense Acquisition Performance Assessment (DAPA) report (Kadish, 2006).

How can a PM working in such an environment be able to control program outcomes and feel empowered? It is not uncommon for perceived roles and norms to be self-limiting, even if the perceptions are wrong (“Intentional Behavior,” 2004; Terry & Hogg, 2000). If the PM views the position as one simply responsible for program execution, then the external forces on the program are likely to contribute to disempowerment and reactive decision making to address the pressures of the moment. Rather, a PM should adopt a more strategic view of the position as equivalent to a Chief Executive Officer of his or her own “company.” Operating within that new paradigmatic framework is likely to contribute to behaviors that can be far more strategic and empowering.

THE PROGRAM MANAGEMENT CONSTRUCT

The organization and functioning of *program management* offices are not unlike those of a small, entrepreneurial company. Program offices are typically organized in cross-functional teams with direct-reporting employees who perform system engineering, contracting, financial, logistics, testing, and perhaps a variety of other functions, depending on the phase and complexity of the program. This program team arrangement concentrates the department’s energy and resources on individual products and delegates important responsibilities to the team and PM. Most program teams, organizationally, have the full functionality, control, and responsibility to allow them to successfully accomplish their mission of producing the end product.

In the existing program office arrangement the PM, in a sense, can appropriately be viewed as the CEO for his or her product. In either role, the leaders are ultimately responsible for the success or failure of their ventures. Both have cost, schedule, and quality responsibility for their products and both have leadership and management responsibilities within their respective organizations. Both are impacted by economic, political, and social forces external to their organizations, and both are under tremendous pressure to succeed. Both are called upon to make good decisions, solve complex problems, conduct delicate

negotiations, and resolve difficult conflicts. Both must have the skills, temperament, and drive to get the job done.

With this view of the PM-as-CEO, it would follow that there would be benefits to the PM and the program to use similar leadership and management tools as traditionally considered important to upper echelon leadership in a business or corporation. Some of these tools include: *executive decision making* and negotiation skills, penchant toward *entrepreneurship*, high ethical standards, and *strategic leadership*.

EXECUTIVE DECISION MAKING AND NEGOTIATION SKILLS

Sound decision-making skills are critical to the success of any program. In business and in programs, many decisions are made in an environment of volatility, uncertainty, complexity, and ambiguity (Michelson, 1997). Decision makers in both instances have more degrees-of-freedom, wider latitude, and broader scope and impact. There typically are fewer decision “templates” to assist the executive leader. It is more difficult to judge “right” answers since every strategic situation is fundamentally different.

To aid in making these executive-level decisions, program managers should adopt four foundational elements of top echelon strategic decision making. These are: 1) develop an overarching strategic framework and articulate clear organizational values against which to measure every decision; 2) make data-driven decisions; 3) be prepared to reverse a decision if subsequent information invalidates the basis for the decision; and 4) involve team members and key stakeholders in the decision-making process.

STRATEGIC FRAMEWORK

A clearly articulated strategic framework and organizational values can be a compass to guide decision makers. Drucker (1967) distinguishes this as knowing “what is ‘right’ rather than what is acceptable,” based on what he calls “boundary conditions” (p. 95). Without a guiding framework to help the program team know what those boundary conditions are, individual decisions that appear acceptable may or may not support the organization’s overall strategy.

DATA-DRIVEN DECISIONS

Ad hoc decisions that are absent good analysis and data to support them can often lead to poor outcomes. Decisions that are objective and data-driven are more likely to be correct and defensible. However, Stryker (1965) warns that in order not to fall victim to a common psychological trap of accepting only data that confirm a desired decision (Hammond, Keeney, & Raiffa, 1998), the astute leader must consider both positive facts, or causal evidence, as well as evidence that appears contrary to the problem at hand. Considering all factual

information in a systematic way can help a program manager uncover and compensate for biases and prejudices that could otherwise lead to a faulty decision.

ACKNOWLEDGING AND REVERSING BAD DECISIONS

When faulty decisions occur, having the humility to admit a wrong decision when evidence mounts against it can save an organization from inflicting even greater damage upon itself. In making decisions, the program manager accepts the risk that the resources and effort will be wasted if an incorrect decision is executed. The leader also accepts the sunk cost of resources, time, and effort expended changing direction that could otherwise have been used for “business as usual.” Program actions may have high visibility; failures involve personal and professional risk for the decision maker. Program managers, like corporate CEOs, should continue to objectively assess and evaluate the results of their decisions and be prepared to reverse course on those choices that are not working.

INVOLVING THE TEAM IN DECISION MAKING

Finally, few decisions are made in a vacuum, and involving team members and stakeholders in the decision process can improve decision making. Bringing in different and diverse experiences and opinions can enrich debate and lead to more widely acceptable decisions. Complex decisions may be improved by greater reliance on the team’s knowledge, experience, critical thinking, and analytical abilities and perceptions (Hambrick & Mason, 1984, p. 195).

NEGOTIATION SKILLS

In both the business and program environments, the ability to successfully negotiate with stakeholders will be critical to success. Banks and Vera (2007) observe that stakeholder relationships are governed by explicit or implicit contracts, the terms of which are subject to negotiation. Fox and Miller (2006) note that “a project manager’s most meaningful authority may stem from his or her ability to establish and maintain positive working relationships in the project environment, to build and maintain political alliances, and to resolve conflicts” (p. 153). Program managers must work to reconcile ambiguous or conflicting stakeholder claims on the program’s resources and products, often in an environment where the PM has less power and control than the stakeholders. Negotiation skills are vital in these situations.

ENTREPRENEURSHIP

Entrepreneurs, by their nature, are opportunistic and risk-taking (Cunningham & Lischeron, 1991). They thrive in environments of change, volatility, and uncertainty and often help create or accelerate those environments. Many CEOs

and virtually all PMs live in such an environment and can adopt entrepreneurial skills to leverage the environment to the success of their endeavors. Specifically, Peter Drucker (1985) identified seven conditions where entrepreneurs can apply innovation to solve problems:

Responding to the unexpected. Program managers should be attuned to the broader economic, political, and social environment to be able to understand and perhaps exploit unexpected changes, trends, or events. This may apply to business or technological innovations becoming popular in the commercial world, such as Blogs, Wikis, social networks, or YouTube, that perhaps could be adopted as tools to better manage programs.

Incongruities. PMs should seek out processes or practices that do not make sense. Some years ago, Malcom McLean, a North Carolina shipper, noted the difficulties of multi-modal shipping that required loading, unloading, and reloading cargo each time it changed transportation modes between trucks, trains, and ships. This incongruity was labor-intensive, costly, and slowed the process of moving material from its point of origin to its final destination. McLean developed a standard size container that could be stacked aboard ship, train, or truck for transport. Goods would be loaded only once, regardless of the changes in transport modes. This idea revolutionized the shipping industry (PBS, 2004).

Process need. Similarly, PMs who can streamline processes will save time and money. Many standard processes exist because “that is the way it has always been done.” Looking for economies in processes can help the entrepreneurial leader “create” more resources by avoiding costs of wasteful processes.

Industry and market structures. Economies of scale save money, so using unmodified commercial products in military systems, wherever possible, makes sense. A Navy program was successful at meeting shipboard shock and vibration standards by mounting unmodified commercial components that would not have met the standards in innovative shock isolating cabinets and consoles.

Demographics. A younger workforce will bring with it ideas for incorporating innovative technology in programs. Enlisting this generation and adopting their ideas may help today’s PM better meet tomorrow’s needs.

Changes in perception. PMs must also watch societal trends for shifts in perceptions toward their products. Public resistance to jet engine noise “pollution” will impact aircraft operating areas and designs. Low social tolerance for battlefield casualties created intense pressure for adding additional armor to combat vehicles.

New knowledge. Fields such as biotechnology and nanotechnology may have revolutionary impacts on battlefield weapons and defenses. Understanding these new areas could create opportunities for entrepreneurial PMs.

Each of these conditions is associated with volatility and uncertainty in the environment and creates opportunities for fundamental organizational change. Visionary entrepreneurs emerge when they see these conditions and the opportunities they create. Synergistically, entrepreneurs can both leverage the changes and help drive the innovations that fuel them.

HIGH ETHICAL STANDARDS

Unethical or illegal behavior can be devastating to an organization. Program managers have access to taxpayer resources, relative autonomy, and considerable influence over the team members and some stakeholders. It is incumbent upon the program manager to set very high ethical standards, provide leadership by example, and put mechanisms in place to detect questionable behavior and deal with it appropriately when it happens.

A good system of “checks and balances” can be instrumental in helping to prevent one or a few individuals from engaging unnoticed in unethical conduct. Frequent contact with subordinate decision makers can help intercept would be pariahs and detect problems at the program office level. Safeguards should also be put in place and actively monitored by the Program Executive Officer or Decision Authority, functionally similar to the responsibility of a corporate board of directors. As Felo (2001) points out, “a Board actively involved in an ethics program, and not the simple existence of an ethics program, is related to the incidence of potential conflicts” (p. 205). The same is true for program oversight.

STRATEGIC LEADERSHIP

With the relative autonomy of program teams comes the implicit requirement to exercise a greater awareness of the environment external to the program. Much as a corporate CEO would be concerned with the impact of activities among industry competitors and the plethora of other social, political, legal, and economic events external to the company, a program manager must be aware of external events that potentially affect his or her program. The PM, then, must accept the responsibility to scan the program’s external environment for threats or opportunities and use this information to create or change the program strategy.

ENVIRONMENTAL SCANNING

Hambrick (1981), identifies four types of environmental scans that will provide leaders with broad intelligence on the current state of the industry. These are scans of the *output environment*, looking at external product and market events and trends; *throughput environment*, examining processing and delivery of products and services; the *administrative environment*, having to do with roles and relationships within organizations; and the *regulatory environment*, which includes changes to laws and regulations, litigation, etc. (p. 257).

A program manager must, to some extent, be concerned with all four of these environments. Scanning the output environment can provide valuable intelligence on the state-of-the-shelf products that may be available to the PM’s program. Understanding current and emerging products outside the PM’s program can help lead to better benchmarking of the product specifications, quality, cost, and usability; and allow the PM to make or propose changes to his or

her product or system requirements.

Similarly, a scan of the program's throughput environment can reveal shortfalls in internal program processes and performance. Adopting best practices and improving program team performance can be important to long-range competitiveness of the team. Administrative environment scans help the PM better manage the program within the administrative and organizational context of the department as a whole by keeping attuned to changes in processes, procedures, standards, and practices.

The PM must also be proactive in understanding changes in the legal and regulatory environment that may have a tremendous impact on the program. Routine scanning of Congressional language, regulatory proposals, and defense-related news sources can often alert the PM's staff to upcoming changes to federal or local laws and regulations, emerging safety and environmental issues, or major industry shifts that could require changes to the program. Discovering major external changes late in a program can be costly or may result in outright program cancellation, while being proactive may enable the PM to make minor program changes early to accommodate the new environment.

