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The Competitive, Crowdsourced Investment (CCI) Initiative

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by the Under Secretary of Defense for Acquisition, Technology, and Logistics

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Our Theme for 2016—Sustaining Momentum

Frank Kendall

It's hardly a secret that we are headed toward a change in administration next year. I've been through these transitions several times, as have most acquisition professionals. During my previous experience in the Pentagon organization of the Under Secretary of Defense for Acquisition, Technology, and Logistics, I worked for a total of eight Under Secretaries in as many years, and I went through one same-party and one other-party administration change.

As some of these transitions approached, there were attempts to cram a lot of accomplishment into a very short time. This generally caused a lot of work and wasn't very successful. In my case, I have had several years to effect the improvements in defense acquisition I thought were most needed. As a result, there won't be a Better Buying Power (BBP) 4.0 this year and, while I do plan to modify Department of Defense Instruction (DoDI) 5000.02 on the margins and to make it consistent with current law, there also won't be a major acquisition policy rewrite this year, although we will be implementing the changes required in the Fiscal Year (FY) 2016 National Defense Authorization Act. We still have a lot to do in implementing the existing BBP actions, however. Also, the new DoDI on the acquisition of services has just gone into effect, so we still have work to do on implementation of that as well.

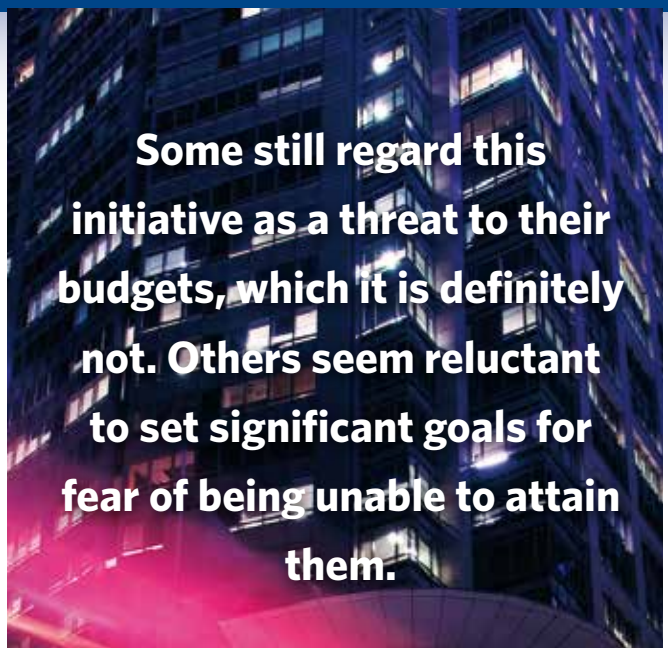
What I would most like to accomplish during the balance of this year is to sustain and build on the momentum we have achieved over the last few years. I don't know what will happen in the election, and, depending on how it turns out, I also don't know what opportunities I may have. But I do know that we have the better part of a year together in which to make more progress on the areas in which we have been working. I also know that we are improving acquisition outcomes. The evidence is clear from the most recent *Annual Report on the Performance of the Defense Acquisition System* and other data that contract costs and schedule overruns are being reduced, as well as cycle time, and that we are tying profit more effectively to performance through the use of incentive structures. I would like to discuss some of the actions that stand out as important areas in which to sustain and build

on the momentum we have gained as we get ready for a new administration next year.

Promote Technical Excellence and Innovation: We are well into implementing BBP 3.0, but we have many actions in progress that need to be completed. My concerns about technological superiority that motivated this edition of BBP are reinforced every time I receive a daily technical intelligence update. This year's budget includes a number of advanced technology demonstrators and experimental prototypes and we need to get these provisions enacted and the projects started. Steve Welby, who has been confirmed as Assistant Secretary of Defense for Research and Engineering, and his teams completed the Long Range Research and Development Planning Program, which was very influential in the FY 2017 budget. We are strengthening the ties between operators, intelligence experts, and acquisition professionals. We will continue to manage the ongoing actions to improve our workforce's technical capacity, and to extract as much benefit as possible from all of our various Research and Development accounts and from industry's investments. Bill LaPlante has left his position as Assistant Secretary of the Air Force, but his dictum to "own the technical baseline" is an enduring imperative to all of our technical and management professionals working to bring new products to our warfighters. As I have said many times, our technological superiority is being challenged in ways we have not seen since the Cold War, and we must respond.

Continue Establishing and Enforcing Affordability Analysis and Caps: We have been doing this for more than 5 years now, and there is solid evidence that both the analysis process by Service programmers and the enforcement of caps by the acquisition chain and the requirements chain are having a beneficial impact. The use of long-term capital planning analysis was a new concept when we introduced it, but it is becoming institutionalized. We can't predict future budgets accurately, but we can do analysis now that helps us make better decisions. Enforcing the resulting caps is the most difficult aspect of having them, but if the caps are to be meaningful, they have to be enforced. We've learned from our experience, but this is still an evolving area. The caps should be set at a level that leaves some margin; they are neither cost positions nor program baselines, nor budgets. They are tools to ensure meaningful long-term capital investment planning and to guide cost versus performance trade-offs during development. I am hopeful that the Department of Defense (DoD) will continue to establish them and enforce them in subsequent administrations.

Promote Increased Use of "Should Cost" as a Management Practice: I believe that in many, but not all, cases "should cost" is now a normal part of business. It should be. Every manager should understand the cost structure under his or her control, analyze it for savings opportunities, set goals to achieve those opportunities and act on those goals. After several years of effort, the use of "should cost" has proliferated across the DoD. It is changing thought patterns and behaviors in a positive way. That implementation isn't uniform, however, and I'm afraid it hasn't been fully embraced in all cases. Some still regard this initiative as a threat to their budgets, which it is definitely not. Others seem reluctant to set significant goals for fear of being unable to attain them. The "culture of spending" isn't dead yet, and the perverse incentive of execution rate targets isn't going away. We need to continue to strike the right balance and to encourage our workforce to do the right thing for both the taxpayer and the warfighter by not wasting resources that could be saved and put to a better purpose. Of all the BBP initiatives over the years, this is the most fundamental thing we have done. Use of "should cost" targets has saved the DoD billions of dollars, and we need to continue expanding and supporting its use.



Provide Strong Incentives to Industry: As I have said and written many times, industry is easy to motivate. Corporations exist for the purpose of making money for their shareholders, so the motivation tool is obvious and effective. The trick for the DoD is to align this self-interest with the DoD's interests, and to do it in a way that will be effective at improving outcomes. We're making progress on this, but I still see some unevenness in how our managers structure incentives. It takes good critical thinking to get incentives "right" because we deal with so many different business situations. Incentives need to "thread the needle" between being easily achieved and impossible so that they do influence behavior. They also need to be meaningful financially both as carrots and sticks, without asking corporations to assume an unreasonable amount of risk. I'll

continue to focus on this aspect of our acquisition strategies as programs come in for review, and I'll expect managers at all levels to do the same.

Effectively Manage Intellectual Property: Going back to BBP 1.0, we have worked hard to mature our collective understanding of how to protect the government's interests while also respecting industry's property rights. This is a complex area of law and one in which the DoD was at a longtime disadvantage relative to industry. I occasionally still wrestle with cases of "vendor lock" based on proprietary content. Hopefully, we have all but stopped the practice of just accepting industry assertions of property rights. We need to continue to grow our expertise in this area and spread the best practices associated with effective management of intellectual property.

It's perfectly legitimate for a company to expect a reasonable return on the intellectual property it has developed or acquired. In general, that return should be in the competitive advantage conveyed by superior technology or lower costs. On the other hand, the use of intellectual property by a firm to sustain a decades-long grip on the aftermarket for a product is something the DoD should and can work to prevent. We're getting better at this, but our efforts need to be sustained and broadened.

Acquire Modular Designs and Open Systems: This idea is anything but new. However, our practice has traditionally not matched our policy. It takes active technical management of design architectures and interfaces to make both open systems and modularity a reality. This is "owning the technical baseline," and the devil really is in the details. Assertions of modularity and openness are not always valid. There are also always cost impacts and design trades that work against achieving these goals. We can point to a few successes in this area over the last several years; each Military Service can take credit for programs to provide open architectures in general and modular designs on some specific platforms. The Long Range Strike Bomber is a notable example. This effort should continue and expand, but success will require a technical management workforce that is trained, experienced and empowered.

Use Monetized Performance Levels in Source Selection: We've had several notable successes with this initiative. They include the Combat Rescue Helicopter, the Joint Light Tactical Vehicle, and the Amphibious Combat Vehicle. This is a relatively new concept; it asks the requirements community to do something that it has traditionally resisted—put priorities and relative value on requirements. Industry traditionally would simply bid threshold values of performance. This initiative gives industry a reason to aim higher, as long as it can do so for a reasonable cost. By providing industry with information on how much we are willing to pay, and how much competitive source selection evaluation cost credit we will give in an evaluated price, we motivate industry to create better products for us. We also get the benefit of more objective source selections. This is a useful property in a period in which protests are more common. The fact is we have to make these best value judgments anyway. We are better off to make them rationally prior to asking for bids. I hope to see several more successful examples of this approach over the balance of the year and to see it continued indefinitely.

Improve the Acquisition of Services: With the publication of DoDI 5000.74, we marked the transition to a more structured way of looking at management of contracted services acquisitions. This is one culmination of a series of steps that date back to BBP 1.0, where we took Air Force initiatives introduced by now LTG Wendy Masiello when she was the Air Force's Program Executive Officer (PEO) for Services Acquisition and expanded them to the rest of DoD. Over the last several years, we have built on these initial steps. Despite this progress, I remain convinced that this area of spending, which is now well above the spending on products, offers the greatest potential for savings and efficiency in the DoD. My Principal Deputy, Alan Estevez, has led this effort and it is starting to pay big dividends.

As we go through this year and gain experience implementing the new DoDI, I would expect us to gain insights that will lead to some modifications, but overall I think we are the right track. This is one area in which I will ask the Service Secretaries and Chiefs to become more involved. A great deal of contracted services are acquired and managed outside the standard acquisition chain and institutions. As Gen. David Petraeus once wrote to his staff in Afghanistan, "Contracting is commanders' business." This is as true outside the operational contingency arena as it has been in Afghanistan and Iraq. However, many of our operational and institutional leaders are not focused on the management of these extensive resources. During the coming year, we can and will do more to change that.

Continue Our Annual Acquisition Assessment Activities: We have instituted three sources of annual assessments that will be continued this year. They are: the *Annual Report on the Performance of the Defense Acquisition System*, the Annual Preferred Supplier Program, and the Program Mangers' Annual Assessments. The first of these provides a growing body of statistical data and analysis on the performance of the acquisition system using a range of metrics. The third edition, released last fall, shows strong evidence of improved performance over the last several years. Each year we have added additional data and analysis to this volume and we will continue to do so this

year. The second item provides public feedback to industry on the relative performance of major business units based on the Contractor Performance Assessment Reporting System (CPARS). We struggled to get this off the ground, but thanks to the Navy's pilot effort led by Sean Stackley and Elliot Branch we were finally successful. Last year, all three Military Departments published their results simultaneously. We will continue that practice this year. The third item is the Program Manager's Annual Assessments, of which I published a subset last fall. I published them (with the writers' permissions) because I was very impressed with the inputs I received and because I thought providing them to a wider audience was a great way to educate outside stakeholders on the great variety of real life problems that our program managers face, and how professionally they deal with those problems. I recently requested this year's assessments and they will be submitted by the time this piece is published. At the PEOs' request, I am also giving PEOs an opportunity to provide a similar input. I will do my best to dedicate two solid weeks to reading and responding to each of the 180 odd assessments I will receive. Last year's reports highlighted a number of problems and opportunities that needed to be addressed; and I expect the same this year. I also will request another round at the end of 2016.

Build Even Greater Professionalism: The DoD has an incredibly professional workforce. When building professionalism was introduced in BBP 2.0, there were some who took that as an assertion that our workforce is not professional. Nothing is further from the truth. However, we all can become even more professional through experience, training, education and personal effort. None of us should ever be complacent; there is always more to learn and always opportunity for increased levels of expertise and broader experience. We also all have a duty to improve the professionalism of those who work with and for us. If there is one legacy each of us should strive for, it is to leave a more professional workforce behind us than we found when we arrived. We are fortunate to have the support of the Congress and Secretary of Defense Ashton Carter in this endeavor. Our Director of the Human Capital Initiative for acquisition personnel, Rene Thomas-Rizzo, has worked hard with the Under Secretary for Personnel and Readiness Brad R. Carson to include provisions in Secretary's Force of the Future initiatives that will benefit our workforce. We will work hard with the Congress and internally to see those initiatives enacted this year.

Increase the Involvement of the Service Chiefs in Acquisition: The most recent National Defense Authorization Act included provisions strengthening the Service Chiefs role in acquisition. I fully support this direction and have already met with all four Service Chiefs to discuss their role. The areas in which I think they can make the greatest contribution are in requirements, budgeting and personnel. As stated above, I also think they can do much to improve the management of acquisition activities that take place outside the acquisition chain of command. During the year we will be implementing this direction.

The BBP initiatives have spanned several major areas of emphasis, included dozens of specific initiatives, and involved more than 100 actions—in each version. There also have been any number of steps we have taken over the past several years to improve acquisition outcomes across the full range of products and services that DoD acquires. Many of them have been outside the specifics of the BBP initiatives.

Underlying all this effort are some fundamental cultural goals. One of them is to move from being a culture that focuses on spending to one that focuses on controlling costs. This may be the area in which we have made the greatest gains. Another has been to encourage a culture that values and encourages the critical thinking needed to confront the huge range of problems acquisition professionals must deal with. We are not engaged in cookbook activities where one way of doing business always works. A third goal is to achieve the widespread appreciation of, and a culture that values, professionalism inside our workforce and, perhaps more important, outside it. Our success depends entirely on the efforts of thousands of true professionals in the full range of disciplines needed for new product design, testing, production, and support. Finally, there is the resurgent importance of being a culture that values and rewards the technical excellence and innovation needed to stay ahead of the committed and capable adversaries we may face in combat. Building and sustaining these aspects of our culture is a task that should never end.

The Competitive, Crowdsourced Investment (CCI) Initiative

Col. Scott T. Wallace, USAF

This article proposes an initiative for consideration by the acquisition community. The suggestion is not endorsed by the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics or any other organization of the Department of Defense.