STAKEHOLDER MANAGEMENT

Managing those groups and individuals who have a key interest in the program is a particularly challenging task for the program manager. Mendonca (2001) holds that "there is an increasing realization today that organizational leaders need to be more sensitive to their... obligations to the larger society, which includes all their stakeholders such as consumers, employees, suppliers, governments, local communities" (p. 267). The Program Executive Officer (PEO), Service and Department staff, and Milestone Decision Authority are obvious stakeholders, but there are others as well. Product sponsors and the warfighters/users of the product are important stakeholders. The taxpaying public, press, interest groups (e.g., Greenpeace, etc), and communities where the products are manufactured or operated are stakeholders with influence on the program. The PM must be aware of these various groups, their power and influence over his or her program, and how best to either enlist their aid or avoid their ire.

SUMMARY

With many roles and responsibilities that are analogous to those of an entrepreneurial corporate CEO, a program manager has a great deal of authority and responsibility to manage the cost, schedule, and technical aspects of his or her program. As with a CEO, the PM also has a great deal of latitude to lead and manage the members of his or her team. In this PM-as-CEO model, the program manager has the opportunity to transition from a reactive to proactive leadership role and bring many of the tools and techniques of upper echelon leadership to bear, which will contribute to *empowerment* and *accountability* for program outcomes.

Author Biography

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FINANCIAL ACCOUNTABILITY AT THE DoD: REVIEWING THE BIDDING

 *Christopher H. Hanks*

However beautiful the strategy, you should occasionally look at the results.

Winston Churchill

The Chief Financial Officers (CFO) Act of 1990 requires the DoD to produce private sector-style financial statements that can win unqualified opinions from auditors. After many years of effort to comply, the department is now projecting that its balance sheets will not be ready until 2017 and is unable to predict when its income statements will be ready. Given that discouraging situation, combined with the increasingly widespread realization that external financial statements are of no practical use for internal management, the question arises whether it makes sense for the DoD to continue its pursuit of “CFO compliance.” A review of the history of the CFO strategy suggests the DoD needs to shift its efforts to the development of managerial cost accounting—not private sector-style financial accounting—if progress is to be made.

Keywords: *Accounting, Accrual-based Accounting, Budgetary Accounting, Business Transformation, Business Transformation Agency, CFO Act, CFO Compliance, Clinger-Cohen Act, Cost Accounting, Enterprise Architecture, Financial Accountability, Financial Management, Financial Statements, Government Management Reform Act (GMRA), Managerial Cost Accounting, Matching Principle, Strategic Leadership, Working Capital Fund*

(CFO)

Chief Financial Officers Act of 1990



Financial Report	Date
Balance Sheet	2017
Net Cost Report	20---
Net Position	20---

memo..



The theory underlying the Chief Financial Officers (CFO) Act of 1990 and related legislation, including the Government Management Reform Act (GMRA) of 1994, the Federal *Financial Management* Improvement Act (FFMIA) of 1996, and the *Clinger-Cohen Act* of 1996, is that if federal agencies are required to develop and use a financial *accounting* and reporting system similar to the one used in the private sector—i.e., one that produces private sector-style *financial statements* (balance sheets and income statements)—agency operations will become more effective and efficient over time. A key assumption is that private sector-style accounting and reporting will provide information beyond what traditional *budgetary accounting*¹ provides that decision makers and managers will be able to use to improve performance.

Although this article focuses on the DoD, the *CFO Act* (and related legislation) applies not just to the DoD but to all executive agencies in the federal government. The infrastructure that has grown up to control and direct the implementation of the CFO strategy across the entire government is described in Steinhoff (2005).

Three years after the CFO Act was passed, its “measure and report” approach would be reinforced by the National Performance Review (NPR) initiated by the Clinton administration in 1993. The NPR and the associated Defense Performance Review were grounded in the “new public management” theories that emerged in the 1990s calling for greater use of market mechanisms in the public sector (Osborne & Gaebler, 1992; Thompson & Jones, 1994). Although the NPR addressed more than financial management, it nevertheless increased the pressure on executive branch agencies, including the DoD, to step up *CFO compliance* efforts. Given that financial accounting is a proven measurement and reporting system, together with the traditional inclination at the DoD to view support activities as “business operations,”² it was perhaps inevitable that DoD leaders would embrace the CFO strategy in the 1990s and commit the department to the achievement of “CFO compliance”—i.e., the ability to produce auditable private sector-style financial statements for all of the department’s activities—no matter how difficult that might prove to be.

THE CHALLENGES OF CFO COMPLIANCE

As things have turned out, it has proven to be very difficult. Indeed, despite almost 20 years of substantial effort and expense on the department’s part³, CFO compliance has not been achieved and remains beyond the department’s reach. The department’s latest Financial Improvement and Audit Readiness Plan, for example, projects that the required CFO balance sheets will not be “audit ready” before 2017 and makes no projections at all about when the required income statements⁴ will be ready beyond that point (DoD, 2009).⁵

WILL THE EFFORT BE WORTH IT?

One lesson the last 20 years has taught is that few decision makers in government pay any attention to the CFO financial statements. In a recent report

on the results of its 12th annual “CFO Survey” of 239 federal financial-management executives and managers, the Association of Government Accountants observes that “few people actually read federal financial statements, much less use them for making decisions.” To explain why that’s the case, the report notes that almost all of the 120 senior executives interviewed—representing 70 departments, departmental agencies, and independent entities and commissions—expressed the view that “very little of the information in federal financial reports (in their current private sector-based form) is relevant to government decision making.” That view, by the way, has nothing to do with whether the financial reports received unqualified auditor opinions or not. As one survey respondent put it when asked about the financial statements his agency had produced that had received unqualified opinions: “We’re getting A’s on our tests but not learning anything” (Association of Government Accountants, 2008).

Given the above situation, it is not unreasonable for the DoD to start try-

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ONE LESSON THE LAST 20 YEARS HAS TAUGHT IS THAT FEW DECISION MAKERS IN GOVERNMENT PAY ANY ATTENTION TO THE CFO FINANCIAL STATEMENTS.

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ing to find a new way. The defenders of the CFO strategy, however, continue to believe that the strategy is sound and that the difficulties DoD has experienced represent a failing of the department rather than a failing of the strategy. To counter that view, it is necessary to dig more deeply into the origins of the CFO strategy and confront the arguments that have been made in its defense more directly.

THE ORIGINS OF THE CFO STRATEGY

The CFO strategy has its origins in work of Professor Robert N. Anthony (1916–2006) of the Harvard Business School. A specialist in the fields of accounting and management control, Anthony was a member of the HBS faculty for more than 40 years. His direct involvement with the Department of Defense came in 1965 when a former HBS accounting colleague, Robert S. McNamara, asked him to come to Washington to help establish a financial-management and accounting system that support the DoD’s new Planning, Programming, and Budgeting System (PPBS) (McCaffery & Jones, 2004; Jones & McCaffery, 2005). Taking up Secretary McNamara’s offer, Anthony went to Washington and served as the DoD Comptroller for 3 years, from 1965 to 1968.

The perspective that Anthony brought to his Pentagon assignment—an accountant’s perspective that lies at the heart of the CFO strategy—is that if the executives and managers running the Department of Defense are to succeed at improving the department’s effectiveness and efficiency over time and make sound resourcing decisions, the department’s accounting system should give them the same kind of information that business executives and managers need

to know whether their businesses are operating profitably or not. For all but the simplest of commercial businesses (which can use cash accounting), such information is obtained by using an “*accrual-based accounting system*.” Accrual-based accounting is based on the idea that the only way to reliably determine whether a business is operating profitably or not (which is what owners, investors, and managers ultimately care about) is to record and match revenues with expenses on the books when those revenues and expenses are realized in interactions with customers, regardless of when cash is received or paid. A business that produces and sells widgets, for example, will spend money to produce widgets that it will hold in inventory before they are sold. Under accrual accounting, even though cash may have been paid out when the widgets were being made, the widgets will not be “expensed” on the books until they are sold (delivered) to customers. When that happens (i.e., when a sale takes place), a revenue entry (the amount the customer has promised to pay) and an expense entry (the “cost of goods sold”) will be made, and the two entries become matched. The private sector’s experience has shown that if the foregoing realization and *matching principle* of accrual accounting is followed, the information on properly assembled financial statements will provide a reliable basis for determining whether a business is operating profitably or not over time.⁶

In thinking about how accrual-based financial accounting could be done to improve DoD management, however, Anthony faced a fundamental definitional problem. As noted above, the purpose of accrual-based financial accounting is to determine whether a business is operating profitably or not—but the DoD is not a business trying to make profits. Rather, it is a publicly funded government activity that was created and exists to produce national security. Finding a way to define the DoD’s outputs, revenues, and expenses so that accrual-based accounting can be done, therefore, is not as straightforward as defining those things for a commercial business, where outputs, revenues, and expenses (namely products, sales, and costs) are usually easier to define. Hanks (2008) further discusses problems associated with viewing DoD activities as “businesses.”

To deal with the definitional problem, Anthony proposed that as many DoD support activities as possible (all of its central logistics activities, for example) should be placed under revolving-fund financing (Thompson & Jones, 1994; Shycoff, 1995).⁷ Revolving-fund financing (now referred to as working-capital-fund financing) creates buyer-seller relationships between support activities and the military forces (mission activities), who are the customers. Revolving-fund support activities sell goods and services to mission activities that pay for the goods and services they receive with appropriated funds (usually Operations & Maintenance appropriations). The proceeds of the sales are then used to replenish the underlying revolving funds so the support activities can keep on operating.

From Anthony’s accounting perspective, the advantage of the revolving-fund arrangements is that the financial-transaction data they generate make it possible, as required by the matching principle of accrual accounting, to expense the goods and services used to produce national security at (or near)

the time that national security is “sold” (i.e., delivered) to the country and its citizens (Anthony, 1962, 1996, and 2000).⁸

THE CFO STRATEGY REQUIRES A SYSTEM-WIDE APPROACH

Anthony’s idea also requires that the new accounting system cover everything the DoD does, not just its revolving-fund support activities. Recognizing this fact when he was the Comptroller (1965–1968), Anthony proposed a broad reform program to establish accrual accounting for the entire department, called Project Prime. If it had been put in place (it was not), Project Prime would have reclassified every activity in the DoD as either a “mission activity” or a “support activity”—with all of the support activities operating under revolving-fund financing (Thompson, 1994, pp. 66–67; Jones & McCaffery, 2005, p. 8). The argument, once again, is based on the private sector model: Just as a multi-division corporation must produce a single consolidated financial report for itself every year so that owners, investors, and managers will know how the corporation (as a whole) is doing, so “must” the DoD produce a single consolidated statement every year—and doing that obviously requires an integrated system of accounting that covers everything the department does.⁹ That perspective helps to explain why the financial management sections in the *Government Management Reform Act* of 1994 extended the CFO Act requirement for financial statements to all of the DoD’s activities, not just its “commercial” ones.¹⁰ It also helps to explain why the GAO (General Accounting Office, renamed the Government Accountability Office in 2004) has been insisting ever since the CFO Act was passed that the DoD must develop a single, overarching “*enterprise architecture*” to control the development and operation of all of its financial-management systems, no matter where they may be operating. The GAO’s argument—first made in a report on “system architectures” (GAO, 1992) that GAO released soon after the CFO Act became law—is that unless and until the DoD has a single, integrated system in place that guarantees all defense activities are using financial data defined the same way and are following the same rules for classifying and recording financial transactions, it will be impossible for the DoD to produce a single, consolidated financial report for itself every year capable of winning an unqualified audit opinion, as the CFO Act (as extended by GMRA) requires.