* * *

Within the private sector, investment capital flows to the businesses that can best generate returns for investors. A result of this incentive structure is a business culture that relentlessly turns capital into future returns.

Within the Department of Defense (DoD), weapon system investment funds—those used for modernization or replacement of existing weapon systems—are allocated to the highest defense priorities. This incentive structure means that DoD acquisition culture focuses on creating the most capable weapon systems. Yet, if DoD acquisitions are to remain affordable in the future, DoD needs to assign greater importance to cost.

Wallace, *a colonel in the U.S. Air Force, is director of the Comparative Technology Office in the Office of the Secretary of Defense.* *The author would like to acknowledge a few of the many people who provided inspiration and countless hours to develop and refine the ideas in this work, including, from the National Defense University, Richard Shipe, Ph.D., professor of Acquisition and Land Combat Systems; Mark Foulon, professor of Business and Industry; Moshe Schwartz, adjunct professor; and, from the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, Sally Sleeper, Ph.D., senior advisor for Manufacturing and Industrial Base Policy.*

To create a culture that balances cost with capability, I propose that the DoD allocate some investment funds to generate future cost savings. Unlike previous and existing practices, this proposed investment program would use the power of competition to effect a desired cultural change within the acquisition community. The opportunity to win additional funds would incentivize program managers (PMs) to improve their weapon systems in a manner similar to how business leaders look for the high-return investments. This would increase the importance of cost in acquisition culture.

Previous Efforts

The Reduction in Total Ownership Costs (RTOC) program provided selected programs with funding in 1999–2011 in order to "maintain or improve current readiness while reducing operations and support [O&S] costs." Programs reported achieving life-cycle cost savings far in excess of the investment. A report on RTOC by the Institute of Defense Analyses (IDA) proposed a framework for encouraging cost reduction across the DoD life-cycle management enterprise. Step 1 in the framework was to "establish an affordability culture encompassing all stakeholders"—a statement indicating that this attribute is not yet present within the Defense Acquisition System.

RTOC program successes demonstrated that it is possible to reduce operating costs with investment funds by improving weapon systems. Exactly how much high-return investment is possible in the DoD is unknown and would make for an interesting study. However, the real challenge isn't to reallocate limited investment funds to cost savings; there will never be enough to invest in both the desired capability needs and effective cost reductions. Instead, the DoD should leverage competition to encourage the permeation of the DoD acquisition culture with business thinking focused on return on investment (ROI). The resulting cultural shift will affect DoD affordability beyond any single investment program.

Competitive, Crowdsourcing Investment

This proposal offers that a fixed amount of Research, Development, Test and Evaluation dollars be set aside for competition between military Services and DoD agencies. A project would be selected as the winner based primarily on the competing Service or agency's proposal to make high-return cost improvements. ROI would be measured by the projected cost savings over a fixed time divided by the total cost of implementing the update, just as investors seek to turn their current assets into future cash flows in private markets. The total cost of any improvement should cover procurement and logistics, man-hours, and, to encourage the most realistic business thinking, the cost of capital.

The real strength of this proposal is not simply the achieved return of these funds; it is the opportunity to reinforce the importance of cost savings and instill business thinking in the acquisition community. To facilitate this cultural change as effectively as possible, this initiative has three key attributes: competition, crowdsourced decision making, and streamlined management.

Competition

Cost savings would be encouraged by having program offices compete to win development funds based on their projected ability to produce ROI. The immediate effect would be to fund programs now that will save funds in the future. By emphasizing competition, the DoD would be rewarding the best business cases rather than the most important programs and, in the longer term, would be investing in development of a business culture within the acquisition community.

Because funds typically are assigned to solve a particular problem, rather than competed against objective criteria, PMs currently are in the business of efficiently spending the resources assigned to achieve the desired capability.

However, there is no reason for cost-saving investments to be divided among the Services from the top down. Were PMs allowed to win funds based on their likely ROI, the DoD would allocate funds in the way the private sector does, where investors put money into projects that generate the highest rates of return. Unlike the DoD budget allocation, the funds awarded competitively might not always go toward the most important defense capability requirements. However, in terms of the entire DoD budget, a dollar saved operating a critical, advanced weapon system provides the same affordability increase as a dollar saved operating less critical systems.

Furthermore, the opportunity to compete and win on the basis of one's innovative ideas provides an individual incentive and a distinguishing, measurable achievement. If an engineer or logistician becomes known for generating successful proposals, one could predict that PMs would compete for the services of that person. Within a personnel system with few avenues to provide recognition of superior performance, competition for limited funds provides an opportunity to identify capable and motivated personnel. Finally, support contractors, original equipment manufacturers and suppliers would all be encouraged to present cost-saving proposals to the program offices in order to win additional funds. One could imagine small businesses that focused on introducing cost savings across the DoD and winning CCI funds for program offices. A key part of the decision of a small company to bring its technology to the DoD would be the business case, rather than the importance of the system or funds available to the program. Encouraging entities within the private sector to compete for DoD funds based on the business case of their proposals is just what DoD needs in order to remain affordable.

Crowdsourced Decisions

The next question for a competitive program proposal is "who chooses?" This dilemma presents another opportunity. A requirement that peers vote on cost-saving proposals will cause PMs to review and evaluate each other's proposals. This kind of crowdsourced decision-making would contrast with the typical, highest-paid person's opinion (HIPPO) in the room that now dominate DoD decision making. Using the crowd will involve more of the acquisition community, increase the cultural impact of the initiative and reduce the additional bureaucracy required to manage this effort. Additionally, if some types of proposals are seen as the best ideas, reviewing PMs likely will apply the same ideas in their programs to better compete in the next round. Clearly, plagiarism of cost-saving ideas should be encouraged! The hope is that the best ideas will be adopted quickly and spread, just

An Example

Imagine that a small company has developed and patented a new design for a hydraulic pump that can be easily adjusted to a variety of volume/pressure needs, is simple to produce, and promises at least twice the lifetime of current technology for the same cost. How should the DoD leverage this new technology? With the CCI, the company will work with a program office that can make the best business case for qualifying this new pump for its weapon system, as that program office would have the best chance of winning CCI funds. Assuming the project is funded and successful, it will be noticed by other program offices. Other PMs will examine their own cost structures to determine if they could propose using the same technology to increase the affordability of their weapon system. Each program office, attempting to make its proposal more attractive, will leverage previous testing to reduce investment costs and increase the projected return. With each successive application, the technology will become more robust and cheaper to qualify, until all the systems for which the business case makes sense have adopted the technology. The process will repeat as new, cost-saving technologies are developed, matured and implemented, just as innovation spreads through the private sector.

as firms quickly copy those companies that produce successful inventions in the private sector.

Additionally, the important 1986 Packard report on DoD acquisition noted that increased latitude should be given to PMs. Due to the significant bureaucracy associated with the Defense Acquisition System, PMs often are constrained as to where and when they can allocate resources. By allowing PMs to vote on proposals, the CCI initiative would empower them to more directly affect their programs and leverage their on-the-ground knowledge to help make good decisions for the enterprise. Finally, PMs are statutorily defined the same way across the Services, but they rarely work together as a community.

The CCI program would create a common space within which PMs would develop and evaluate proposals. The primary criterion for evaluation would be ROI but also would include factors such as schedule risk and technical risk. The PMs, regardless of which military Service was involved, would be asked to vote by evaluating listed factors. Allowances would be made to permit horizontal communication among the PMs so they could share the rationale behind their choices and provide feedback to other PMs on the progress of their CCI programs. PMs who already are extremely busy likely would task out the evaluation of the proposals to their Program Support Managers (PSMs), engineers or project staffs, who would most significantly benefit from reviewing others' proposals.

A "secret ballot" concept would instruct PMs to vote in accordance with their evaluation of the criteria and prevent external influence from forcing them to support Service or agency priorities. In addition, every PM submitting a project would have to vote twice. In this way, the PMs' first votes likely would go to their own entries, but their second votes must be for programs other than their own. Each PM would then have to vote for a program that, in the PM's opinon, best meets the evaluation criteria.

Streamlined Management

Finally, to implement the program with minimal overhead and to effectively establish the peer-voting decision making described above, the proposals will be created and tracked on a crowdfunding-like website similar to Kickstarter (www.kickstarter.com). Mounds of paperwork often are required to obtain even a little funding within the DoD. By streamlining the process, the CCI program directly addresses this "high barriers to entry" problem, well known as a factor that reduces competition.

Such a website would reduce the overhead cost in terms of time and energy associated with proposing a project. The primary opportunity to "sell" the project is a short, approximately 5-minute, video of the PM, PSM, or engineer explaining the approach and the expected benefits. Such a process might have been cost-prohibitive just 10 years ago, before the widespread popularity of online videos, but video creation and Web hosting are trivial costs today.

Voting would take place through the website, and old proposals would remain as a resource so that future PMs, or their staffs, could easily leverage others' ideas when creating knock-off or follow-up proposals. Winning projects would be required to provide updates on their progress within the website until the funds are expended and future proposals from the same offices could link to their past successes, or failures. This would create an incentive for the projects to share the reasons for their successes or failures and how their follow-on projects would complement the past programs.

Such a system would minimize administration costs. The staff responsible for administration of CCI would be minimal; once the website is established and the projects selected, funds would be transferred to the appropriate program offices for obligation and execution. Obligation rates could be tracked on the website to determine if programs are on schedule. Reporting through this mechanism would eliminate additional bureaucracy and provide transparent tracking.

Finally, if successful, the PMs or program executive officers (PEOs) might then choose to use the platform to manage their own Service programs. A PEO could run a similar competition among their PMs or use the platform to obtain quarterly updates of numerous programs without expensive and time-intensive meetings. The ability to generate videos of acquisition strategy briefs, milestone decisions or program update briefings and upload them to such a website is new for the acquisition community but would appeal to the youngest engineers and managers now entering the workforce.

Readers are encouraged to browse the Kickstarter or other crowdfunding websites and review proposals for cost, schedule and performance information. I am certain they will find that some well-run programs quickly communicate their goals in an easy-to-understand format.

Conclusions

As former Secretary of Defense Chuck Hagel noted in his November 2014 Defense Innovative Initiative Memorandum, "We need to continue to further examine our business practices and find ways to be more efficient and effective." The current strategic context of increasing demands and reducing budgets stresses that we need to balance our defense capabilities with our costs, yet our current acquisition culture remains focused on capability. Directing funding to solve the most important capability challenges has created the current capability-focused acquisition culture. Investing in cost savings, if done correctly, will provide balance. If the DoD takes deliberate steps to align incentives and reward programs that create the highest returns, the acquisition community will respond.

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Performance Based Logistics ... What's Stopping Us?

Jim Davis ■ Dean Newman ■ Mike Kotzian

Nearly everyone agrees that performance based logistics (PBL) solutions can be effective logistics support vehicles that can improve both readiness and deliver real savings. So, then why aren't the majority of our weapon systems supported under PBL arrangements? To address this question, let's look to identify the key qualities of successful PBL teams as well as the vital ingredients that go into a successful arrangement.

However, before we address the question of "what's stopping us," we want to step back and give you some background on the basic concepts of PBLs. First, we'll define what a PBL is and just as important, what it is not. Next, we'll discuss the effectiveness of PBL contracts, awarding of a PBL contract, and other PBL challenges you might face. We'll conclude by reviewing the three pillars and three key ingredients that we believe are necessary for successful PBL agreements.

What Is a PBL?

When addressing the topic of "PBL," the term can mean different things to different people. From a formal definition viewpoint, the Office of the Assistant Secretary of Defense for Logistics and Materiel Readiness (ASD[L&MR]) released the *PBL Guidebook: A Guide to Developing Performance-Based Arrangements* (https://acc.dau.mil/CommunityBrowser.aspx?id=706778) in May 2014 that defined PBL as follows:

> PBL is synonymous with performance-based life cycle product support, where outcomes are acquired through performance-based arrangements that deliver Warfighter requirements and incentivize product support providers to reduce costs through innovation. These arrangements are contracts with industry or intra-governmental agreements.
>
> A PBL arrangement is not synonymous with contractor logistics support (CLS). CLS signifies the "who" of providing support, not the "how" of the business model. CLS is support provided by a contractor, whether the arrangement is structured around Warfighter outcomes with associated incentives or not. PBL arrangements, on the other hand, are tied to Warfighter outcomes and integrate the various product support activities (e.g., supply support, sustaining engineering, maintenance, etc.) of the supply chain with appropriate incentives

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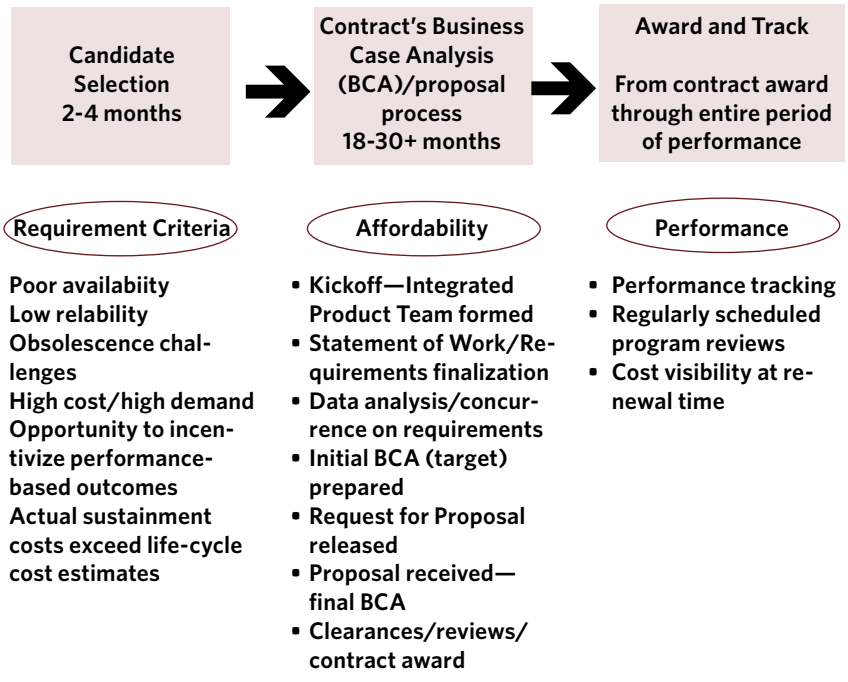
and metrics. In addition, PBL focuses on combining best practices of both government and industry.

Perhaps a more simplistic definition would be: A PBL arrangement buys an affordable outcome that effectively supports the warfighter requirements … if the agreement is structured correctly.

PBLs … the Early Years

The Department of Defense (DoD) involvement with PBL solutions dates back to early 1990s. The early PBL efforts were primarily focused on improving the performance of the logistics processes in order to achieve improvements in weapon system readiness. This readiness would be measured in a variety of metrics that the PBL team deemed reflective of the improvement—and, hopefully, in alignment with the warfighter requirement. While cost wasn't initially a focus of PBLs, there typically was an informal agreement between requirements and budgeting that the PBL arrangement wouldn't cost more than the traditional support plan. In other words, implement the PBL arrangement at equal or lower cost than traditional support. The long-term PBL arrangement would then allow the upfront costs of the PBL implementation to be amortized over the life of the contract. There are no exotic concepts here, just the old notion that "it takes money to make money."

Figure 1. The PBL Process



Source: Modified from July 21, 2015, briefing by the Deputy Assistant Secretary of the Navy for Expeditionary Programs and Logistics Management.

PBL Model and Tenets

While there may be slight differences depending upon who one talks to, a generic PBL model is shown in Figure 1. The PBL "flow" is illustrated by the three sequential boxes running from candidate selection, to business case analysis and proposal, to contract award and subsequent compliance tracking and/or monitoring. This flow correlates to the acquisition life cycle framework: spend the time and effort to identify and lock in the PBL requirements; conduct an analysis to determine if the PBL approach is affordable (i.e., avoid starting or continuing programs that cannot be produced and supported within reasonable expectations for future budgets); and award the PBL contract with the recognition of the necessity to continually track and monitor the PBL contract award performance in terms of contract compliance evaluated through agreed-upon PBL metrics.

Have PBL Contracts Been Effective?

There have been numerous studies and reports on PBLs over the past 15 or more years. Much like fashion styles, the affinity for PBLs has ebbed and flowed during this time. Most recently, there has been a renewed emphasis on PBL solutions. As called out in the most recently released DoD Instruction (DoDI) 5000.02, *Operation of the Defense Acquisition System* (http://www.acq.osd.mil/fo/docs/500002p.pdf), "The Program Manager will develop and implement an affordable and effective performance-based product support strategy." Note the order of the requirements—affordable and effective.

This focus on PBLs complements the results of an independent study chartered by the Principal Deputy Assistant Secretary of Defense for Logistics and Materiel Readiness (PDASD[L&MR]) on PBL strategies. The study, *Project Proof Point: A Study to Determine the Impact of Performance Based Logistics (PBL) on Life Cycle Costs* (https://acc.dau.mil/adl/en-US/550258/file/68272/Final%20Proof%20Point%20Narrative%20Report%20(30%20Nov%2011) generally substantiated the PBL approach to DoD's weapon system life cycle support using four tiers of evidence—empirical evidence, statistical point of proof with a defined level of confidence, compelling evidence, and a preponderance of evidence—to arrive at the following conclusion:

> PBL arrangements, which adhere to generally recognized PBL tenets, reduce DoD cost per unit of performance while simultaneously driving up the absolute levels of system, subsystem, and major component readiness availability when compared to non-PBL arrangements.

The referenced PBL "tenets" are listed in Figure 2. The thinking is that, as with any complex acquisition and/or sustainment strategy, there are certain desired characteristics necessary

to drive optimal outcomes. For PBL, these characteristics are commonly referred to as the "tenets" of PBL.

Another measure of effectiveness for PBLs can be captured in the writeups submitted for the annual Secretary of Defense Performance-Based Logistics Awards Program. The award writeups read like testimonials to the PBL methodology and provide program managers with a wealth of ideas and best practices they might utilize when developing their own PBL solutions. The list of award recipients and accompanying award citations can be found on the Defense Acquisition University's (DAU) Acquisition Community Connection website under Performance Based Logistics Community of Practice (https://acc.dau.mil/pbl).

What's So Hard About a PBL Contract?

To recap, we have senior leadership direction to utilize a PBL solution; a plethora of reports and articles that espouse the benefits and advantages of PBL solutions; and an archive of best practices and desk guides to help program managers develop their own PBL solution. It's a slam dunk! Put the proverbial fork in the life-cycle logistics support requirements and deliver a robust PBL solution for your program. Alas, if it were only that easy. As you might expect, there are some challenges in delivering a successful PBL arrangement.

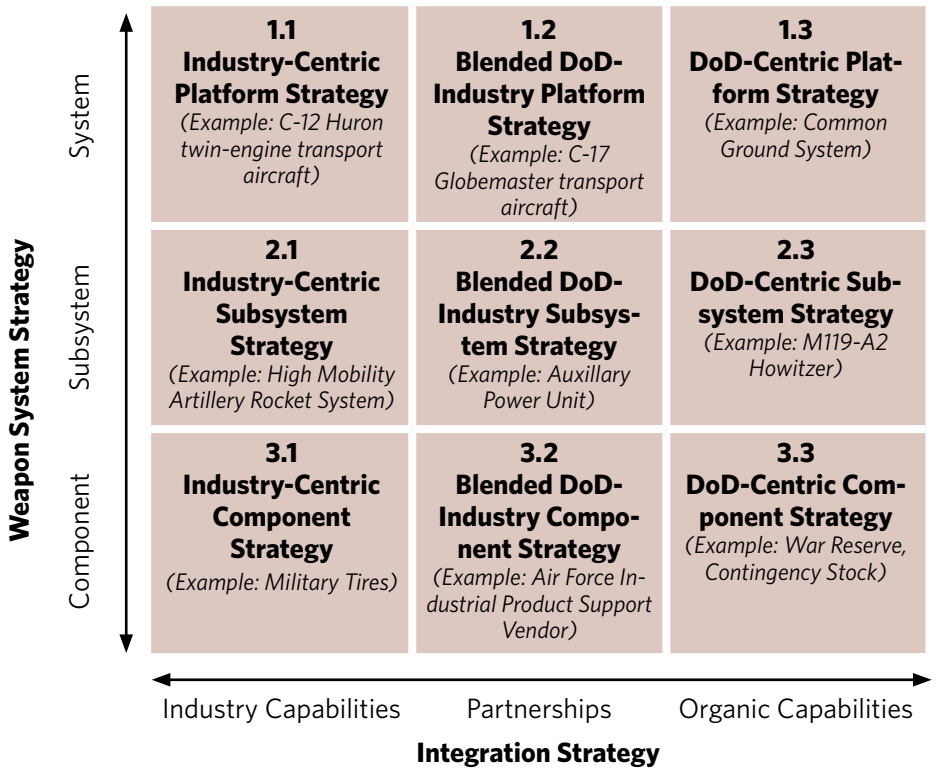
One challenge is to consider where the weapon system is in the acquisition life cycle. If it is too early in the acquisition life cycle, there aren't enough data to develop a PBL arrangement that balances both the risks and opportunities. Too late in the acquisition life cycle and we just don't have enough time to develop and execute a long-term PBL. Then there is that sweet spot where we have some good hard data and have adequate time left in the program to make a PBL contract worthwhile. Combine this last category with a weapon system that is falling short of expectations and you can start zeroing in your best potential PBL candidates. Remember, though: A successful PBL arrangement also needs that enthusiastic provider responsible for delivering a PBL solution within the context of a contractual agreement. If the provider isn't interested in a PBL solution,

Figure 2. The Tenets of Performance Based Logistics

Tenets of PBL	Description
Tenets Tied to Arrangements	1. Acquired clearly defined warfighter-relevant outcomes, not just sustainment services or replacement equipment 2. Use measurable and manageable metrics that accurately assess the product support provider's performance against delivery of targeted warfighter outcomes. 3. Provide significant incentives to the support provider that are tied to the achievement of the outcomes (for aspects of performance that are within their control). 4. Firm Fixed Price contracts generally are the preferred contract type (Fixed Price Incentive Firm and Cost Plus Incentive Fee may be effective) 5. Provide sufficient contract length for the product support provider to recoup investments on improved product (e.g.,Mean Time Between Failure and sustainment processes; e.g., manufacturing capabilities)
Tenets Tied to Organization	6. Performance Based Logistics (PBL) knowledge and resources are maintained for the government team and product support providers. 7. Leadership champions the effort throughout their organizations(s). 8. Everyone with a vested interest in the outcome is involved. 9. Supply chain activities are aligned to the desired PBL outcome versus disparate internal goals. 10. Risk management is shared between the government, customer, and support provider.

Source: *PBL Guidebook*, May 2014.

Figure 3: Product Support Decision Matrix



Source: Defense Acquisition University LOG 340 course material.

then the DoD team is just pushing a rock up a hill. Suffice to say, not all providers have embraced the PBL concept.

Other Challenges

In some cases, the PBL proposal is noncompliant and doesn't meet Defense Contract Audit Agency (DCAA) audit requirements. Needless to say, this is not a good way to start off your PBL effort. So right up front, the keys are compliant and auditable proposals, and this can only happen with much more emphasis on government-industry communication and a better understanding of the requirement (and the data behind the requirement). Throw in Title 10 implications (the part of the United States Code outlining the role of the Armed Forces), shifting programs, funding uncertainties and—well, you get the idea.

Finally, the biggest challenge of all is forming the right team and building a project plan that complements the targeted weapon system. One of the first steps is determining the scope of the PBL. PBLs come in all shapes and sizes and can cover a range of requirements. DoD has primarily grouped the efforts into three distinct categories: component, subsystem and system-level PBLs. As the names suggest, the categories range from smaller efforts (component) up to the entire weapon system level (system). As you look to expand the size and scope of your effort, expect to face a far more complex (and lengthy) development effort. The Product Support Decision Matrix (Figure 3) illustrates these points.

Before we leave the challenges, let's take a moment to reflect on something positive. Despite these challenges, there are some very successful PBL efforts in DoD as already noted in the Secretary of Defense's PBL award winners. The Navy has been very effective developing PBL arrangements at the component and subsystem levels. For example, the Naval Supply Systems Weapons System Support (NAVSUP WSS), in conjunction with Naval Air Systems Command (NAVAIR) and Naval Sea Systems Command (NAVSEA) Program Offices, currently have 36 active PBL arrangements with an annual obligation value of more than $1.4 billion.

Potential PBL Provider Understandings

We would be remiss if we didn't at least touch on what the PBL provider needs to appreciate. There is a great deal for the provider to understand, but by far the most important concept is the need to bring a different approach in providing the logistics support solution. If the proposal is to sell us more spares or to increase the number of field representatives at our sites, then we can pretty much guarantee the proposal will be dead on arrival. There has to be a significant process change that achieves both PBL requirements—"affordable and effective." In short, we're looking for new approaches to long-term sustainment support that avoids such inefficiencies as merely stocking a warehouse full of spare parts gathering dust until needed—think in terms of just-in-time logistics.

Three Pillars of a Successful PBL Team

There are many qualities common throughout successful PBL teams, but we identified three components we feel are most important in establishing the PBL team. You can look at it as you do any business agreement that is mutually beneficial to all parties.

1. Long-term agreements. In just about all cases, PBL providers must make upfront investments that will substantially reduce future sustainment costs. It would make no sense for PBL providers to ramp up capacity and/or capability without any guarantees that they will be able to recoup their investments over time. The agreement requires long-term contracts for the provider to amortize these upfront costs over a

reasonable timeframe. Exactly how long this timeframe will be depends on the PBL.

2. Everybody wins. The PBL provider should expect to make a reasonable profit and the government needs to receive the required performance at an affordable price. The "win-win" concept, while a bit of a cliché, is at the heart of the effort and is aligned to the first pillar of a long-term agreement. After all, a "win-lose" or, even worse, a "lose-lose" effort would never stand the test of time. Some might argue that our business culture drives each side to try to get the very best deal for its team even at the expense of the other side. We would take the counter position that the government and industry professionals recognize the symbiotic relationship they must cultivate over the long term.

3. Trust. There must be trust between the provider and the government. Just like trust in a marriage, trust in a PBL requires time and communication. Given all the challenges a PBL must overcome, it would be impossible for us to overstress communications—and data.

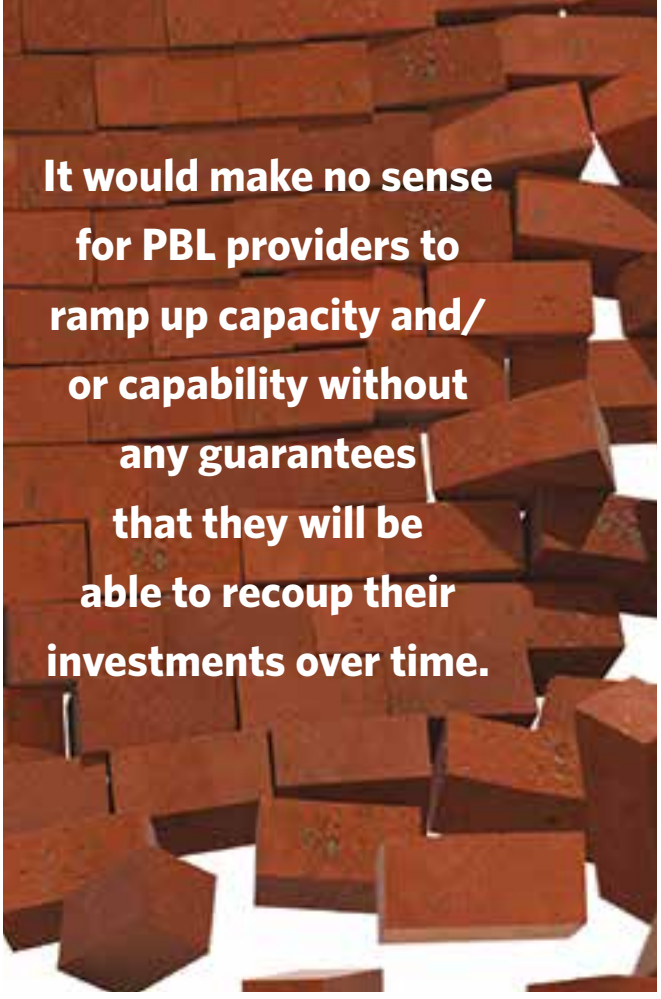
Three Key Ingredients for Success

So again, we have solid evidence that PBL contracts have made positive impacts on warfighter readiness and that PBLs can provide cost savings. We also recognize that there are obstacles such as time, education and experience, and funding. However, these impediments must be viewed as speed bumps to be overcome and not as roadblocks that turn off the PBL efforts. Here are three key ingredients that should be considered when going forward:

- **Senior champions.** We could call this one "friends in high places," although some might suggest that these champions are more forceful than the PBL team would like. But as we know, visibility is an effective way to keep projects on the front burners and moving in the right direction. Perhaps it's a little bit of the Hawthorne effect (individuals modify their behavior when they know they are being watched) or the "squeaky wheel" syndrome. No matter, high-level attention and encouragement helps keep the PBL team moving forward and can provide the horsepower to deflect external impediments along the way.