A KEY QUESTION

Given its “failure” every year to comply with the requirements of the CFO Act, the DoD has not been in a position to ask (or even raise) the question of who, exactly, would benefit from having a consolidated financial report for the defense department, if one were to be produced. Instead, the department has been forced to devote a substantial amount of time, effort, and money to what

One of the most unfortunate aspects of DoD's pursuit of CFO financial accounting over the last 20 years has been that it has diverted resources that might otherwise have been applied to the development of better managerial cost accounting in the department. One telling example illustrates the point: Cost accounting is not and never has been part of the charter of the Defense Finance and Accounting Service (DFAS). When it was formed in 1991, DFAS was charged to work on achieving CFO compliance (i.e. financial accounting) at the department. Today, 18 years later, the DFAS charter still does not include cost accounting as a DFAS mission.

But we're getting ahead of the story. Even though Anthony formulated the basic ideas of the CFO strategy in the 1960s, he was not successful in getting the strategy implemented at the department. Another 25 years would pass before the strategy would make itself felt again at the DoD—in the form of the CFO Act of 1990. The next section describes how that happened.

During his tour at the Pentagon, Anthony's effort to establish private sector-style, accrual-based accounting influenced the thinking of many people. Two members of the financial management community at the time who took Anthony's ideas to heart were Charles A. Bowsher, who served as the Assistant Secretary of the Navy for Financial Management from 1967 to 1971, and Donald B. Shycoff, who was working as a program and budget analyst in the DoD Comptroller's office when Anthony joined the department in 1965. Twenty-five years after their original contact with Anthony, Messrs. Bowsher and Shycoff would go on to play key roles in bringing the CFO strategy to bear at the DoD.

After leaving his Navy position in 1971, Mr. Bowsher returned to Arthur Andersen & Co., where he became the partner responsible for all of the firm's government services work. During his next 10 years at Arthur Andersen, Mr. Bowsher worked on efforts to encourage public discussion of the need for financial reporting in the public sector. In particular (working with then Comptroller General, Elmer Staats), Mr. Bowsher led a research project at Arthur Andersen designed to demonstrate how financial statements for the federal government could be constructed. Then in 1981, Mr. Bowsher was selected by President Ronald Reagan to succeed Mr. Staats as Comptroller General and head of the GAO.¹³ Mr. Bowsher served in that position for 15 years, from 1981 to 1996. During that time he, and the GAO under his leadership, played a major and influential role in the development and passage of the 1990 CFO Act.¹⁴

Under Mr. Bowsher's leadership, the GAO was also active in developing the ideas underlying the Clinger-Cohen Act of 1996, which required every executive-branch agency in the government to establish an "integrated information technology architecture" for its business information systems. Like the CFO Act, the Clinger-Cohen Act had the effect of making management recommendations from the Comptroller General and GAO relating to financial accounting into the law of the land.¹⁵

While Mr. Bowsher was leading the GAO, Donald Shycoff would go on to become the Principal Deputy Comptroller at DoD from 1989 to 1992 and Acting DoD Comptroller from 1992 to 1993. During those 4 years, he would organize

and lead the development of the Defense Business Operations Fund (DBOF). The DBOF was established in 1991, the year after the CFO Act became law. As Mr. Shycoff himself has said, the express purpose of the DBOF was to expand the use of revolving-fund financing in line with what Anthony had proposed 25 years earlier (Shycoff, 1995).

Messrs. Bowsher and Shycoff have both publicly acknowledged the influence that Anthony had on their thinking (Shycoff, 1995; Jensen & Bowsher, 1997).

THE ARGUMENTS FOR THE CFO STRATEGY HAVE CHANGED OVER TIME

By the time the CFO and GMRA legislation was being enacted in the early 1990s, the promotional arguments for the CFO strategy had become somewhat more negative in tone (“this will help reduce waste, fraud, and abuse”) compared to the ones Anthony had made 25 years earlier (“this will help DoD operate more efficiently”). The shift in tone was the result of the “waste, fraud, and abuse” scandals in defense contracting that received great attention in the 1980s, combined with the widespread (but faulty) assumption among non-accountants that the primary purpose of financial audits was to detect fraud.¹⁶ By the mid to late 1990s, however, as the pursuit of CFO compliance became more active, financial managers began to re-discover that unless the accounting system delivers cost information useful for day-to-day management, operating managers (including managers in revolving-fund activities) will not pay much attention to what the accounting system produces.¹⁷

The recognition that better managerial cost accounting is what internal managers need, not financial accounting, underlies the most recent argument that proponents have been making for continuing the pursuit of CFO compliance. The argument is that the “discipline and controls” being built into DoD financial systems to make the production of auditable statements possible will, along the way as it were, lead to higher-quality and more reliable financial data—and that will help to improve managerial cost accounting, even if the CFO financial statements themselves are of no use to internal managers. As discussed earlier, the problem with that argument is that it assumes the expense data that are defined and collected in a financial accounting system will—when rolled up by a managerial cost accounting system—be relevant to the decisions that internal managers make each day.

A specific example from the supply business area helps to explain why that assumption is false. To do their part in helping to make sure national security is delivered in the future, DoD supply managers who manage spare parts have a forward-looking job. That is, it is their responsibility to do things today (project demands, optimize spares mixes, place orders, etc.) so that as many of the right items as possible will be on the shelf in the future when mechanics will need them—not to “sell” spare parts that have been purchased and brought into the supply system in the past. The day-to-day “costs” of doing that forward-looking mission are captured in the obligations that supply managers make during bud-

get execution—not by the historical “cost of goods sold” expense entries (even if the entries have been blessed by auditors) made under private sector-style financial accounting.

The population and costs of spare parts tend to change over time as weapon systems are used and are continuously being modified, upgraded, and modernized. The “cost of goods sold” for spare parts sold by a supply activity today, therefore, may have very little to do with the current obligations that must be made to ensure that suitable spare parts will be on the supply shelf in the future when needed. Extensive research on the demand for military spare parts, for example, has shown that even when only peacetime training is taking place, the failure patterns and demand rates for many different reparable-type spares (which are more expensive than consumable repair parts) can be and often are quite volatile from one year to the next, even when annual operating tempos are relatively stable (Crawford, 1983; King & Mattern, 1985; Keating & Camm, 2002; Peltz, Colabella, Williams, & Boren, 2004).

The above argument becomes even clearer at the weapon system level. Although historical costs certainly have to be taken into account (and they are) when developing the estimates of what new weapon systems will cost, it is the future costs of weapon systems that acquisition program managers are trying to manage each day, not the historical purchase costs of systems already in the inventory. Although well meaning, the “data discipline” being enforced in the pursuit of financial accounting and CFO compliance at the DoD is not helping to improve the department’s managerial cost accounting capabilities.¹⁸

WHY, IN THE END, THE CFO STRATEGY IS NOT GOOD FOR THE DoD

As the preceding discussion is meant to suggest, neither Anthony’s original arguments, nor the current “data discipline” arguments, stand up to the most basic reason why continuing the pursuit of the CFO strategy is *not* a good idea for the DoD. That reason is the following: The compact that exists between the DoD and Congress, in terms of what the Congress (on behalf of the country) wants from the DoD, and what DoD is working to provide, is a forward looking compact. That is, once agreement has been reached on future threats, the Congress wants the DoD to do the best job it can to assure that the resources and capabilities that will come into existence in the future as a result of current decisions will be sufficient to meet those threats. That implies the costs that the Congress and the DoD should most care about when thinking about efficiency are the obligations that are being made during execution in order to provide for national security in the future, not the historical costs tracked by private sector-style financial accounting.

CAN THE DoD CHANGE COURSE?

The CFO Act is still the law. For the DoD to move away from the production of CFO financial statements, either Congress needs to amend the CFO Act as it applies to the DoD (which is not likely to happen) or the DoD needs to propose new “accounting initiatives” to replace its current CFO compliance efforts. The new initiatives must still support the basic intent of the CFO Act—to improve DoD’s effectiveness, efficiency, and fiscal responsibility—but without requiring the production of private sector-style financial statements. More and better managerial cost accounting would serve that purpose, but it needs to recognize the primacy of the budgeting process. Is it possible to expand the capabilities of the department’s budgetary accounting and reporting systems to include managerial cost accounting capabilities?

One possibility would be to explore whether the data elements called “Object Class Codes” in current budgetary systems could be expanded. Object Class Codes report obligations by the nature of the goods or services being purchased. For example, in budgetary accounting records, “Object Class Code 21” is attached to any obligation made anywhere in the department to cover the costs of “Travel and Transportation of Persons” (e.g., air tickets, rental cars, lodging, per diem, etc.). That makes it possible (using any data system that can roll up obligation amounts and their Object Class Codes), to determine what DoD activities at any level are spending for travel (assuming budgetary accounts are kept for the activity). That information would clearly be of interest to a manager trying to determine, for example, whether an activity could accomplish its mission more efficiently by investing in an electronic conferencing system, thereby reducing business travel.

In a cost study done for the Defense Travel Management Office in 2007, for example, Object Class Code 21 data were used to obtain an estimate of the total direct costs of (i.e., obligations for) DoD business travel in FY06. In comparison with totals obtained from other sources (travel voucher sums, DFAS disbursements, travel card charges, etc.), the Object Class Code 21 data captured as much if not more of DoD’s travel costs than all other sources combined (Mandelbaum et al., 2008). As another example suggesting the proposed approach may have merit, one reviewer of a previous version of this article noted that in a GPRA pilot project the Navy conducted several years ago, operational managers in the Atlantic Fleet made significant changes in the allocation of funds across the “products” the Fleet produces (e.g., trained carrier battle groups ready for deployment) based on information collected in its budgetary accounting system.

Object Class Codes for the entire government are defined and maintained by the Office of Management and Budget (OMB). The codes the DoD uses are published in Volume 1, Appendix A of the DoD Financial Management Regulation (FMR). Actual obligations by Object Class Code are collected by the DoD Comptroller’s office every year, so the codes are being used. In particular, the “FAD 740” report in the annual “Financial Summary Tables” on the Office of the Under Secretary of Defense (Comptroller) Web site classifies DoD’s total obliga-

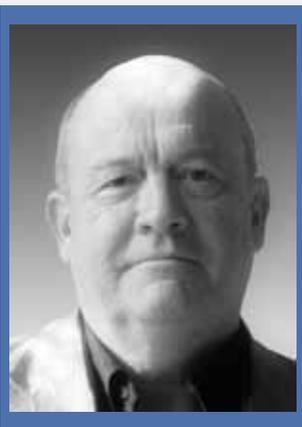
tions each fiscal year across the approximately 30 different Object Class Codes currently used in the department's budgetary accounting systems.