- **Focused PBL team.** PBL team members often juggle additional tasks during the extended time it takes to deliver a PBL agreement. Distractions such as enterprise resource planning (ERP) implementations, changing operational requirements, and budget reductions are just some of the challenges that the team must work around. This is just another reason to have the support of senior champions.

- **A ripe component, subsystem or system.** We mentioned that the PBL candidate must be in the right place of its life cycle with a willing partner or partners on the provider side. Again, don't assume your potential PBL provider is well versed on PBL.



Final Thoughts

Frank Kendall—the Under Secretary of Defense for Acquisition, Technology, and Logistics—has personally campaigned for the PBL cause. The emphasis that he and other senior DoD leadership have given PBL solutions is reflected in recent DoD guidance such as the three iterations of Better Buying Power (http://bbp.dau.mil/) and DoDI 5000.02. Kendall's memo of May 14, 2012, states, "Developing correctly structured, priced, and executed PBLs is often a more complex task than initiating a standard transactional arrangement. It requires a combined and focused effort by the Program Manager, the Product Support Manager, and the Contracting Community, among others. However, the ability to more affordably support the Warfighter at a greater level of readiness is worth the effort."

It's clear that the time is right for the DoD to pursue PBL solutions. The question isn't so much "Why did you develop a PBL" but, rather, "Why didn't you develop a PBL?" The ball is now in the Services' and the Defense Logistics Agency's courts. No doubt it's a tough ball to play. They have to carve out the resources (dedicated teams and funds) required and press forward with the next generation of performance based logistics solutions. It's important that they succeed—our warfighters are counting on them.

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Something for Nothing

"Cash Flow" as a Contract Incentive

John Pritchard ■ *John Krieger*

Pritchard *and* **Krieger** *are professors at the Defense Acquisition University's Defense Systems Management College at Fort Belvoir, Virginia.*

During our combined 70 years in acquisitions, we often have wondered why the government believes it needs to devote additional resources for incentives to achieve a benefit. The government actually has complete control over one of the strongest contract incentives possible—cash flow. Most important, in our fiscally constrained, sequestration-challenged environment, this incentive wouldn't require additional resources: It uses funds already budgeted or obligated. Unfortunately, we haven't really tried to exploit it as we should. So let's get to it.

A contractor's need for cash flow and the desire for it to flow as quickly as possible provide a unique opportunity to employ positive and negative cash-flow incentives. Cash flow is a major driver in a contractor's decision to bid or make no bid on a government acquisition. We believe linking successful contractor performance to progress payment rates and liquidation rates would provide an effective incentive. Moreover, this cash-flow incentive links directly to implementing the Better Buying Power Initiatives issued by the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD[AT&L]).

In his memorandum titled *Better Buying Power* [BBP] *2.0: Continuing the Pursuit for Greater Efficiency and Productively in Defense Spending*, USD(AT&L) Frank Kendall emphasized affordability, while increasing

productivity and value to the taxpayers and warfighters. One of Kendall's seven focus areas was "Incentivize Productivity and Innovation in Industry and Government."

BBP 2.0 was a significant change from former USD(AT&L) and current Defense Secretary Ashton Carter's original BBP, "Incentivize Productivity and Innovation in Industry." That focus area had not included government.

The interim release of BBP 3.0 addressed the topics of "Incentivize Productivity in Industry and Government" and "Incentivize Innovation in Industry and Government." Kendall emphasized the continuity with both BBP 1.0 and BBP 2.0:

> BBP 3.0 continues the focus on continuous improvement with a new emphasis on initiatives that encourage innovation and promote technical excellence with the overarching goal of ensuring that the United States' military has the dominant capabilities to meet future national security requirements.

Cash flow is vitally important to a contractor's business health, and its importance cannot be overstated. Without cash flow, business grinds to a halt and does so quickly. Employees, subcontractors, vendors and, especially, lenders show little patience in waiting for the funds due to them.

We've heard it said that "revenue is vanity, but cash is king." If you don't believe that, consider that in the 2013 annual reports for the top three defense contractors the terms free cash flow(s) or cash flow(s) appeared a combined 225 times. The reports indicate that industry is concerned about ensuring that flow continues unabated. Lockheed Martin Corp.'s report stated:

> Other policies could negatively impact our working capital and cash flow. For example, the government has expressed a preference for requiring progress payments rather than performance based payments on new fixed-price contracts, which if implemented, delays our ability to recover a significant amount of costs incurred on a contract and thus affects the timing of our cash flows.

Northrop Grumman Corp.'s report stated:

> Changes to business practices for U.S. Government contractors could have a significant adverse effect on current programs, potential new awards and the processes by which procurements are awarded and managed.

Successful contractors are experts in managing and controlling the cash they need to pay for investments, bills, employees, subcontractors, taxes and all the other cash outflows. If existing funds are insufficient to cover expenditures, the contractor will need to borrow funds and the interest on that loan will be an "unallowable" expense (Federal Acquisition Regulation [FAR] 31.205-20). Therefore, even before proposing on contract efforts, industry considers the importance of cash flow in its decisions to bid or make no bid.

To better understand this concept, let's review some of the basics of fixed-price contract financing methods—specifically, progress payments. Under a fixed-price contract arrangement, a contractor only receives contract payments upon delivery of supplies or services, unless other contract financing arrangements are employed (see FAR Part 32 Contract Financing). Companies generally cannot wait for extended periods (sometimes 1, 2, or even 3 years) to receive payments for work accomplished but not yet delivered. There can be significant cash requirements for some supply contracts, particularly those for major systems. Consider, for example, expendable vehicles used to launch satellites, which historically have had a development to production time of 7 to 10 years, and a production to launch time greater than 2 years. That is a very long time to ask a contractor to wait for payment.

To address this problem, the government often uses a financing arrangement on fixed-price contracts called progress payments. This arrangement allows for contract payments at regular intervals for work in process that has not yet been delivered.

Let's look at progress payments as discussed in the FAR:

- Progress payments are a contract financing method addressed in FAR subpart 32.5—Progress Payments Based

on Costs. Progress payments may be customary or unusual. Customary progress payments are those made under the general guidance in subpart 32.5, using the customary progress payment rate, the cost base and frequency of payment established in the Progress Payments clause, and either the ordinary liquidation method or the alternate method. According to FAR 32.501, unusual progress payments are anything else.

- Customary progress payments have a payment rate and a liquidation rate for invoice payments and deliveries, respectively. When a contractor submits its invoice for payments, the full amount is not paid; a portion is reserved for final payment.
- For a large business, the customary progress payment rate and the liquidation rate are 80 percent, and for a small business the rates are 85 percent. (Note: In accordance with DFARS [Defense Federal Acquisition Regulation Supplement] 232.501-1(a), within Department of Defense [DoD] the rates are 80 percent for large business concerns, 90 percent for small business concerns and 95 percent for small disadvantaged business concerns.)
- Progress payments are liquidated by deducting from any payment under the contract for delivery and acceptance the unliquidated progress payments, or 80 percent of the amount invoiced for large businesses or 85 percent for small businesses—whichever is less.
- Unusual progress payments are any other than customary progress payments, and may be used only in exceptional cases, and when authorized in accordance with subsection FAR 32.501-2. Typically, unusual progress payments would be used if the contract necessitates predelivery expenditures that are large in relation to contract price and in relation to the contractor's working capital and credit. Other than the difference in rate, these unusual progress payments operate the same as customary progress payments. Special permission is required to use unusual progress payments.

To understand the progress payment and liquidation concepts, consider the simplest of contracts, a contract for the delivery of a single supply item—the production of one launch vehicle. Presume that (1) a contract exists for one noncommercial medium expendable launch vehicle system, (2) the price of the system is $100 million, and (3) progress payments made to the contractor before the customer accepted the system were $70 million (80 percent of costs incurred). Then the normal progress payment liquidation procedure would be as follows:

$ 100,000,000	Contract Price
- $ 70,000,000	Minus Progress Payments
$ 30,000,000	Equals Amount Paid Upon Delivery and Acceptance

(Note: For a more detailed discussion of the progress payment and liquidation concepts, see the Defense Acquisition University White Paper, "Liquidating Progress Payments Based on Costs Using the Alternate Liquidation Rate Method" [Oct. 5, 2010].)

The progress payment and liquidation rates directly affect a contractor's cash flow, based on the amounts paid and the amounts withheld. If the large business customary progress payment rate is used under a fixed-price contract, the contractor can bill and be paid only for 80 percent of the costs incurred until it makes delivery. This means the company has to fund 20 percent of the costs incurred until it makes delivery. Even when delivery is made, the progress payments will not be liquidated at the full amount but at the reduced liquidation rate until final contract closeout.

Our proposed incentive concept is to directly tie the progress payment and liquidation rates of a contract to a contractor's performance. The difference between the limits on customary rates and what could conceivably be used as unusual rates provide the government an additional opportunity for incentivizing contractors. Under such an arrangement, the program manager and contracting officer, with proper approvals in accordance with agency procedures, could establish objective (measurable) levels of contractor performance (e.g., cost or performance, including schedule) above minimum contract requirements, for which the government would be willing to provide unusual progress payments.

Using objective performance criteria, the government could directly link liquidation rates to performance. Progress payment and liquidation rates could be changed over stated periods or intervals (e.g., measuring performance annually and then making any adjustments to the rates). However, if a company doesn't excel, it would not be entitled to use this approach to increase cash flow. An example would be an incentive on payload margin for our medium launch vehicle, where the minimum requirement is 100 pounds of margin and the contract was awarded to a large business:

Margin (lbs.)	Progress Payment/Liquidation Rate
100	80 Percent
150	85 Percent
200	90 Percent

Once this approach is implemented, if the contactor provides that higher level of performance, its progress payments and liquation rates would increase, thereby improving its cash flow. However, once the higher rate is earned and awarded, if the contractor later falters, the payment and liquidation rates would return to the lower customary progress payment and liquidation rates. This last part provides an additional incentive for the contractor to continue a high standard of performance. No contractor would want its cash flow reduced after achieving a higher level.

Variations on the approach just described are possible. There is no reason that the changes to the progress payment rate and the liquidation must be symmetrical. For instance, an incentive could be structured that increased the progress payment rate but not the liquidation rate. Alternatively, an

incentive could be structured that adjusted the progress payment rate to one level but the liquidation rate to a different level. But, whatever the approach, the government must ensure that its rights are protected.

There are clear advantages to this type of incentive approach—advantages to both the government and contractors:

- For existing contracts, this incentive approach would use funds already budgeted or obligated. It doesn't require any additional or special funding for the contract. The "cost" of the incentive is based solely on changing progress payment and liquidation rates for funds already obligated.
- The incentive is used to leverage areas the government wants to incentivize (e.g., cost or performance, including schedule).
- The increases and decreases in the progress payment and liquidation rate would be tied to objective measures, and subjectivity would be eliminated, at minimal administrative cost.
- The approach is particularly suited as a reward in the superior supplier incentive program. The DoD could offer this incentive only to those companies that qualify as superior suppliers. Once in the superior category, these contractors would be expected to show superior performance to earn or maintain the higher payment rate.
- While imposing no added cost to the DoD, except expedited outlays, the incentive approach provides an effective way to secure a contractor's attention.

Embedded in that last bulleted item may be the only downside, the acceleration of outlays. Although this may not be a concern in the DoD, it certainly will be an issue with the Treasury Department. Treasury just does not like to see money go out; it only likes to see money come in.

The DoD is implementing the BBP 1.0 and BBP 2.0 initiatives and implementation of additional initiatives from BBP 3.0 is under way. This incentive approach could easily be applied to contractors that are helping DoD achieve its BBP objectives. For instance, it could be used implementing the superior supplier's initiative.

Existing laws pertaining to progress payments (10 U.S. Code [U.S.C.] § 2307(2) and 41 U.S.C. § 255)) do not prohibit this type of approach. However, some policy changes would need to be addressed to implement this incentive. The DoD would need to make a few policy changes to the DFARS and issue a deviation from some FAR requirements. The approach described would require a deviation from, or supplementation to, FAR 32.501-2(a). The deviation or supplementation would add an additional reason to the one already at FAR 32.501-2(a)(1) for using unusual progress payments as a contract incentive. DFARS 216.4—Incentive Contracts would also have to be supplemented to discuss the approach.

Implementation of this incentive approach would begin with forming a "Reinvention Lab" (i.e., assigning one buying activity to test this incentive). The test case could be designed to measure the real world impacts of this approach, both positive and negative. The results of this test would then form the basis for a final decision on full implementation across the DoD.

The government appears to be missing an excellent opportunity to incentivize industry without applying additional resources. We suggest that the USD(AT&L) or the Director of Defense Procurement and Acquisition Policy explore this opportunity. This incentive would provide significant value in implementing the BBP Initiatives, especially in a period of declining government resources. As negligible resources are required to implement the incentive, this is the closest the government ever will come to getting something for nothing.

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Keeping **Naval Guns** Ready

David L. Rogers

A look at the work of the Naval Surface Warfare Center Indian Head Explosive Ordnance Disposal Technology Division

Close a major maritime chokepoint and "the price of gasoline would quadruple in six weeks," Secretary of the Navy Raymond Mabus said. Therefore, U.S. naval ships operate forward, partnering with other navies to protect maritime routes and the global economy.

This protection depends on keeping these forward naval ships ready, particularly their guns and ammunition—the weapons of choice for countering a multitude of threats. That gun readiness is assured with responsive technical support. It is done fast, and as far forward as possible, aided by civilian engineers from Naval Surface Warfare Center Indian Head Explosive Ordnance Disposal Technology Division in Maryland. This is a service that will be needed more as operating environments intensify and budgets tighten.

Rogers *is the Deputy Department Head, Systems Integration Department, Naval Surface Warfare Center Indian Head Explosive Ordnance Disposal Technology Division, Picatinny Detachment.*

Between 1990 and 2014, the world economy doubled, rising from $35 trillion to $75 trillion, lifting billions of people out of poverty, according Pulitzer Prize winner and economic researcher Dr. Daniel Yergin. "Seaborne trade is the backbone, basis and foundation of this globalization," accounting for 75 percent of total global trade. It will grow even more, as tanker capacity expands to meet world energy demands that are predicted to increase by between 35 percent and 40 percent over the next 2 decades.

Disruption means global crisis. Even with oil prices falling, "Blocking a chokepoint, even temporarily, can lead to substantial increases in total energy costs and world energy prices," the U.S. Energy Information Administration reported in December 2014. And, threats are real—terrorism, piracy, territorial disputes, crime and more. Consider the 2010 suicide boat attack with an improvised explosive that damaged the Japanese oil tanker, MVM *Star*, in the Straits of Hormuz between Oman and Iran.

Working with other naval forces, the U.S. Navy and Coast Guard have a central role in protecting these global maritime trade arteries. U.S. naval ships possess an array of weapons to meet a wide spectrum of threats. These weapons include missiles, torpedoes, and aircraft-launched munitions. And the ships' guns help protect sea lanes, as well as U.S. vessels:

Counterpiracy: Among other examples, the USS *Mason* (DDG 87) used its 20 millimeter (mm) Close in Weapons System and 25 mm gun to sink pirate skiffs in the Arabian Sea in 2011; the USS *Ashland* (LSD 48) used its 25 mm gun to do the same in the Gulf of Aden in 2011, as did USS *Farragut* (DDG 99) in the Somali Basin in 2010 and the USS *Porter* (DDG 78) within Somali waters in 2007.

Small boat threats: In 2012, the USNS *Rappahannock* (T-AO 204) used its gun initially to warn a small boat speeding toward it in the Strait of Hormuz, and then fired on the boat and stopped it. In 2014 in the Persian Gulf, a U.S. Coast Guard vessel's gun fired a warning shot at an Iranian dhow after the latter's crew trained a .50-caliber machine gun on the U.S. vessel. This ended the confrontation.

Countering maritime crime: "The MK75 [76 mm gun] is invaluable to accomplishing [U.S. Coast Guard (USCG) Cutter] *Thetis*' primary missions of counter-drug and alien and migrant interdiction operations," stated the cutter's weapons officer. "In addition, it actively provides for the safety and security of U.S. and foreign-flagged vessels in U.S. waters and on the high seas."

Clearing hazards from sea lanes: In 2012, the USCG Cutter *Anacapa* (WPB-1335) used its 25 mm gun to sink a 164-foot derelict ship adrift in the Gulf of Alaska's busy shipping lanes.

Naval guns complement other ship's weapons. They provide warning shots, which missiles don't do as well; and, within their ranges, guns typically engage faster. In cluttered, narrow waterways, speed is critical to countering many land-based weapons and seemingly ambiguous vessels that become threats. Such threats are exemplified by Egyptian jihadists who fired rocket-propelled grenades at ships in the Suez Canal in 2013, and Yemen's Houthi rebels, who reportedly were positioning small, armed boats, long-range cannons and missiles on Perim Island in the 20-mile wide Bab El Mandeb Strait.

Guns also produce a high volume of fire. The 5-inch Mk 45 gun's firing rate is 16 to 20 rounds a minute; the 57 mm Mk 110 can fire 220 rounds a minute; and the 20 mm Mk 15, Close-In Weapons System, is capable of firing 3,000 to 4,500 rounds a minute. Relative to other naval weapons, gun ammunition is cheaper and easier to supply.

"Guns are not irrelevant," stated U.S. Naval Institute author and naval expert, Eric Wertheim. "They're more important now than perhaps at any time since World War II."

They also are more complex, reflecting the intense competition to "fire effectively first," the longstanding naval axiom. Most naval guns are linked to fire-control systems and are remotely controlled. In fractions of a second, they load, interact with ammunition fuzes, and fire. Complexity increases as guns are developed to shoot faster, farther and more precisely.

And these complex systems are used often. To maintain tactical proficiency, Navy surface combatants have been directed to conduct daily exercises, firing .50 caliber to 5-inch guns. Because of their extensive use in the severe naval environment, shipboard guns eventually break and repairs require technical expertise beyond what available onboard the ships.

Gun Down, Naval Engineers Forward

In March 2015 on Guam: Responding to a request from the Navy's Regional Maintenance Center in Yokosuka, two civilian engineers boarded the USS *Fitzgerald* (DDG 62). The ship's 5-inch gun, "Jenny," was out of service due to a problem that eluded the ship's force and regional maintenance center. After troubleshooting the problem, the engineers replaced the firing circuit card assembly, along with associated wiring and relay components. On March 23, 2015, Jenny fired successfully.

The engineers were from Naval Surface Warfare Center Indian Head Explosive Ordnance Disposal Technology Division (NSWC IHEODTD), which researches and develops "energetics"—energy-releasing, chemical materials for explosives, propellants and pyrotechnics. It's an expertise, critical to defense, not found in industry to the same degree because of cost, risk and limited applicability. This expertise also enables NSWC IHEODTD to serve as "In-Service Engineering Agents" for the following naval guns and their ammunition:

- 20 mm, Mark 15 Close-In Weapon System, on all Navy surface combatant ships

Naval guns complement other ship's weapons. They provide warning shots, which missiles don't do as well; and, within their ranges, guns typically engage faster.

- 25 mm, Mark 38, on Navy aircraft carriers, cruisers, destroyers, frigates, dock landing ships, amphibious transport dock ships, amphibious assault ships, amphibious command ships, patrol ships, offshore support vessels, and Coast Guard fast response cutters
- 30 mm, Mark 46 on LPD-17 class dock landing ships, Littoral (coastal) Combat Ship Surface Warfare Mission Modules, and identified for Zumwalt-class guided missile destroyers (DDG 1000s)
- 57 mm, Mark 110 on LCS and Coast Guard National Security Cutters and offshore patrol cutters
- 76 mm, Mark 75 on frigates and Coast Guard cutters
- 5-inch, Mark 45, on destroyers and cruisers

Repairing forward-deployed ships has long been imperative for the U.S. Navy. "Only in the most serious cases of major injuries beyond the ability of local facilities to repair, should a combat vessel be sent back to a Navy yard or shipyard," wrote World War II, Navy logistics czar Rear Adm. Worrall R. Carter. That mandate hasn't changed in principle. What continually changes is how repairs are done locally. It's a never-ending quest to do more repairs and upgrades forward, faster and more cost effectively.

That's especially so in naval gun upkeep, which is critical to the Navy's readiness. Today, this effort relies on a vast system that rapidly provides technical expertise to Navy ships and Coast Guard Cutters deployed across the globe, as well as Navy regional maintenance centers in Norfolk, Virginia; San Diego, California; Mayport, Florida; Puget Sound, Washington; Pearl Harbor, Hawaii; Naples, Italy; and their detachments in Bahrain in the Persian Gulf and in Rota, Spain. This expertise includes online manuals from NSWC IHEODTD that enable ships' forces and maintenance centers to do as much as they can in forward deployments.

When ships' forces report gun casualties, technical expertise moves fast. The associated regional maintenance centers assess the problem, and usually resolve it, with spares and technical expertise. If not, the NSWC IHEODTD is contacted and its engineering teams assigned to each gun weapon system spring into action using a scaled-up approach. Initially, they interact with ships forces and/or centers, via phone and email.

If the problem still can't be solved, this very specialized technical expertise physically moves to the gun. NSWC IHEODTD rapidly dispatches its engineers and technicians either from its Picatinny, New Jersey, detachment, or those stationed in fleet concentration areas. Some engineers will address a gun's problem on a ship in port. Some will sail with the ship, diagnosing and fixing the gun while under way. Others will fly to an overseas port, helicopter out to a ship, and stay aboard until the gun is up.

Whatever the case, the goal is to get the gun up fast.

Guns With Fast "Pit Crews"

Winning in stock-car racing requires identifying and eliminating bottlenecks and weaknesses that can shave tenths of a second off lap time—and that includes pit stops. "If you don't have a well-performing pit crew that executes well on pit road, you are going to affect the overall outcome of the race," said Greg Morin, head coach of 48 pit crew, which helped driver Jimmie Johnson win six championships.

The same rule applies to ship overhauls. Like pit crews, naval gun engineers continually seek to overhaul faster and cheaper, thereby enabling ships to redeploy quickly. The difference is that the parts are bigger than those in NASCAR.

Take the 5-inch, Mk 45 gun, which weighs 45,000 pounds and costs $22 million each. Like all guns, it must be overhauled after firing in a corrosive maritime environment. The original maintenance philosophy was to remove a gun from the ship and send it back to the depot for renovation twice in its lifetime. The cost was $8 million per gun per overhaul, with two such overhauls expected in the gun's 35-year lifespan. As Defense Department budgets began to shrink in the 1990s, the Navy conceived a new concept of operations—pierside maintenance and repair. The goal was to reduce costs over the gun's life cycle. By making more frequent and focused repairs, the need for a depot-level repair could be extended to the gun's midlife and then done just once. The program was a success, and today a Standard Pier-Side Maintenance and Repair saves the Navy approximately $11.5 million over the life of each Mk 45 Gun.

In order to expedite the process, NSWC IHEODTD engineers go aboard ships before scheduled overhauls. They assess all the guns' varying material conditions, determine maintenance needs and order replacement parts, which often take a long time to arrive. When the ship and a team of gun engineers hit

Repairing forward-deployed ships has long been imperative for the U.S. Navy. "Only in the most serious cases of major injuries beyond the ability of local facilities to repair, should a combat vessel be sent back to a Navy yard or shipyard."

the yard, maintenance needs are known, replacement parts are available, and the gun overhaul begins. Some guns, like the 25 mm Mk 38 Mod 2, are small enough that they can be removed from the ship, sent to manufacturers for reworking and then be reinstalled by the Navy. This normally occurs when the ship is in port for an extended scheduled maintenance.

This expedited process, with gun engineers jumping on ships before overhaul, saves time and money. In comparison, the 5-inch gun's overhaul now takes 6 to 9 weeks and costs approximately $750,000—significantly faster and less expensive than previous practices.

Guns also must be upgraded. The 20 mm Close-In Weapons System (CIWS) has a 20-year roadmap for upgrades, which enables it to engage surface vessels in addition to air threats. This roadmap entails tracking and enabling gun upgrades across the fleet. When depot maintenance is performed, NSWC IHEODTD sends fleet service technicians to a ship that needs an upgraded gun. That ship may be in Norfolk, San Diego, Japan or elsewhere. Once on site, NSWC IHEODTD technicians coordinate upgrades of the existing system or, in some cases, removal of an old gun and installation of a new one.

That expertise is applied to installing guns on new ships, as will be done for the "upgunned littoral combat ship, with 57 mm Mk 110, 25 mm Mk 38, and 30 mm Mk 50 guns." Again, emphasis is given to being faster and more cost effective. Previously, guns for new ships were manufactured in Louisville, Kentucky, and transported for shake-out tests at Fort Knox, Kentucky, which could test one to two guns a week. The guns were then returned to the manufacturer for adjustment, and sent to ships for installation. Today, guns go to NSWC IHEODTD's detachment at Picatinny, with its own range and engineering facility. There as many as five to six guns can be tested daily and then adjusted if necessary.

Readiness of ships and their guns is tied to ammunition. Keeping the guns ready for use is a challenging task in forward areas. At sea, ammunition is transferred from logistics ships to combatant ships by helicopter or by connected replenishment, where it is subject to salt water spray and considerable handling. On forward bases, the required amounts of ammunition might be stored for several years in magazines without temperature and humidity controls. Consequently, ammunition and its packaging can become corroded or damaged and deemed unserviceable.

To keep that ammunition ready, NSWC IHEODTD sends teams of engineers and technicians to forward ammunition storage sites in Guam, Hawaii, Italy, Spain and other locations. There, these "Mobile Ammunition Evaluation Reconditioning Units" inspect, refurbish and repackage ammunition. These units not only ensure the ammunition's readiness, they also save millions of dollars by avoiding the demilitarization and replacement of ammunition that otherwise would be unserviceable.

Top Four Reasons This Service Matters

(1) Success at sea depends greatly on the support behind it. That's especially so for naval guns, which play a key role in protecting sea lanes, which is very vital to the global economy. The readiness of these guns is tied to naval regional maintenance centers and NSWC IHEODTD's in-service engineering.

(2) There are no good substitutes. At the start of World War II, a Navy captain said, "Contractors would solve all the problems," a view that has persisted. Industry does many things more cost effectively than defense personnel, but there would be a huge cost involved in replicating and performing in-service engineering for various guns across globally distributed Navy and Coast Guard fleets. And, long-term support cannot be assured because of corporate and marketplace uncertainties.

(3) The need for this in-service engineering will increase in the growing intensity of the operating environment. In response to increasing maritime threats, the Navy is shifting to a concept of "distributed lethality." This means putting guns and missiles on more ships, including logistics vessels. It also means keeping more ships' guns ready.

(4) The need for this service will increase as budgets become more constrained. The readiness of naval guns and ammunition is not end-state. Rather, it's a journey to continually do more forward, faster and more cost effectively. Such improvements come from continually doing, learning and changing. And that's what we do at NSWC IHEODTD.