Expanding the number of Object Class Codes could be done by selecting from the output measures that have been developed for the Performance Assessment Rating Tool (PART) exercises the department has been doing in response to the 1993 Government Performance and Results Act (GPRA). The Obama administration has announced plans to improve PART by making the system more output-oriented, which would fit well with the idea of expanding Object Class Code definitions so that they can do a better job of describing the outputs that defense obligations are buying.

CONCLUSIONS

Even if the DoD is able to say at some point that it has achieved CFO compliance, the consolidated financial statements that will have been produced, will not be used to allocate resources either by the Congress or by managers at any level in the DoD. To obtain the more practical information needed to work on improving effectiveness, efficiency, and fiscal responsibility, the DoD needs to convert its CFO-compliance efforts into efforts aimed more directly at establishing relevant managerial cost accounting—tied to the budgeting process—that both Congress and DoD managers will be able to use.

Author Biography



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ENDNOTES

1. Budgetary accounting is what federal agencies have been required to do for 90 years, ever since the passage of the Budget and Accounting Act in 1921. The purpose of budgetary accounting is to allow federal agencies and activities to keep track of the obligation authority and other budgetary resources they receive from the authorization and appropriations process. The Statement of Budgetary Resources (SBR) is the single financial statement that federal agencies are required to produce each year under budgetary accounting. The SBR is subject to independent audit to assure that budgetary resources have been allocated and used in accordance with all laws and controls governing their limits and use.
2. In its recommendations on how to manage the newly formed DoD, the first Hoover Commission (1947-1949) called for the use of “businesslike practices for the provision of common services.” Forty years later, the 1986 Packard Commission Report on Defense Management would include the following statement by the Commission members: “Defense acquisition represents the largest and, in our judgment, the most important *business enterprise* in the world [italics added].” Today, continuing that tradition, the DoD Business Transformation Agency uses the term “Core Business Missions” when referring collectively to the support activities the department operates in the following six functional areas: logistics (i.e., central supply and maintenance, warehousing, distribution, and transportation); acquisition; information management; human resources management; real property and installations management; and financial management.
3. The achievement of CFO compliance has been a goal of every major business-process reform effort at the DoD for 20 years, including: the Defense Management Review and Corporate Information Management (CIM) (1988-1992); the Defense Performance Review and Acquisition Reform (1992-1996); the Business Reform Initiative and Acquisition Excellence (1996-2000); the Financial Management Modernization Program (2001-2003); Business Management Modernization (2003-2005); and Business Transformation (2006-present). A study would be required to determine how much has been spent specifically on the pursuit of CFO compliance, but it is not unreasonable to think the total has been in the billions of dollars. One recent example offers a glimpse into the sums that can be involved. In February 2005, the DoD Inspector General let a three-year, multiple-award, IDIQ (Indefinite Delivery, Indefinite Quantity) contract to 20 professional private sector accounting firms specifically “to assist the DoD in improving the reliability of its CFO Act financial statements.” The dollar ceiling on the contact was \$977.5 million.
4. Some government activities—such as revolving fund activities—have other sources of “income” (revenue) besides appropriations. The revenues that revolving fund activities collect are called exchange revenues. As a consequence, the “results-of-operations” income statements required by the CFO Act have two parts: the Statement of Net Costs, which adjusts results of operations for the year based on exchange revenues, and the Statement of Net Position, which reports the results of operations relating to “non-exchange revenues” (i.e., appropriations).
5. In an attempt to show progress, the DoD has begun reporting the achievement of “partial” CFO compliance. The March 2009 FIAR Plan, for example, reports that unqualified audit opinions have been achieved on “39 percent” of the department’s *total* assets and liabilities at the end of 2008. A problem with such claims is that they appear to be self-contradictory. If the DoD does not know what its *total* assets and liabilities were at the end of 2008, how can the department claim an opinion of 39 percent of that total?
6. If a firm is reporting profits but has not taken into account future costs that it either knows or expects to have to pay—e.g., warranty payments, future environmental cleanup costs, retirement payments, etc.—its financial statements will not give investors all the information they need to make fully informed investment decisions. Separate from how it treats inventory held for sale, therefore, accrual accounting also makes it possible for firms to deal with such future expenses by allowing the effect of such future expenses to be reflected on the financial statements even though it may be many years before cash is paid out. It

is this aspect of accrual accounting that fits with the CFO Act's goal of improving fiscal responsibility in government. The assumption is that if future costs are incorporated into the financial statements, decision makers will take such costs into account when making program decisions. Proponents of CFO compliance have pointed to this aspect of accrual-based accounting as one of the reasons why the DoD should "stay the course" with CFO compliance, even though other options for providing visibility of the department's future liabilities would seem to be possible.

7. Dr. Robert N. Anthony acted on his ideas about revolving-fund financing when he was the Comptroller. For example, he personally led the effort that began in 1965 to place all of the department's aeronautical maintenance depots under revolving-fund financing—and in 1968 all of the department's aeronautical maintenance depots did, in fact, become "industrially funded," which they are to this day.
8. Such "purchases" of national security by the country and its citizens, of course, are made indirectly and "in bulk" through the Congressional appropriations process, rather than directly and individually each time a revolving-fund transaction takes place, so the business analogy is not perfect. Nevertheless, given the CFO strategy's goal of setting up accrual-based financial accounting for the "businesses" of defense, revolving-fund arrangements provide a way of saying that expenses (operating costs) and revenues (defense appropriations) are being matched. All of the DoD's revolving-fund support activities use accrual-based accounting as it is described here.
9. In the private sector, multidivision corporations (like GE or IBM) must produce financial statements showing the financial position and results of operations for the corporation viewed a single financial entity. Financial transactions that take place between divisions within such corporations are done using "transfer prices." When assembling the corporate financial statements at the end of the year, it is necessary to keep track of who paid what to whom within the corporation over the course of the year to avoid double counting in the corporate statements. A "consolidated" financial statement, therefore, is one in which all the necessary "eliminating entries" have been made so that the corporate financial statements accurately reflect the financial position and results of operations (i.e., income) of the corporation as a whole. In the DoD setting, the coin of the realm for execution is obligation authority (OA), so revolving-fund sales within the DoD are booked as intra-governmental transfers of OA on the DoD's books, based on the transfer prices charged by the revolving-fund activities. The magnitude and complexity of the intra-departmental transfers that are generated—both among the revolving-fund activities themselves and between those activities and the department's direct-funded activities—are enormous. Because the DoD (and its major Components—the Army, Navy, and Air Force) are each viewed as single corporate entities by the CFO Act, they are required to produce consolidated financial statements, just as multidivisional corporations in the private sector must do. But the DoD's accounting systems, of course, were never designed to keep track of the "eliminating entries" required to produce private sector-style, consolidated financial statements. After many years of unsuccessful internal effort to solve its intra-governmental eliminations "problem," the DoD has now turned to commercial Enterprise Resource Planning (ERP) systems in the hope that they will be able to untangle the situation. For example, in the Defense Agencies Initiative (DAI), the Business Transformation Agency is pursuing an Oracle-based ERP system that is supposed to become, upon project completion, the integrated financial management system for 28 different defense agencies. A central DAI goal is to show it is possible for a commercial ERP system to produce a consolidated financial statement for 28 different agencies viewed as a single corporate entity. The first phase of the DAI covers an initial test group of six agencies and is supposed to be completed in 2010.
10. Before being expanded by the 1994 GMRA, the CFO Act required private sector-style financial statements only for "commercial" activities in government, i.e., activities where "businesslike" financial transactions take place, such as revolving-fund activities.
11. Since its establishment in FY 2006, the DoD's Business Transformation Agency (BTA) has devoted substantial effort to the production of congressionally required Enterprise Transition

Plan (ETP) and Business Enterprise Architecture (BEA) documentation. The latest ETP, released in September 2008, is an 8.3Mb file available at the BTA Web site. A Congressional Report issued in March 2009 is also available on the BTA Web site. Based on current plans, the BTA will eventually become an organization of roughly 350 personnel, including both government and contract staff. Total funding for all BTA budget lines was \$335.8 million in FY07 and just over \$400 million in FY09. That includes operational funding for the BTA's internal operations and staff as well as procurement funding for all 27 of the DoD-wide systems acquisitions programs currently proceeding under BTA program management.

12. Generally accepted accounting principles (GAAP) refers to the extensive set of formally defined standards, conventions, and rules for recording financial transactions and preparing financial statements that professional accountants follow. The primary job of the auditor of the financial statements for a business is to examine and test the business' accounting records to provide assurance that financial accounting and reporting has been done in accordance with GAAP and (thus) "fairly presents" the financial position and results of operations for the business for the year in question.
13. The Comptroller General is appointed for a 15-year term and serves as the head of the Government Accountability Office (GAO). When it was created in 1921, the GAO was called the General Accounting Office. Congress changed the name in 2004 to reflect the shift in the GAO's mission that has taken place over the last 40 years—away from accounting and auditing and into program evaluation.
14. As the Comptroller General, Mr. Bowsher was influential in the passage of the Single Audit Act of 1984, which required audits of state and local governments and other recipients of federal grant, and in the discussions of the Federal Management Reorganization and Cost Control Act, which was first proposed by Senator William Roth in 1986 and that evolved to eventually become the CFO Act of 1990. In remarks he made upon his induction into the Accounting Hall of Fame in 1996, Mr. Bowsher said the following about his role in the development and passage of the CFO Act:

In 1933, Colonel Carter (Arthur Carter, President of the New York Society of CPAs) was able to persuade the Congress with one testimony to enact the basic legislation that required annual independent audits for all public corporations. It has taken me most of my 15-year term, many audits of the Internal Revenue Service, the Air Force, the Customs Service and other agencies, and well over 20 testimonies before Congressional committees to achieve similar legislation for the public sector. I can only conclude that Colonel Carter was a more persuasive individual.

15. The GAO has continued to vigorously promote the development and use of enterprise architectures (EA) across the government, including at the DoD. An August 2006 GAO report, for example (GAO-06-31), concludes by recommending that the heads of 27 major departments and agencies, including the Secretary of Defense, "ensure that their respective EA programs develop and implement plans for fully satisfying each of the conditions in our enterprise architecture management maturity framework"—a construct first described in an April 2003 GAO report, GAO-03-584G.
16. Most accountants who do audits will say that the primary purpose of a financial audit is not to look for fraud by management but rather to verify that the financial statements fairly present the financial position and results of operations (of the company involved) in accordance with GAAP. To make the distinction, financial statement auditors will sometimes describe themselves as being "watchdogs" rather than "bloodhounds."
17. One important exception to this rule is that operating managers do pay close attention to reports of Anti-Deficiency Act violations generated by the budgetary accounting system.
18. For more evidence supporting this point, readers are encouraged to view the tutorial on the department's Standard Financial Information System (SFIS) initiative—available at: <http://www.bta.mil/products/training//SFIS/index.html>. The tutorial makes it clear that the primary purpose of the SFIS is to facilitate the production of CFO-style financial statements.