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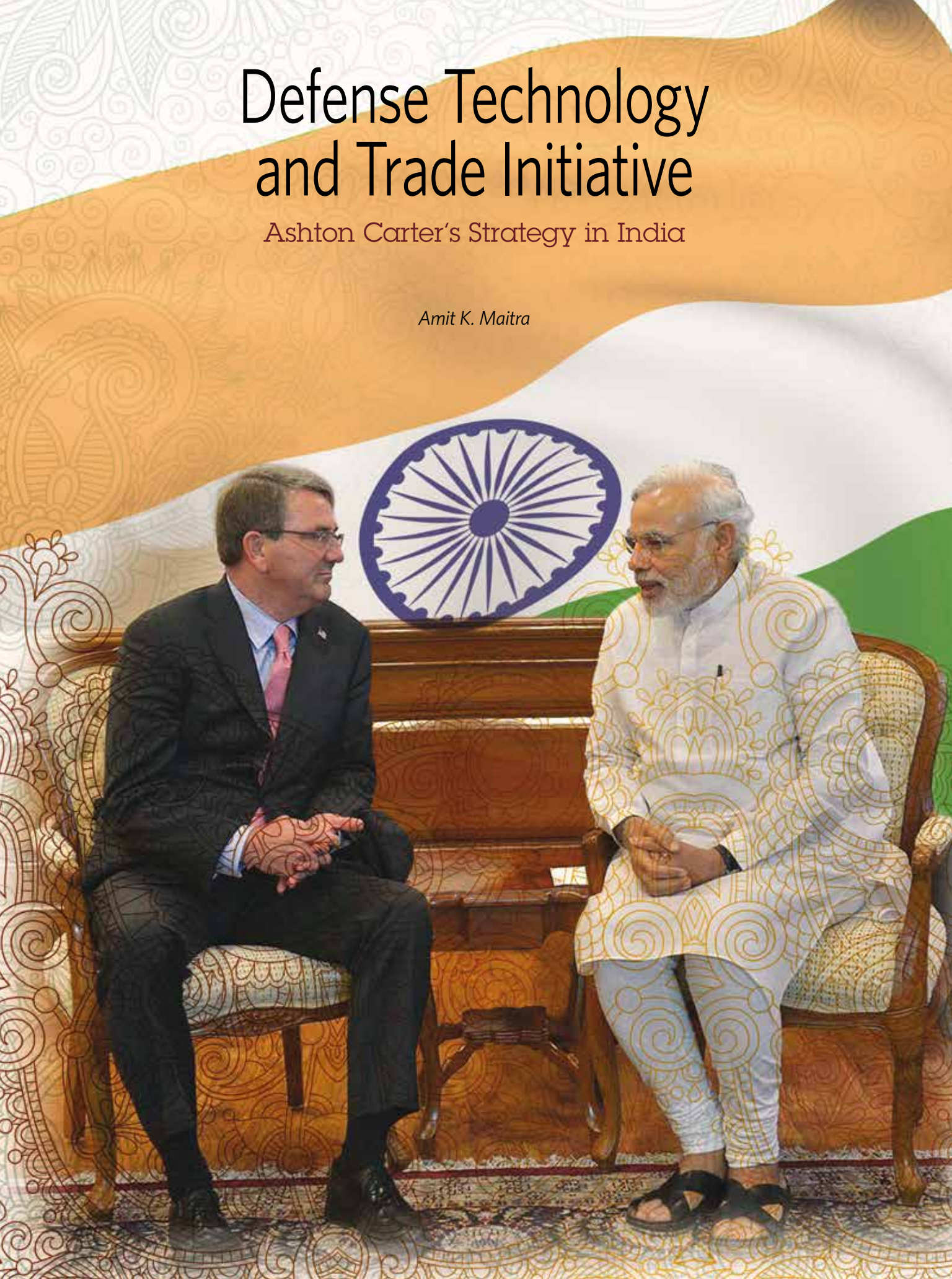
Defense Technology and Trade Initiative

Ashton Carter's Strategy in India

Amit K. Maitra



In early June 2015, Defense Secretary Ashton B. Carter met with senior Indian officials to work on initiatives that were set in motion during President Obama's January 2015 visit to India. During that visit, Obama and Indian Prime Minister Narendra Modi focused on shared concerns ranging from maritime security and cooperation and joint training on aircraft carrier and jet engine technology.

Modi, who has a broad vision of India as a global power, has a noticeably great affinity for the United States. Also, in the wake of China's efforts to project power into the Indian Ocean and beyond, both the United States and India share an interest in building closer ties, especially on defense matters.

Modi has given priority to domestic manufacturing, including production of military hardware. Sanjeev Shrivastav, an analyst at the Institute for Defense Studies and Analyses in New Delhi, argues that the Modi administration views an extensive co-production deal with the United States as "a significant move forward."

Carter visits India frequently. However, his June arrival as the U.S. defense secretary heralded a new beginning. He landed in the southeastern city of Visakhapatnam and toured the Indian Navy's eastern command headquarters. This first visit by an American defense secretary to an Indian military operations command highlighted the importance of maritime defense and manufacturing ties between the two nations. After a briefing from the Indian commander, Carter visited a frigate designed and built in India, with its engines supplied by General Electric and many of its systems and subsystems also acquired from abroad.

U.S. and Indian defense officials have been discussing the exchange of technology on major military items, such as jet engines and launch catapults for aircraft carriers. Jet engines

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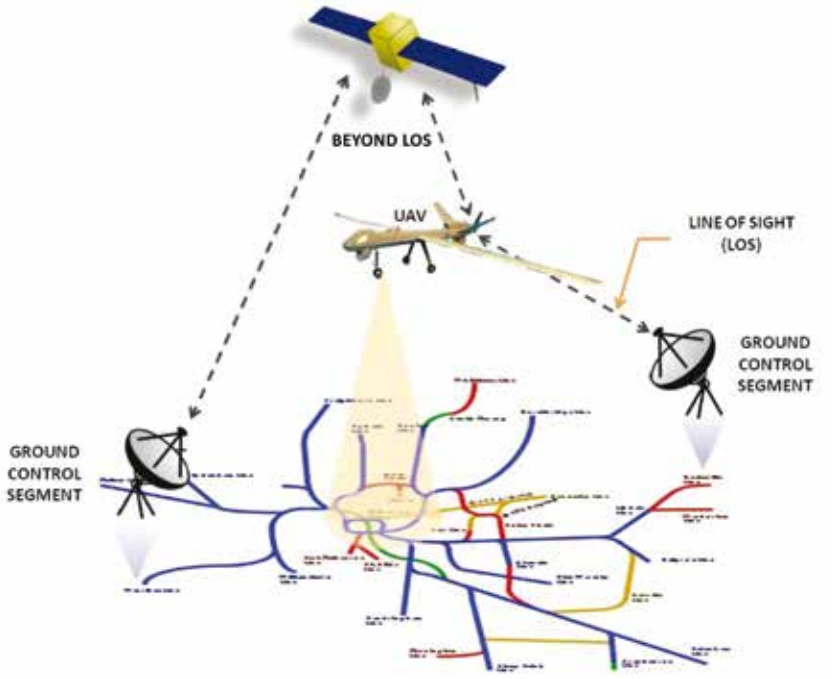
← **U.S. Defense Secretary Ashton B. Carter, left, meets with Indian Prime Minister Narendra Modi in New Delhi, India, June 3, 2015.**
Department of Defense photo by Glenn Fawcett

and aircraft carrier technology represent the larger projects that the Pentagon is considering for co-production with India.

As the main architect of the India-U.S. Defense Technology and Trade Initiative (DTTI), Carter staunchly advocates treating India like some of the closest U.S. partners in terms of the extent and level of technology transfer, co-development, co-production and collaborative ventures, and expedited approval process for licenses, among other activities. Under Carter's leadership, the Pentagon, with its special India team, is ready to help senior officials cut through their own bureaucratic barriers and red tape.

During the June 2015 visit to India, Carter completed the details of two small research projects that the U.S. and Indian militaries would conduct together. These projects are very small, but their importance could be significant, depending on the outcomes. The expectation, according to U.S. officials traveling with Carter, is that Washington and New Delhi would become accustomed to working with each other through these small-scale initial projects.

Figure 1. Unmanned Aerial Vehicle Line of Sight



Source: *Report on Unmanned Aircraft Systems: Perceptions & Potential,* Aerospace Industries Association, May 10, 2013.

Carter also signed the 2015 U.S.-India Defense Framework, the stated purpose of which is "to open up this relationship on everything from maritime security to aircraft carrier and jet engine technology cooperation." Before the visit last June, Carter had told delegates at the Shangri-La Dialogue plenary session in Singapore that the framework agreement with India was meant "to blaze a trail for things to come." What benefits accrue to whom as the U.S. and Indian industry partners undertake technology transfer, co-development, co-production and collaborative ventures?

The Unmanned Aerial Vehicle

The small portable, hand-launched and remote-controlled, electric-powered RQ-11 Raven is built by AeroVironment, Inc., in Monrovia, California, and has changed the way military ground forces operate. The design, development and manufacturing and market reach of this particular unmanned aerial vehicle provide a case study of technological advancements and joint venture co-production and co-development requirements.

In 1987, AeroVironment introduced the first true small unmanned aerial vehicle (UAV) for military use. Since then, the U.S. military's UAV market has witnessed meteoric growth, as UAVs have proven their value in operations around the world. Several industry reports project that U.S. military UAV manufacturing will generate $86.5 billion in revenue over 2013–2018. These forecasts provide the following breakdown of U.S. sales of UAVs:

- Research, development, tests, and evaluations
- UAV, as an assembly
- Payloads
- Ground control systems
- Service, support, and maintenance
- Training
- Data management
- Revenue by UAV groups (by vehicle airspeed, weight, and operating altitude)

Since the U.S. Department of Defense (DoD) is the single largest consumer of UAV technology, industry experts predict that the U.S. Government will continue investing in UAVs to keep its technological and pure force supremacy in the coming decades.

A market research study by the Teal Group Corporation predicted that the United States will account for 65 percent of total worldwide research, development, test and evaluation spending on UAV technology over the next decade and about 41 percent of the procurement. This study provides a comprehensive analysis of UAV system payloads and key UAV manufacturers. Philip Finnegan, the Teal Group's director of corporate analysis and study author, forecasts the UAV market at 89 percent military and 11 percent cumulative civilian uses for the decade. He foresees the mili-

tary market share decreasing to 86 percent and the civilian market rising to 14 percent by the end of the 10-year period covered by the forecast.

Thomas Nielsen, president of the Association for Unmanned Vehicle Systems International, reminds us that, in addition to the military use of UAVs, other applications should not be overlooked: fire safety, land safety, search and rescue, firefighting and other crime prevention—just to name a few such activities. Forecasts from market research firms indicate that UAV applications will continue evolving in all these domains. Today, UAVs are used to monitor national borders and pipeline utility assets, and protect civilians via search and rescue missions (e.g., find people who are lost and in distress). These missions are well served by small UAVs, as they can be launched easily, day or night, to provide precise situational awareness whenever and wherever they are needed.

According to several industry reports, UAV electronics will be the world's fastest-growing aerospace payload market, with new sensor programs for current and future air vehicles presenting surprising growth opportunities.

David Rockwell, author of the electronics portion of the Teal Group study report, identified and listed a few speculative new programs in the out-years that demonstrate how wise companies' managements will plan for future growth.

Varied Strategies of Small UAV Companies

The U.S. military and allied forces extensively use AeroVironment's UAVs, which deliver valuable capabilities to provide intelligence, surveillance and reconnaissance (ISR) superiority in today's combat zones.

AeroVironment's Raven is the most widely used unmanned aircraft system in the world today. It can be operated manually or programmed for autonomous operation with the system's advanced avionics and precise GPS navigation. The hand-launched Raven weighs 4.2 pounds. With its 4.5-foot wingspan, it provides aerial observation, day or night, at line-of-sight ranges of up to 10 kilometers (see Figure 1 on page 28).

When an optional stabilized gimbaled payload is added, Raven delivers real-time color or infrared imagery to ground control and remote viewing stations. AeroVironment's common Ground Control Station interfaces with all its tactical ISR air vehicles, thereby reducing the training required, as well as the time and cost involved. The company has won every DoD competition for programs of record involving small UAVs. Despite AeroVironment's market presence and the global UAV industry's growth forecast, the December 2013 DoD report, *Unmanned Systems Integrated Roadmap FY2013–2038*, points to the grim reality of defense funding. A comparison of DoD funding plans versus industry predictions shows DoD will not be the bulk user within that market. The Bipartisan Budget

Table 1. AeroVironment's Recent Developments

Date	Approach	Description	Importance
June 2014	New Product launch	AeroVironment Inc. and BP U.S. launched the first Federal Aviation Adminisration-approved, commercial UAVs to provide mapping. Geographic Information System (GIS), and other commercial information services to BP's Prudhoe Bay oil field.	
February 2014	Agreement	AeroVironment Inc. and Lockheed Martin Corp. (U.S.) signed an agreement to jointly pursue opportunities in UAV development.	
November 2013	Contract	The company was given a contract worth $2.3 million for the Defense Advanced Research Projects Agency's Concept Definition Tactically Exploited Reconnaissance Node (TERN) program for a Medium Altitude Long Endurance Unmanned Aircraft System.	
October 2013	Contract	The company was awarded a contract worth $13.5 million by the U.S. Army for RQ-11B Raven Unmanned Aircraft System Gimbaled Sensor Payloads.	
August 2013	Contract	The company received an order worth $13.8 million for the RQ-11B Raven Small Unmanned Aircraft Systems and Gimbaled Payloads.	

Source: Data compiled by author from AeroVironment published literature on the company website (www.avinc.com <http://www.avinc.com>), and several other Market Research Reports published through the Internet,including *U.S. Military Unmanned Aerial Vehicles (UAV) Market Forecast 2013-2018*, Jan. 9, 2014, Market Research Media, Ltd.; Teal Group's 2014 Market Study: *UAV Market Profile and Forecast*, July 17, 2014, Teal Group Corp. See http://www.marketsandmarkets.com/Market-Reports/commercial-drones-market-195137996.html.

Carter staunchly advocates treating India like some of the closest U.S. partners in terms of the extent and level of technology transfer, co-development, co-production and collaborative ventures, and expedited approval process for licenses, among other activities.

Control Act of 2013 imposed budget cuts on the DoD, thereby reducing the DoD's UAV procurement expenditures from $3.9 billion in 2013 to a requested $2.4 billion for 2015. Procurement contracts for the compact drone (as UAVs commonly are called) dropped from $30 million in 2013 to $13 million for 2015.

Two factors constrain U.S. companies from contributing to the UAV industry's growth independent of government contracts: commercial use of drones are subject to Federal Aviation Administration regulations, and companies also must overcome export license restrictions before they are allowed to make foreign sales of these drones. AeroVironment's "Hummingbird drone," ordered by the Pentagon and a favorite for combat operations in Iraq and Afghanistan, took an enormous hit in 2015. According to Chief Executive Officer Timothy Conver, revenue is expected to drop to $230 million in the coming fiscal year. Table 1 on page 29 provides a partial listing of the company's recent developments.

Given uncertainty in the U.S. domestic market, AeroVironment has ventured into international marketing opportunities. DTTI offered a fortuitous foundational opportunity to overcome bureaucratic obstacles, including export approvals, and arrange cooperation with an emerging economic power at the research, co-development and co-production stages for select defense systems. Today, the company is focused on a pathfinder project involving a mini-UAV initiative with Indian industry partners.

In discussing the Make in India initiative, U.S. officials note that it requires time and tenacity to create high-tech military defense sector industry. The mini-UAV projects will help develop deeper levels of cooperation and partnership between U.S.–Indian businesses, militaries, and American and Indian engineers, to produce cutting-edge designs. This understanding is warranted, because Make in India is not about transferring old technologies from the United States for final product assembly in India: Rather, it aims at joint development of new technologies through design, engineering, manufacturing, testing, production, deployment, operations and sustainment. Keith Webster, director of International Cooperation, Office of the U.S. Under Secretary of Defense for Acquisition, Technology, and Logistics (OUSD[AT&L]), notes that modest programs like mini-UAVs will allow both the U.S. and Indian participants to understand how they can work together more effectively, work out procedures, and learn from that experience.

Webster views AeroVironment's arrangement with the Indian counterpart as an excellent opportunity for lessons learned about the complexities of the transfer process. As mentioned earlier, a rapid reaction-cell has been instituted within OUSD(AT&L) specifically to move Indian transactions faster, and it has approved the export license for AeroVironment to proceed with the pathfinder project. Now, the company must

Table 2: Steps in Production and Handling of a Complete System of Technology Development and Transfer

Steps	Technology Transferred	Transfer Media
Research	Product Design	Documentation & Hardware
Laboratory Development		
Prototype	Manufacturing Technology	Documentation & Hardware
Manufacturing Process Development		
Pilot Production	Quality Analysis Techniques	Documentation & People
Engineering Support		
Product Management Techniques →	Product Management Techniques	Documentation & People

Source: Maitra, Amit K. *Transferring Technology Across Borders: Policies, Practices and Conditioning Factors*, GENERAL SYSTEMS, Vol. XXI, 1976.

Table 3. Audit Matrix

	Transfer Mechanisms						
	Documentation		Training		Seminars	Learning, Visits, and Exchanges	Equipment
Type of Technology	Manuals, Special Process Drawings	Regular Information	Formal	OJT	Formal	Formal	Formal
Planning and Proposal	X	X	X		X	X	
Design and Construction	X		X	X		X	X
Startup	X	X	X			X	X
Value Engineering	X	X				X	X
Research and Product Development	X		X	X	X	X	X
Environmental Support	X	X			X	X	X

Source: Maitra, Amit K. *Transferring Technology Across Borders: Policies, Practices and Conditioning Factors*, GENERAL SYSTEMS, Vol. XXI, 1976.

determine both the technology package and the transfer process. AeroVironment must assess its Indian partner's current industrial base to support the manufacture of the particular UAV model and the locally manufactured components that could be integrated into the UAV model. These questions are germane to the UAV pathfinder project, as they provide the highly sophisticated nuances related to electronic components and circuitry and the ability to develop a local capability for component integration.

The questions help identify and list the basic steps to produce a complex product like UAVs, including research, laboratory development, prototype development, manufacturing process development, pilot production, and engineering support. From these steps, elements of a technology transfer package evolve in the following manner (see Table 2, on page 30):

- A product design is achieved through laboratory development and prototype development. This element can be directly transferred through documentation and the hardware itself.
- Manufacturing techniques are established through the combination of manufacturing process development and pilot production steps. Again, these techniques can be transferred through documentation and hardware.
- Quality assurance techniques are developed from product testing in pilot production and data gathering entailed in engineering support. These two steps incorporate design refinement and continuous updating of the product; new state-of-the-art techniques also form part of the technology transfer package and are transferred through documentation and people.

Another very important element of transferrable technology is that of product management techniques. These techniques are not exactly product oriented, nor do they directly relate to the steps outlined above. They include the development and management skills to ensure sufficient and timely production of high-quality products at a predetermined cost. This element and that of quality assurance techniques constitute the most valuable ingredients that many overseas suppliers have to offer to Indian industry in a technology transfer package.

In April 2015, Prime Minster Modi announced plans to shelve the purchase of 126 Rafale warplanes from France's Dassault Aviation SA, a contract that would have seen 108 planes built in India. Talks stalled for several years over pricing and a requirement for Dassault to assume liability for the 108 jets to be built under license by Hindustan Aeronautics Ltd (HAL).

The state-run company has been plagued by quality problems: for instance, its indigenous Tejas fighter jet took more than 20 years to develop. India has several options, such as inviting private companies to either replace or complement HAL. Justin Bronk at London's Royal United Services Institute for Defence and Security Studies observed that finding an alternative to HAL for making one of the world's most advanced fighter jets may be difficult. Indian industry is not ready to produce a fighter jet of this complexity. Technical knowhow, coupled with human knowhow, is the winning combination for India.

As a first step toward more specific analysis and evaluation of all technology components required to establish a high-technology manufacturing facility, including that for the AeroVironment type of pathfinder project, a Total Technology System framework is warranted. A Total Technology System built in the form of an audit matrix is shown in Table 3 on page 31.

To fully enhance the concept of evaluating stages and mechanisms of technology transfer, pathfinder type of projects should use the audit matrix to identify which aspects of technology are critical to different types of industry. There is no one best means for technology development and transfer. For mass production technology, one element may be more important than another. For Indian industry, design, development, test, evaluation, integration, verification, validation and quality checks may bring more critical new technology than the start-up phase. These determinations depend not only on the type of technology being supplied, but also on the overall needs of the Indian industry and its environment. The AeroVironment pathfinder project offers an excellent vehicle for raising questions about the type of technology and its particular transfer mechanism, and the cost, quality and extent of its importance to the ongoing project and the Indian environment. To that end, Table 4 discusses the rationale and aim of asking questions, such as *what* and *when* and *how*: How best can the AeroVironment pathfinder project guide a potential Indian partner on tried and tested methods of sustainable product engineering design and development processes and tools?

The pathfinder project permits the company to initiate joint programs, by sharing development and production of a new UAV aimed at Indian domestic and export markets. The scope of the global market for UAV applications comprises Military, Civil and Commercial, and Homeland Security. Military involves ISR, Combat Operations, Battle Damage Assessment/Target Designation Mission. Civil and Commercial contain Agriculture, 3D Mapping, Film Industry, Photography, Oil and Gas, Product Delivery, Wildlife Research and Survey, and Climate and Pollution Monitoring. Homeland Security includes an array of applications, including Border Security, Fire Fighting, Traffic Monitoring, Disaster Management, Search and Rescue, Police Operations and Investigations, and Maritime Security.

A snapshot of the global market for UAV payloads points toward Electro-Optical/Infrared Sensor, Cameras, Synthetic Aperture Radar, Signals intelligence, Electronic Intelligence, Communications Intelligence, Maritime Patrol Radar, Inertial Navigation System, Laser Sensors, Electronic Warfare, Optronics, and others including Autopilot, Lidar, Weapons, Automatic Target Recognition.

The Indian market for Raven type of UAV is wide open and by virtue of its pathfinder project, AeroVironment has established a beachhead in South Asia and will be able to enjoy a comparative advantage over its licensee.

By participating in co-production and co-development of UAVs, Indian industry will acquire new product development, manufacturing, logistics, and marketing skills. It will co-develop products and co-produce technology for UAV markets

Table 4. Questions and Answers Readily Accessible Through the Pathfinder Project

Rationale	Given the wide scope and broad impact of DTTI's programs and policies, as well as the differing workflows and approaches of Make in India across the sectors, examples are needed of effective practice that are collaboratively developed but reflect institutional difference within a "real-world" environment.
Aim	The AeroVironment pathfinder project will aim to develop shareable models of good practice with regard to implementation of DTTI's requirements. In doing so, the project will enable their own and associated Indian industry partners to find out what works best in implementing DTTI projects, in a variety of institutions across sectors, and will share this knowledge openly thereby aiding other Indian industry partners in the wider sectors.
How will they achieve this?	The AeroVironment pathfinder project will produce guidance that will enable Indian industry partners to improve awareness and clarity of tried and tested sustainable product design and development principles, approaches, tools and resources. The project aim is to embed this new thinking into their product design and development "stage gate" (decision-making) processes and in key documents and guidance materials.

Table 5. Potential for UAV Market Growth

Region	Market Share	CAGR*
Americas	65.3%	111.93%
Europe	17.59%	102.11%
Asia-Pacific	11%	98.47%
Rest of the World	6.11%	98.47%

*Compound Annual Growth Rate percentage (2014-2020)

Source: *Commercial Drones Market*: GLOBAL FORECAST TO 2020, SE 3099-2015, Markets and Markets (http://www.marketsandmarkets.com/Market-Reports/commercial-drones-market-195137996.html).

in six main geographic regions: North America, Europe, Asia-Pacific, Latin America, Africa, and the Middle East.

The two joint-venture partners' challenge is to find concrete areas to step up product development, manufacturing, logistics, and export marketing cooperation so that only their strategic logic sets the pace of product development and penetration, persuasion and prosecution of their export marketing ventures. Until then, as Table 5 on page 32 shows, their individual shares remain visible targets to acquire from everywhere.

From this case material, it is possible to form a general observation about a particular firm's or industry's willingness to share front-end technology, impart sophisticated design and engineering capabilities, instruct foreign nationals in management skills, etc.: Foreign firms, facing narrowing opportunities to earn returns in their domestic markets, are eager to meet various conditions in a meaningful way so they can utilize their technology asset effectively. They prefer a U.S. Government policy that is flexible toward strategic trade and disclosure of technology products and information. DTTI allows defense systems, equipment, weapons and their subsystems to flow in both directions across the United States and India. AeroVironment pathfinder project illustrates, to paraphrase Carter, what can be achieved by opening the private sector, where companies are both eager and better prepared to assist both India and the United States.

Acknowledgments

The author thanks Mukesh Aghi, president of U.S. India Business Council (USIBC), Washington DC, and Rahul Madhaban, director of USIBC–Defense and Aerospace, both of whom graciously reviewed the ongoing programs involving the U.S. and India business communities. Valuable comments on various DTTI-related issues were provided by Keith Webster, director of International Cooperation, DoD Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics (OUSD[AT&L]); Duncan M. Lang, India Rapid Reaction Cell (IRRC), OUSD(AT&L); Maureen Schumann, DoD's Defense Press Office, Office of the Assistant to the Secretary of Defense (Public Affairs); and numerous others. The content is solely the responsibility of the author.

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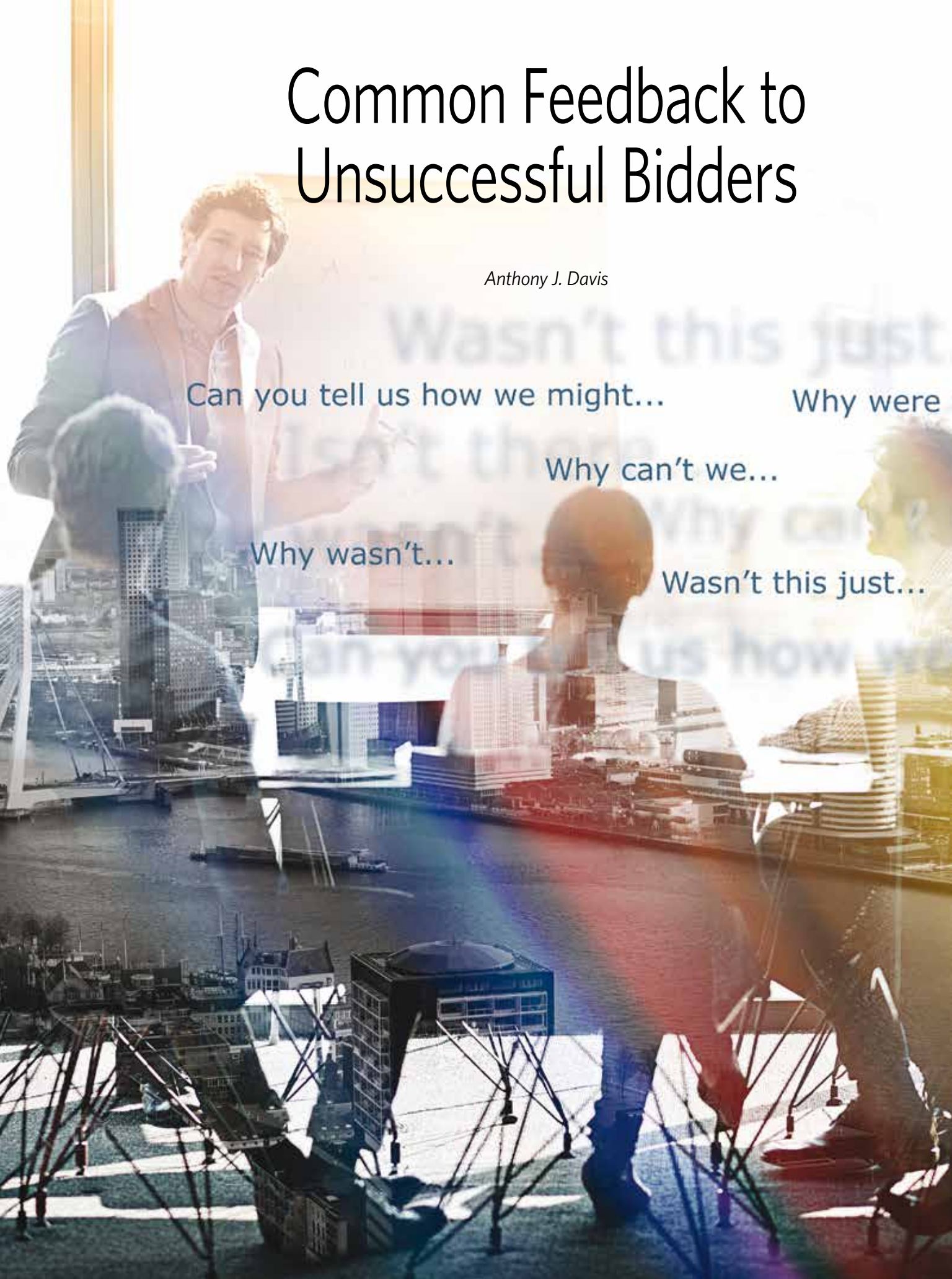
Common Feedback to Unsuccessful Bidders

Anthony J. Davis



The Federal Acquisition Regulations (FAR) allow several opportunities for the government to provide feedback to bidders during or after competitions. The post-award debriefing of offerors is one of those opportunities, and can be a very valuable tool for companies seeking feedback on their proposals. The government is required by the FAR to provide a post-award debriefing to any offeror who requests one in writing within 3 days of notification of contract award.