DETERMINATION OF AN ACHIEVABLE MATERIEL AVAILABILITY FOR THE JOINT AIR-TO-GROUND MISSILE

 *James C. Byrd and Michael "Mike" J. Osborne*

When Am (Materiel Availability), which marks a significant departure from Ao (Operational Availability), was established as a fleet-level Key Performance Parameter (KPP) by Joint Requirements Oversight Council Memorandum 161-06, issued by Navy Admiral Edmund P. Giambastiani on August 17, 2006, the Joint Attack Munitions Systems (JAMS) Project Office Logistics Directorate was tasked to develop a viable Am threshold and objective Am KPP for the Joint Air-to-Ground Missile (JAGM) system. This article describes the thought process and analyses that resulted in the JAGM Am KPP contained in the JAGM Capability Development Document (CDD) and system specification. The cause and effect relationships between logistics activities as well as the pros and cons of the application of Am to the JAGM system are discussed.

Keywords: *Materiel Availability, Key Performance Parameter, Performance-Based Logistics, Key System Attribute*

Concept image rendering, not actual missile.

JAGM

Joint Air to Ground Missile



On August 17, 2006, Joint Requirements Oversight Council Memorandum (JROCM) 161-06 (Giambastiani, 2006) approved the *Key Performance Parameters* (KPP) Study recommendations and endorsed the implementation of a mandated *Materiel Availability* (Am) KPP. This memorandum also mandated the implementation of materiel reliability and ownership costs as supporting *Key System Attributes* (KSA). These mandates apply to all Major Defense Acquisition Programs (MDAP). The Deputy Under Secretary of Defense for Logistics and Materiel Readiness (DUSD L&MR) issued a policy memorandum establishing four materiel readiness outcome goals for all Acquisition Category (ACAT) I acquisition programs (DUSD L&MR, 2007). This list included all mandates contained in JROCM 161-06 and defined Mean-Down-Time (MDT) as an additional KSA as well as 14 life cycle sustainment *enablers*. On March 1, 2009, the Chairman of the Joint Chiefs of Staff (CJCS) (2009b) released CJCSI 3170.01G, which provided guidance on the development of KPPs. Am is defined as “a measure of the percentage of the total inventory of a system operationally capable (ready for tasking) of performing an assigned mission at a given point in time based on materiel condition” (Chairman of the Joint Chiefs of Staff, 2009a, p. GL-15). It is expressed as:

$$\frac{\text{number of end items operational}}{\text{total population of end items}}$$

The formula yields the percentage of end items that are Fully Mission Capable (FMC) at the time of the measurement.

APPLICABILITY TO JOINT ATTACK MUNITIONS SYSTEM (JAMS)

The initial JAMS response to the mandate to add the requirement to the JAGM CDD was to request an exemption. The Program Office rationale seemed straightforward since missile products are unique given that tens of thousands of spare end items are available in depot storage for issue upon demand. Given that the JAGM missile is a certified round with no field maintenance, there is no forward maintenance downtime.

After missiles are expended, aircraft are reloaded; replacement inventory is then requisitioned and issued from the Ammunition Supply Points (ASP). ASPs would requisition replenishment rounds from the depot storage sites. This volume of inventory made it possible to provide near 100 percent Am at the unit level. It was therefore proposed by the JAMS Program Office that the materiel reliability KSA might satisfy the Am KPP requirement. This request was quickly denied. The rationale for the denial related to the actual definition of Am was as follows: “The materiel availability addresses the total population of end items planned for operational use, including those temporarily in nonoperational status once placed into service, [such as depot-level maintenance]” (Chairman of the Joint Chiefs of Staff, 2009a, p. B-B-3).

The JAMS Program Office therefore shaped the Am analysis to include repair/maintenance time, logistics time, depot turnaround-time, transportation

time, system Operating Tempo (OPTEMPO) retrograde evacuation time, transit quantities, and total end item inventory into the MDT mix.

RAMIFICATIONS OF MATERIEL AVAILABILITY TO JAMS

Am (Materiel Availability) is a significant departure from Ao (Operational Availability), which is an analysis that provides a probability of success based on the average of the key element—downtime—over a specified period of time. Ao is measurable during demonstration testing (Department of Defense, 1982), but once fielded, data collection and Ao validation are not possible since not all elements of downtime are a unit-reportable requirement. Am, on the other hand, is the measure of the percentage, not probability, of the total FMC systems at any given point in time. Interestingly, Am is not measurable during Logistics Demonstrations or Independent Operational Test and Evaluation (IOT&E) events because the key player in the Am algorithm—the supply chain parameter component of MDT—does not yet exist. Instead, key components of Am are approximated against reasonable estimates of external factors such as the supply chain.

Although not intuitively obvious, it became clear that the JAMS Program Office needed to assume control of what constituted an achievable Am that could be included into the CDD, as opposed to a mandated Am. The achievable Am baseline is the result of product and support design specifications and analysis of controllable and uncontrollable circumstances to define threshold and objective Am metrics. This analysis must be performed by the developer and must be submitted and defended by the materiel development command. Delegating this responsibility to the developing command drives the materiel developer to consider all elements of Am and examine element interaction in order to arrive at an achievable and defensible Am requirement to include in the CDD.

RESULTS

INITIAL FINDING

Am results will be necessarily lower than Ao analysis results (apples versus oranges) since Am encompasses *all* elements of downtime across the entire system population. Instead of attempting to measure an Ao probability by collecting actual downtime to arrive at Mean Time between Failures (MTBF) and Mean Time to Repair (MTTR), the Am algorithm must be dissected into its basic components for analysis.

Examining each MDT component's contribution to downtime allows the materiel developer to identify and focus on controllable components that define early supportability, producibility, durability, and reliability design criteria during the technology development and system development and demonstration phases of the program (Assistant Under Secretary of Defense [Materiel and

Readiness], 2004). These derived design criteria must be included in the system specification and form the basis for Performance-Based Logistics (PBL) metrics included in performance-based agreements and ultimately into support contract language. Am therefore forces the materiel developer to consider both the acquisition and sustainment phases of the life cycle in a deliberate design effort to compress MDT while minimizing the frequency, duration, and cost of support elements.

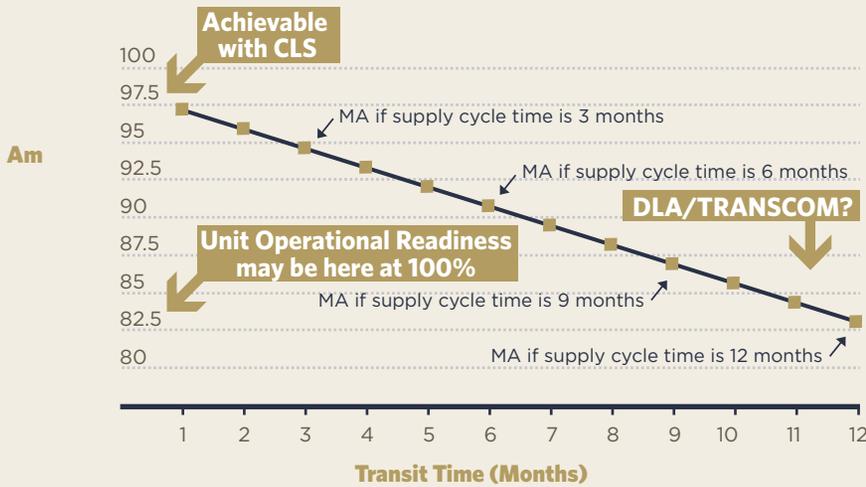
FROM THE MATERIEL DEVELOPER PERSPECTIVE,
AM COMPONENTS CAN BE GROUPED INTO TWO
FUNDAMENTAL CATEGORIES, CONTROLLABLE
AND UNCONTROLLABLE.

From the materiel developer perspective, Am components can be grouped into two fundamental categories: controllable and uncontrollable.

Controllable components are those that are within the control of the materiel developer and are the only components that the developer can influence in reducing MDT. These components are reliability, maintainability, maintenance turnaround time, repair/maintenance time, logistics time, and depot turnaround time. Reliability is a KSA minimum value that is included in the CDD as a derivation from stated user requirements and is used in the algorithm to determine achievable Am. The remaining elements are key-design components for reducing MDT, and their value must be optimized and included in the system specification in order to cost effectively maximize Am. Although depot turnaround time is difficult to quantify if the system is in the Technology Demonstration phase (pre-Milestone B), it is an obvious PBL metric candidate for inclusion in the support section of the production contract or the Contractor Logistics Support (CLS) Statement of Work. Less obvious perhaps is the effect of transitioning from tightly controlled contractor supply chain turnaround times (TAT) under a CLS concept to an organic support or partnerships scenario. CLS supply chain TAT efficiency is a combination of detailed specification requirements and the contractor's desire to meet applied TAT metrics (use of FedEx, DHL, etc.). Supply chain variances emerge under organic support, which are out of the control of the program office. These variances, when negatively impacting both supply chain timelines and depot TAT, cause Am to degrade when the transition occurs.

Uncontrollable Am components include OPTEMPO, transportation time, and retrograde evacuation time. Transportation out of theater retrograde, which can be a low priority, will vary depending on the mode and frequency of trips. Missiles in particular cannot be shipped commercially (FedEx, DHL etc.), but only through government transportation nodes, which causes wide variations in the missile retrograde times. These components are out of the control of the developer and are driven by policy and the transportation infrastructure. Assuming a range of transportation times from 1 to 12 months, modeling analysis demonstrated the effect on Am as illustrated in Figure 1.

FIGURE 1. TRANSIT TIME IMPACT ON AM



Am can be anywhere between 98% and 82% with no effect on fill rate at demand point. Spares drawdown is from storage.

SECOND FINDING

Upon this initial analysis, the JAMS Logistics Directorate concluded that the only logical approach to implementation was to model component relationships in order to target meaningful Am values. This required collecting hard OPTEM-PO data, depot experience data from other related programs, and analysis of design attributes of similar systems. Reasonable assumptions were made to fill in the data gaps. These data were rolled into a simple model that provides the resulting Am given a set of inputs, as well as providing values of key data points of interest. This resulted in an achievable and defensible Am value to include in the CDD.

Because Am is not testable during Logistics Demonstrations or IOT&E events due to the absence of the supply chain component of MDT, the Army Test and Evaluation Command (ATEC) contacted the JAMS PO to discuss implementation approaches. ATEC had come to the same conclusion as the JAMS PO—that modeling and simulation was the only logical approach—and requested that we provide our model to them as a starting point for their modeling and simulation efforts. Details of the JAMS Am analysis are discussed in ensuing paragraphs.

Munitions uniquely differ from more traditional systems because although ships, aircraft, and ground vehicles may be destroyed in performing their mission, a successful munitions mission *always* results in its destruction. In addition, high volume expenditure rates during wartime operations such as Operations Iraqi Freedom and Enduring Freedom (OIF and OEF) create significant inventory fluctuation over time. How would this impact Am over time? It was therefore determined that a period of interest must be included in the Am analysis algorithm.

Collection of operational data for reliability and maintenance analysis was also an issue. Classic reliability is expressed as the probability that a system will successfully complete its mission for a specified duration. The reliability of JAMS products such as HELLFIRE is expressed as the probability of a successful engagement for a defined period of on-wing time or captive carry time. This captive carry limit is known as *durability*. For example, a durability limit of 100 hours means that the reliability of the round decreases when captive carry time exceeds 100 hours. This clock begins when a factory fresh round is installed on

CLASSIC RELIABILITY IS EXPRESSED AS
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an aircraft in operational service. Just as nonmunitions systems require periodic maintenance to maintain system reliability, so does the missile. During current wartime operations, this is called Reset. Because JAMS munitions are typically certified rounds, they are not maintained in the field and must be returned for depot maintenance. Current munitions design does not include a mission clock, which is partially due to technology limits during the period of development, but also due to conservative expectations. Original estimates assumed that no missile would be on-wing longer than the durability requirement. Operations in Bosnia gave us a glimpse that this might not be the case. OIF and OEF confirmed this with captive carry times exceeding durability limits by almost 1,000 percent. In response to this, the JAMS PO is developing Health Monitoring Units (HMU) to be installed in the round with an external indicator to display key operational data. This will soon undergo limited field testing. In the interim, JAMS has deployed depot maintenance technicians to the field tasked to collect and report this data. These factors are important to the Am calculations. Exceeding the durability limits negatively impacts Am through a reduction in materiel reliability (KSA), and returning the munition to the depot also decreases the Am by removing it from the total operational population. Lastly, there is the challenge of considering operating at a reduced reliability to offset the negative impact on Am by removing the unit from service. These kinds of issues illustrate Am's influence and are clearly optimization problems, pitting cost and performance against Am requirements.

The uniqueness of the munitions system caused several assumptions to be made in order to bound the analysis within a relevant range and stabilize inherent dynamics associated with design, operations, and policy. The following assumptions also simplified our approach, which was critical in meeting a short suspense:

- The analysis models missile availability based on aircraft operations.

- Based on a two-level maintenance concept, Unit (pass/fail Built-in-Test (BIT), remove and replace) and Depot only.
- First-in-first-out: Expenditures consist of the highest captive carry times.
- The scrap rate is calculated against maintenance pipeline.
- This is a steady state model. All inputs remain static for the period of interest.
- Stockpile surveillance is assumed to occur once annually with a sample size of 10 percent.
- Transit time is bi-directional, both to and from the depot.
- Depot MTTR does not include touch labor or time associated with batch processing of missiles such as paint and curing time.
- Reset was included in this model due to current events—missiles exceeding durability limits during OIF/OEF.

The modeling process was straightforward. Operations and Support (O&S) data and reliability requirements were modeled to derive the annual volume of maintenance, which is expressed as the MDT pipeline. This pipeline represents the number of systems unavailable for service, which is the prime factor in calculating Am. Managing this pipeline became the strategy, and the goal was simple: explore viable, cost-effective methods to shorten the pipeline in order to maximize Am. Key controllable components were analyzed to examine their impact. Model algorithms follow:

- STORAGE/TRANS: Total quantity of missiles in stockpile and in transit at any time. Computed as $TOTAL\ MSLS - TOTAL\ EXPENDITURES - ON-WING$
- ON-WING: Total quantity of missiles on-wing. Computed as $A/C\ DEPLOYED \times JAGM\ LOAD\ (\%) \times MISSION\ LOAD$
- ANNUAL MSL OP HRS: Total annual cumulative missile captive carry time. Computed as $MISSION\ LOAD \times JAGM\ LOAD\ (\%) \times A/C\ DEPLOYED \times OPTEMPO \times 12$
- PREFLT BIT FAILURES: Annual quantity of missile BIT failures during aircraft loading operations. Computed as $PREFLIGHT\ BIT\ FAILURE\ RATE \times (ANNUAL\ MSL\ OP\ HRS \div DURABILITY\ RQMT)$
- MTBF: Derived from missile reliability and durability. Computed as $(-1 \times DURABILITY) \div (\text{Log } [MSL\ RELIABILITY])$
- ANNUAL IN-FLT FAILURES: Annual on-wing missile failures during missions. Computed as $(ANNUAL\ MSL\ OP\ HRS \div MTBF) \times (1 - EXPENDITURE\ RATE\ [\%])$
- STOCKPILE FAILURES: Failures discovered during annual surveillance exercise. Computed as $(1 - STOCKPILE\ RELIABILITY) \times .1 \times (STORAGE\ AND\ TRANS - RESET - ANNUAL\ IN-FLT\ FAILURES - PREFLT\ BIT\ FAILURES)$
- TOTAL ANNUAL FAILURES: Total quantity of missiles out of service due to functional failure or exceeding durability limits.

Computed as PREFLT BIT FAILURES + STOCKPILE FAILURES + ANNUAL IN-FLT FAILURES + RESET + SCRAP. SCRAP is computed as SCRAP RATE x RESET

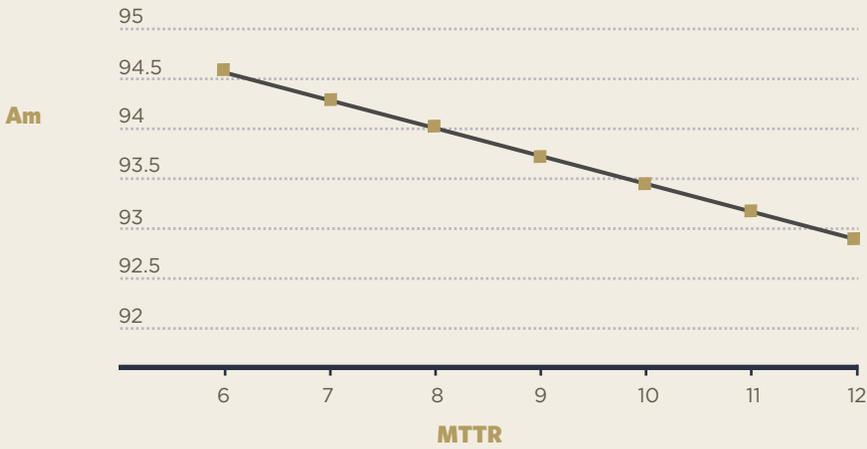
- RESET: Total annual missiles that have accumulated Captive Carry Time beyond the durability limit and must be returned to depot for service. Computed as $(\text{ANNUAL MSL OP HRS} \div \text{DURABILITY RQMT}) - (1 - \text{EXPENDITURE RATE [\%]})$
- TOTAL EXPENDITURES: Total quantity of expended missiles for the period of interest. Computed as $\text{RESET} \times \text{PERIOD OF INT} \times \text{EXPENDITURE RATE (\%)}$
- TOUCH LABOR/MO: Total monthly depot touch labor. Computed as $(\text{TOTAL ANNUAL FAILURES} \div 12) \times \text{DEPOT MTTR}$
- MONTHS BACKLOG: Number of months in depot backlog based on capacity and volume. Computed as $\text{TOUCH LABOR/MO} \div (160 \times \text{SHIFT} \times \text{TEST SETS})$
- QTY IN TRANSIT: Total number of missiles expected to be in transit at any point in time. Computed as $\text{MONTHS IN TRANSIT} \times (\text{TOTAL ANNUAL FAILURES} \div 12)$
- DEPOT WORKLOAD: Total number of missiles in work at the depot at any given time. Computed as $\text{TOTAL ANNUAL FAILURES} \div 12 \times \text{MONTHS BACKLOG}$
- PIPELINE QTY: Total quantity of unserviceable missiles in the maintenance pipeline and serviceable missiles in transit from the depot to storage at any give time. Computed as $\text{DEPOT WORK LOAD} + \text{QTY IN TRANSIT}$
- MATERIEL AVAILABILITY: Percentage total population of end items ready for service at any give time. Computed as $1 - (\text{PIPELINE QTY} \div [\text{INITIAL TOTAL MSLS} - \text{TOTAL EXPENDITURES}])$

MTTR was selected as a key component for analysis since it is a significant piece of the depot repair turn around time. The system is a certified round; therefore, the MTTR is restricted to depot level. The MTTR as defined herein addresses only direct touch labor required to test, fault isolate, and replace failed components. It does not include time processes such as painting, curing, or any processes that are typically batched processed. The definition of this component is specific because it focuses on design for maintainability. This depot maintenance is accomplished using an All-Up-Round (AUR) test set, which is often limited to only one or two sets. This is where the maintenance throughput becomes limited due to nonavailability of test set time, thus creating a bottleneck. This is not uncommon in operations involving high-cost, one-of-a-kind test equipment. The relationship between MTTR and Am is illustrated in Figure 2.

Because the net effect of MTTR was not as significant as expected, the shortest MTTR possible (6 hours) given technical limitations and cost constraints was included in the system specification. Figure 2 shows that a doubling of the MTTR to 12 hours reduces the Am by approximately 2 percent.

Directly associated with MTTR, Direct Labor and Test Equipment were se-

FIGURE 2. MTTR IMPACT ON Am

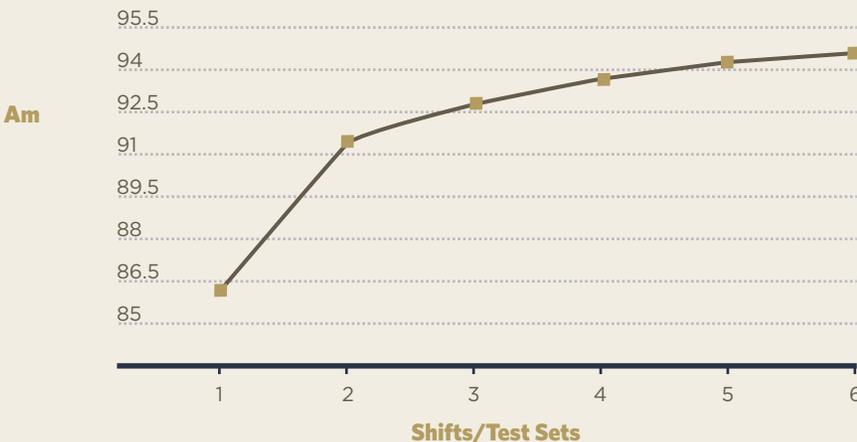


lected. These components represent the number of standard work shifts and quantity of test equipment in operation at the depot. Their effects on Am are illustrated in Figure 3. The numbering along the X axis represents a combination of work shifts and equipment converted into shifts. Additional equipment will not be added until all possible shifts are used. For example, 3 represents 3 shifts per day/5 days per week on 1 test set. Six might represent 3 shifts per day/5 days per week on 2 test sets. There are, of course, possibilities in between that might incorporate underutilized production equipment on a noninterference basis.

While initial gains are significant, returns decline almost leveling off by 6 shifts/test sets. This is due to inventory build up resulting from transit time remaining unchanged. Typical transit time is within approximately 25 percent of depot backlog so the net effect of reducing depot turnaround time diminishes.

Durability is the last of the controllable components with significant effect on Am. Durability was examined rather than reliability because it offered greater improvement within reasonable limits and could be continually improved

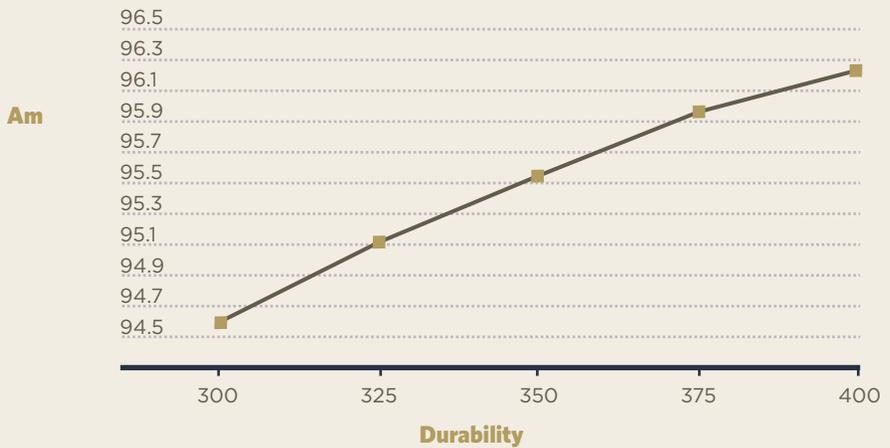
FIGURE 3. DEPOT DIRECT LABOR AND TEST EQUIPMENT IMPACT ON AM



through reliability growth studies during and after development. The JAMS PO is currently requesting the return of high captive carry rounds from theater to study the possibility of extending durability limits. Additionally the fielding of the HMU capability, as previously noted, will provide much needed data in the evaluation of the viability of expanding the durability/captive carry limits, and will provide the data to assess the reliability and service life of the tactical missile stockpile under the Stockpile Reliability Program (SRP). As illustrated in Figure 4, extensions to durability limits can yield significant gains in Am.

FIGURE 4. DURABILITY IMPACT ON AM

The focus from controllable components (within control of the materiel de-

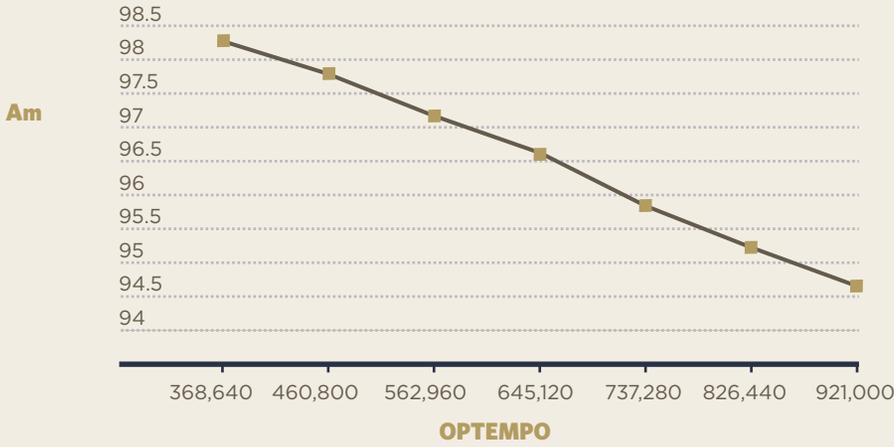


veloper) to those uncontrollable components was the next step. These are the components that were necessarily estimated based on historical experience. These components by their very nature are variable, and it is therefore prudent that the effect of variances in the uncontrollable elements be examined in order to understand the impact to Am caused by events out of the control of the materiel developer and the program manager.

The first to examine is OPTEMPO, which, as it varies, has a significant effect on Am. This component is simply the total annual operating hours accumulated by all rounds in service and is dependent on quantity per platform, platform density, monthly OPTEMPO of the platform, and munitions expenditure rate. Figure 5 illustrates the impact of reducing the platform OPTEMPO by 5 hr/mo increments. The analysis assumed worst case OPTEMPO to ensure that the Am was viable during the most critical need.

Expenditure rate was the most interesting component in the analysis. Surprisingly, the Am increases significantly as the expenditure rate increases. This is due to an effect termed *launching the pipeline*. This essentially means that as the expenditure rate increases, fewer rounds will enter the maintenance pipeline. This is largely due to Reset comprising almost 90 percent of the maintenance volume. If the first-in-first out policy is practiced, then the oldest rounds will be fired first. This essentially leaves preflight BIT failures, in flight BIT failures, and annual stockpile surveillance failures as the only driver for the depot mainte-

FIGURE 5. MISSILE OPTEMPO IMPACT ON Am

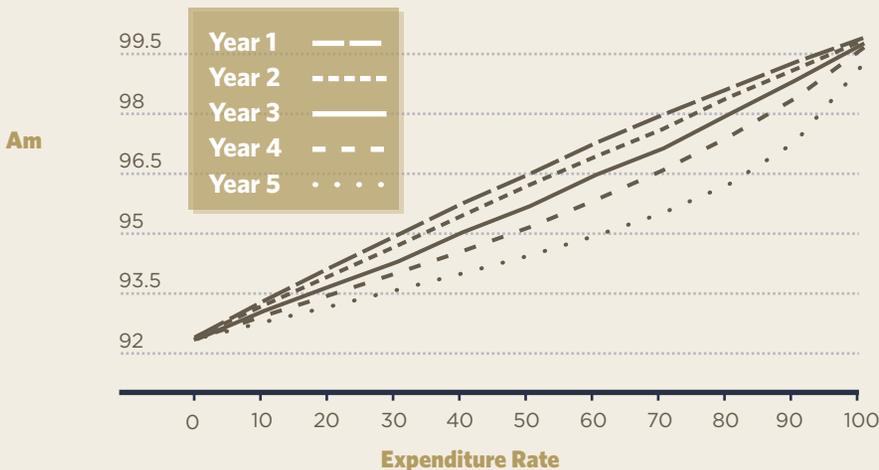


nance workload. As expenditure rates decrease, so does Am. This is primarily due to more rapid accumulation of captive carry hours on in-service rounds that are rarely expended.

The period of interest in years makes little difference. This is due to the reduction in total population by the number of expended rounds. Although the ratio of unserviceable rounds to total population becomes smaller, it is not significant (see Figure 6). By the end of 5 years, the Am at expenditure rates above 50 percent is at or above acceptable levels while inventory levels are almost depleted. Figure 6 illustrates the effect of the expenditure rate on Am.

This points to a weakness in applying Am across the board. For Am to be meaningful in this application, an additional constraint such as a KSA specifying a minimum inventory level would be needed. For example, a minimum inventory level of 10,000 rounds would mean that expended rounds would be deducted from inventory until reaching 10,000, at which time expended rounds would not be deducted but would be counted as unavailable for service. This additional

FIGURE 6. IMPACT OF EXPENDITURES ON Am OVER TIME



KSA would apply to systems such as munitions that experience large, naturally occurring inventory fluctuations resulting from training and combat operations. By tying inventory levels to Am, replenishment quantities could be significantly influenced or possibly totally based on Am. In doing so, production and support contracts could be designed as total PBL agreements where the contractor has the latitude to optimize all PBL elements, including production, to achieve the required Am.

CONCLUSIONS

Much work remains before Am can be totally integrated into requirements development, design, development and support contracting, and ultimately measured. As far as the JAMS PO approach goes, it provided a logical and defensible basis for defining viable Am requirements. This experience has also demonstrated the extent to which Am reaches across organizations and policies.

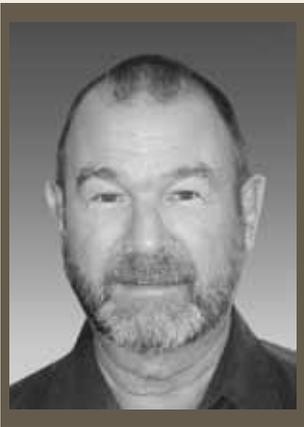
Implementation of Am also has a direct impact on PBL implementation. A mandate to include a KPP of Materiel Availability in all CDDs for ACAT I programs drives the materiel developer to examine all controllable conditions and define a calculated value for each in the system specification. This in turn allows the materiel developer the opportunity to engage and evaluate the progressing design for sustainment during the Life Cycle Logistics phase of the program, and develop very specific PBL metrics as the PBL planning takes place during the Technology development and System Design and Development stage. Am simplifies PBL in that as Am forces “design for support” to reduce the frequency, duration, and cost of the support elements that affect the Am, there is less of a maintenance burden and infrastructure to consider for the application of PBL principles. PBL contracts can now be managed against Am and cost, allowing the contractor to internally derive contract deliverables required to achieve the required Am metric. This arrangement could give the contractor control of requirements such as repair quantities and inventory levels traditionally retained by the government.

Government agencies such as Defense Logistics Agency, Transportation Command, organic depots, and materiel support commands must become stakeholders in the uncontrollable Am components that they own by implementing PBL concepts designed to respond to system-level requirements rather than their own internal metrics.

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TWENTY MINUTES FROM NOW

 *Mark Oehlert*

The Department of Defense (DoD) acquisition workforce is reaching a point at which change—rapid, relentless change—will become the norm. The global marketplace and the billions of consumers that make up the cyberspace called Web 2.0 will drive this change and wield influence over its features, products, and capabilities available to the DoD enterprise—capabilities represented by words such as Twitter, Wikipedia, Flickr, Firefox, RSS, or blogging. To fully realize the potential of these technologies, even within the very real boundaries of policy and technology within which the defense acquisition workforce must operate, the author advocates in this article a degree of re-thinking about how business is conducted, both internally and externally, and even what the definition of that business is.

Keywords: *Social Media, Web 2.0, Policy and Technology, Knowledge Management, Global Marketplace*

"The future is already here - it is just unevenly distributed."

William Gibson, noted author

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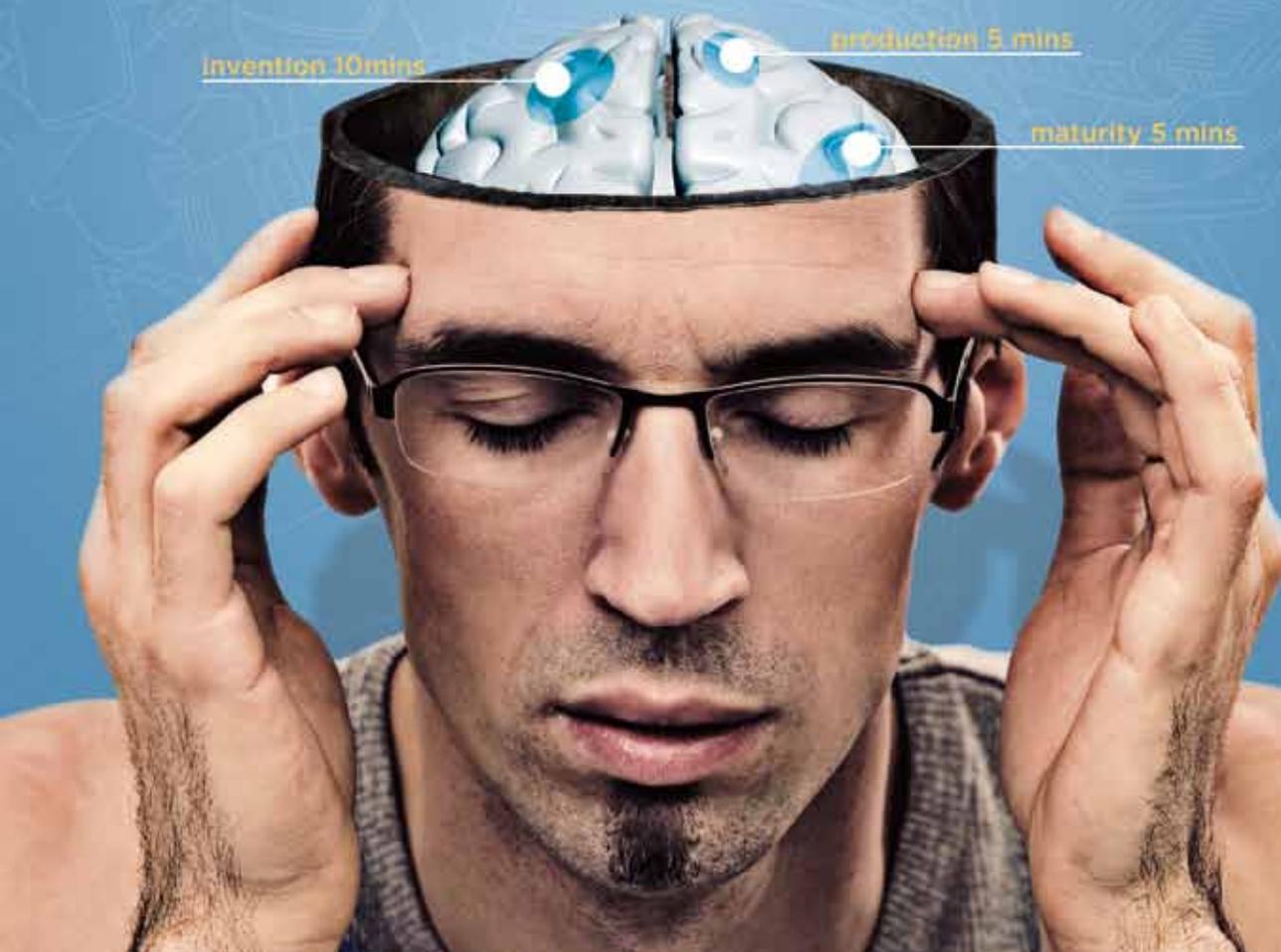
minutes
from now

situational awareness

Invention 10mins

production 5 mins

maturity 5 mins



strategy. As noted Knowledge Management (KM) practitioner John Bordeaux (2009) recently argued as it related to DoD-wide KM strategy:

The focus should not be on the KM troops or the CKO [Chief Knowledge Officer]. DoD has arrived at the notion that KM is essential, and has moved therefore to secure the position of KM across the department. This, sadly, removes the focus from what works and from the warfighter. A focus on a large KM program, careers, etc., is to focus on a structural fix to a behavioral and technology problem. Worse than not fixing it, these structures work against the very types of initiatives that succeed on the ground. (pp. 2-3)

Substitute “social media” or “Web 2.0” for KM and it’s the same argument. Specifically related to social media, Mark Drapeau of National Defense University and Lin Wells, the former Principal Deputy Assistant Secretary of Defense (Networks and Information Integration), the Acting DoD Chief Information Officer, and the Principal Deputy Assistant Secretary of Defense (Command, Control, Communications, and Intelligence) have asserted that:

Social software, if deployed, trained on, monitored, managed, and utilized properly, is expected to yield numerous advantages: improve understanding of how others use the software, unlock self-organizing capabilities within the government, promote networking and collaboration with groups outside the government, speed decision making, and increase agility and adaptability. (Drapeau & Wells, 2009, p. vi)

One dynamic that has become increasingly clear is that today, the actual technology—the software or the hardware—is usually the smallest part to understanding the potential impact that it could have on an organization. Other facets include the organizational design and change management issues. One of the defining characteristics of a number of these technologies is that they are not culturally neutral—that is to say, by deploying them within organizations they will, by their very presence, change the culture of the organization. Wikis—online collaborative writing environments—as an example, tend to both reduce e-mail traffic around the creation of a new document and democratize the editing process so that not only does everyone have the ability to author new portions of the document, but everyone can also have the ability to roll back the document to prior versions.

This is a step away from the old routine of attaching the document to an e-mail, sending it out to the writing team while appointing someone “version master,” and then making sure that everyone applies the “Track Changes” feature of the software to the document. The new arrangement, while possessing favorable attributes (reduction of e-mail for one), can also be troubling for those who perceive a potential loss of control. The dilemma is clearly apparent: We have a technology that is incredibly simple and cheap (if not free) to deploy, but that carries with it some real potential organizational issues that must be addressed

if the technology is to be successfully deployed and employed.

These are not culturally neutral applications. The very way in which social media operate means that they step outside the boundaries of traditional silos, departments, and regions. To fully realize the potential of these technologies, even within the very real boundaries of policy and technology within which the defense acquisition workforce must operate requires a degree of re-thinking about how business is conducted, both internally and externally, and even what the definition of that business is. Imagine that “the grapevine” is not a poisonous plant to be cut off at the roots, but a natural source of vitality to be cultivated and nourished. Imagine that its branching, intertwining shoots are the natural pathways through which information and energy flow in the organization. Consider that these informal networks of learning conversations are as much a core business process as marketing, distribution, or product development. In fact, thoughtful conversations around questions that matter might be the core process in any company—the source of organizational intelligence that enables the other business processes to create positive results (Brown & Isaacs, 1996).

Gibson and Amara, authors of the two quotes that introduce this article, are both right. The future is here, and we are both overestimating its impact in the short run and underestimating its impact in the long run. Are these technologies dramatically impacting our business today? They are just starting to. Would it be wise to begin to seriously consider how to deal with the impact of these technologies when they are adopted at an enterprise-level? Yes.

The eLearning Technology Center (eLTC) at the Defense Acquisition University is exploring a number of ways to increase awareness of the potentials (and pitfalls) of emerging technologies like Web 2.0 among both DAU faculty/staff and the much larger defense acquisition workforce. We welcome your comments, support, and involvement.

Author Biography



Mark Oehlert is a recognized expert, author, and speaker in the fields of innovation, emerging technology, and game-based learning. He has worked in the e-Learning field for 10 years, bringing his unique insight as a trained historian and anthropologist to a range of challenges from performance support to mobile computing and learning strategy development. Oehlert now serves as an Innovation Evangelist at the Defense Acquisition University.

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“SHOW ME THE MONEY”

 **Bill Fournier**

The recent article entitled, “How to Make Incentive and Award Fees Work,” makes a case for program success using multiple incentives and subjective award fees, was originally published in the *Defense Acquisition Review Journal (ARJ)*, Issue 48, July 2008, Vol. 16, No. 2. The article used a definition of program success as the perception from the program managers and contracting officers themselves. I question the possible unintended positive biases and inability to measure real vs. perceived integrated program success.

“Show me the money”—a famous quote from the movie *Jerry Maguire*—best expresses how following the money can improve program management contract financial incentives. This can be applied consistently with a CAIV (Cost as an Independent Variable) approach in which the government fixes a threshold for schedule, performance, and risk variables, and offers financial incentives based on the short-term and long-term expected costs.

Some incentives’ approaches encourage the developer’s activities, which although appearing positive, are actually misleading. These incentives’ approaches may allow the developer to maximize the collecting of incentives by trading off other areas such as increasing the schedules’ risks or reducing the system’s performance. The developer can decide to ignore the current contracts’ incentives intentionally to reduce competition and thus collect larger expected future incentives. Some incentives’ approaches have three major shortcomings: not considering the future contracts, being complicated, or being subjective.

Future contracts' impacts need consideration in regard to financial incentives or contracting strategies. A \$100,000 competition incentive on the System Design and Development (SDD) phase contract will be ineffective when earning it would increase the developer's competition on the follow-on billion-dollar production contract. The government should consider a few likely developer actions to reduce competition on future contracts (example: a late and/or poor quality Technical Data Package).

A better method to deal with future contracts' impacts is to align the contracting strategy such that the government and contractor are both incentivized for short- and long-term program success. This approach needs to consider the best way to leverage long-term competition in order to align the developers' financial incentives at the right points in the life cycle. In the above example, some programs' contracting strategies should have the competitive SDD contract with a priced production option.

The second shortcoming is having complicated incentive risks such as cost and performance incentives. One situation is when minimum weight and minimum cost incentives on the same contract are usually traded off in design. The problem is these incentives work against each other. A design to minimize cost will not be the lightest. The lightest design will be more costly in efforts to reduce weight by using more expensive materials. Financial incentives can encourage the trade-off of schedule and other performance parameters in unintended ways. This approach is tempting for the value added of pushing the performance from the threshold to the objective value, but tends to fail because of an imperfect knowledge of true design trade-offs. A better CAIV-type approach is to fix threshold values for everything except cost. The cost incentive should be based on an expected net present value life cycle cost.

The third shortcoming is subjectivity. Subjective items can be ineffective for two reasons: the difficulty in measuring the improvement of the integrated program success and the increased burden of the resources to administer the contract. Subjective incentives do provide the program more flexibility, but the continual shifting of contract priorities for the program can be damaging. One analogy here is like pushing a three-dimensional balloon; one needs to be wary of making progress in one area (the X axis) but losing progress in another area (the Y or Z axis).

Basically, I am worried about my balloon analogy: that gains in incentive areas will be losses in other areas. When feasible, I feel a better approach is to strive to be objective, to be simple, and to consider the whole program life cycle. Good financial incentives can enhance the likelihood of real integrated program success.

William "Bill" Fournier

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DEFENSE ARJ

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DEFENSE ARJ

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2010

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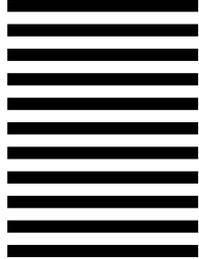
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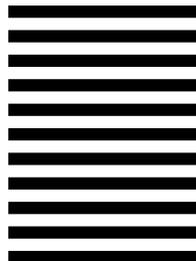


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