In the dozens of competition debriefs I've conducted or attended in more than a decade, I'm consistently surprised by how often we repeat the same information. The following reviews the format we use for debriefings, questions we're frequently asked during the discussions, and some of the common feedback we seem to repeat regularly.

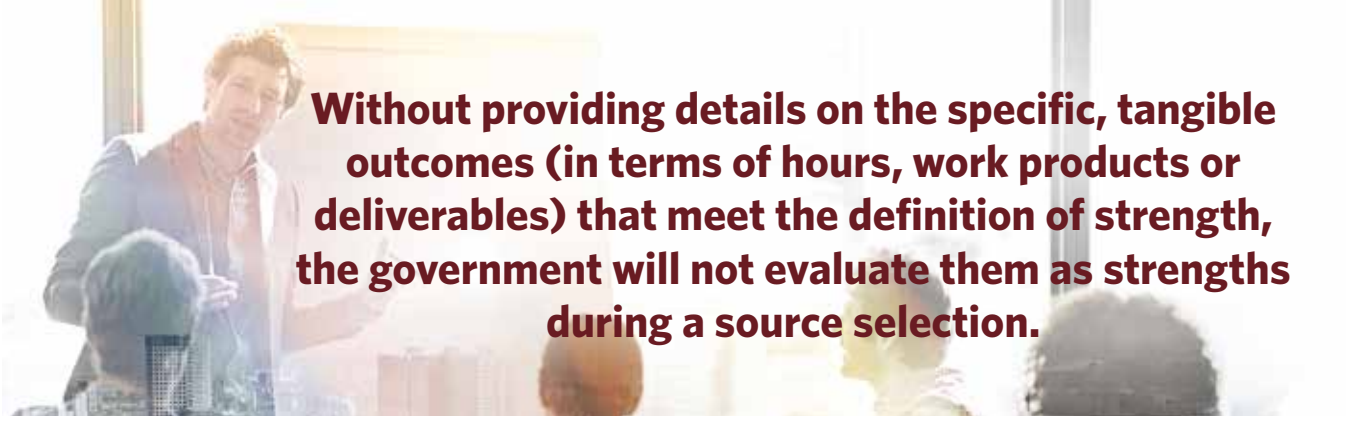
The Department of Defense (DoD) guidance on debriefings states the objective as: "The crux of any post award debriefing is the SSA [Source Selection Authority] award decision and whether that decision is well supported and resulted from a source selection conducted in a thorough, fair and sound manner consistent with the requirements and source-selection methodology established in the RFP [request for proposal]." The preceding quote (under section B.8.3.1) and other information about DoD source selections can be found on DAU's Acquisition Community Connection at: https://acc.dau.mil/dodssp.

First, our standard debriefing format: The objective of this post-award debriefing is to highlight the significant elements in your proposal and to summarize the rationale for award. The ground rules are open and honest discussions within the limits of FAR 15.506.

The focus is on your proposal submission. But overall evaluated cost, task order management and technical proposal ranking for the successful bidder will be provided, including summary of the rationale for award.

Reasonable responses will be given to relevant questions about whether the source-selection procedures, applicable regulations and other applicable authorities were followed in eliminating your proposal from the competition.

Davis *is the Director of Science and Technology for the United States Special Operations Command (USSOCOM), MacDill Air Force Base in Florida. He leads the application of applied research and advanced technology development funding to SOCOM technology needs, delivering and transitioning technologies to Special Operations Forces worldwide. The views presented are those of the author and do not necessarily represent the views of the Department of Defense or its Components.*



Without providing details on the specific, tangible outcomes (in terms of hours, work products or deliverables) that meet the definition of strength, the government will not evaluate them as strengths during a source selection.

You are encouraged to ask questions. Answers not provided today will be provided in writing as soon as possible. In accordance with the FAR 15.506(e), the government will not disclose:

- Trade secrets
- Privileged or confidential processes and techniques
- Commercial and financial information that is privileged or confidential
- Names of individuals providing reference information on past performance

Source Selection Process/Evaluation Factors: In this section, we read a summary of the source-selection process outlined in Sections L and M of the RFP, including the rating scheme and prioritization of factors evaluated. An example is shown below:

A color-code rating technique was used to evaluate the Management and Technical proposals. Past Performance was evaluated for an overall confidence rating and cost proposals were not given a rating. Each proposal was evaluated against the following four factors: (1) Management, (2) Technical Proposal, (3) Past Performance, and (4) Cost. Evaluation of Factors 1 and 2 focused on the strengths, weaknesses, significant weaknesses and deficiencies of the proposals. Evaluation of risk associated with the proposals for these factors are inherent in the evaluation.

As outlined within the RFP, Management and Technical are equal in importance and more important than Past Performance. When combined, these three are significantly more important than Cost.

Following the reading of our standard debriefing, we review the ratings the company in question received. In particular, we focus on the "strengths, weaknesses, significant weaknesses, and deficiencies of the proposal" that resulted in the final overall rating.

Some Common Questions and Answers

Q: Can you tell us how we might compete more favorably next time?

A: Our response to this generally is fairly standard, and tracks directly back to what we tell you in Sections L (Instructions, conditions, and notices to offerors or respondents) and M (Evaluation factors for award). First, your proposal should show that you understand the requirement, preferably without regurgitating it. Second, your proposal should demonstrate how you are going to meet the requirement. Last, but certainly not least, the higher color ratings are awarded when the proposal (1) meets requirements; (2) shows a thorough (or exceptional) approach and understanding of the requirements; (3) contains strengths which outweigh (or far outweigh) any weaknesses; (4) and when risk—not evaluated separately—of unsuccessful performance is low or very low.

Q: Why wasn't our "concept X" evaluated as a strength?

A: The DoD source-selection procedures (https://acc.dau.mil/dodssp) define a strength as "an aspect of an offeror's proposal that has merit or exceeds specified performance or capability requirements in a way that will be advantageous to the government during contract performance." It is incumbent on the vendors to demonstrate their understanding of the requirement, and explain how their approaches will provide value to the government. In many cases, good ideas do not rise to the level of a strength in evaluation because: (1) the concept expressed in the proposal does provide value to the government but is part of what was asked for in the RFP (i.e., is part of how you will meet our requirements, not a way to meet them better, smarter, faster, etc.); or (2) the concept isn't supported by or integrated with the rest of the proposal (does not track to pricing, is not supported by staffing, is not integrated with service-delivery model, etc.).

For example, nearly all proposals we review include ideas such as reach-back support, a council of graybeards to provide strategic consultation, or something else intended to differentiate the proposal from others. But, without providing details on the specific, tangible outcomes (in terms of hours, work products or deliverables) that meet the definition of strength, the government will not evaluate them as strengths during a source selection.

Q: Why were we evaluated with a weakness for "Y?"

A: In general, we would prefer that it never come to this. Our intent is to have significant and substantive discussions throughout our acquisitions to the broadest extent authorized. As a result of those discussions, we should at the very least

have communicated to the vendors any significant deficiencies or weaknesses in their proposals and given them time to correct those deficiencies. The presence of a weakness in the final evaluation generally means (1) we don't believe the vendor understands or recognizes the weakness we've pointed out and hasn't changed its proposal to respond to it; or (2) despite the vendor's attempt(s) to respond to the weakness, we still don't understand how the vendor plans to address it or don't see the staffing or other resources to resolve the matter.

Q: Wasn't this just a Lowest Priced, Technically Acceptable (LPTA) source selection?

A: There is a time and place for LPTA, but the RFP will always state specifically where the evaluation falls on the best value continuum. The vast majority of our source selections are conducted as best value trade-offs. From the top down in Special Operations Research, Development and Acquisition, we're strong believers in best value source selections and actively strive to be the best in DoD at conducting them. We focus a great deal of time and effort to ensure we have a well-trained and prepared acquisition workforce with the experience and tools to properly execute, document and communicate the source selections we make and to defend the selections in the event of any protests.

Q: Can you tell us how our cost or proposal compared with the other offerors?

A: Unfortunately, no. In most cases, we will provide the winning offeror's total cost, and the winner's evaluation results in terms of colors. We are prohibited by the FAR from disclosing any proprietary information (including other offerors' costs), directly comparing vendors or providing point-by-point comparisons.

Some Common Feedback

The evaluation team felt you spent too much of your proposal regurgitating the requirement to us. It's sometimes a fine balance, but you need to convey to us that you understand the requirement without just reading it back to us. In addition, including examples of work on past efforts does not demonstrate your understanding of the requirement. That experience is evaluated as part of past performance.

Your pricing, staffing model or overall approach (or portions of them) did not make sense to us, were not well supported or didn't track back clearly to your understanding of the requirement. When evaluating your proposal, we take a very structured approach. We read to understand your overall approach and understanding of the requirement, evaluate whether your proposal meets our requirements, and then identify any strengths or weaknesses of your approach. Well-written proposals lead us clearly and unambiguously through that process and are consistent throughout. An example of this is dividing a large proposal into sections by different vendor offices or organizations. This can save time by having the subject-matter expert write each proposal area, but frequently results in a disjointed proposal when the different sections are not well integrated. We recommend a detailed final review by the offeror of the entire proposal to ensure it is clear and consistent and that the data are not repeated in multiple sections.

Evaluation of past performance is based on the offeror's recent/relevant performance record from a variety of sources. This may include information provided by the offeror, information obtained from questionnaires (internally or externally), or information obtained from any other source available to the government (Past Performance Information Retrieval System, electronic Subcontract Reporting System, etc.).

So, that's a quick down and dirty overview of the format we use for debriefings of unsuccessful offerors, questions we're frequently asked during the discussions, and some of the common feedback we seem to repeat regularly. Hopefully, it provides some insight into the thought patterns and work processes of the evaluation team and background for your next source selection.

The author can be contacted at **anthony.davis@socom.mil**.

MDAP/MAIS Program Manager Changes

With the assistance of the Office of the Secretary of Defense, *Defense AT&L* magazine publishes the names of incoming and outgoing program managers for major defense acquisition programs (MDAPs) and major automated information system (MAIS) programs. This announcement lists all such changes of leadership, for both civilian and military program managers for the months of September-December 2015.

Navy/Marine Corps

CAPT Mark Kempf relieved **CAPT Scott D. Heller** as program manager for the Distributed Common Ground System Navy Program (PMW 120) on Sept. 1, 2015.

CAPT Mark Johnson relieved **CAPT Joseph D. Mauser** as program manager for the Tactical Tomahawk Program (PMA 280) on Sept. 19, 2015.

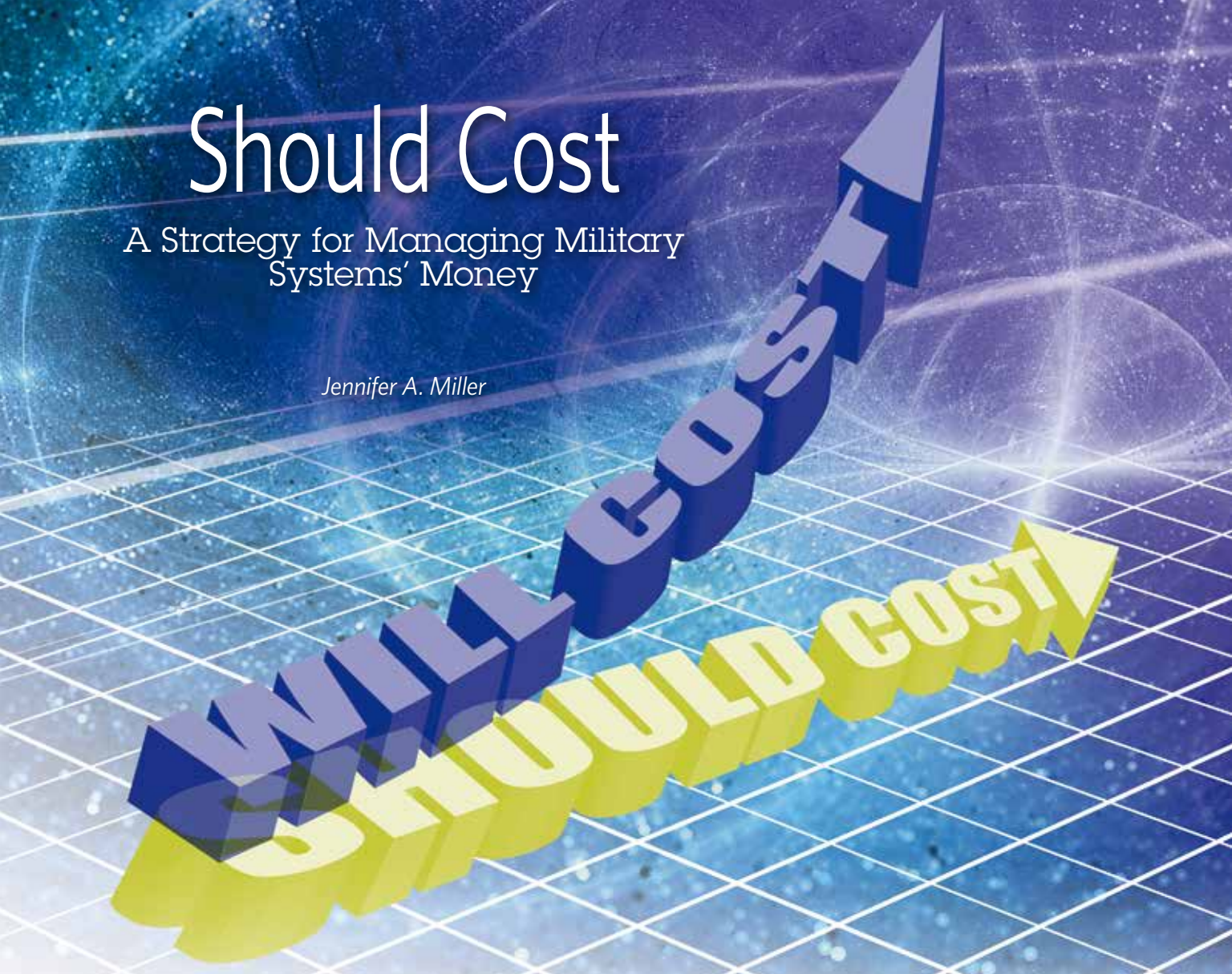
Thomas Rivers relieved **CAPT Christopher P. Mercer** as program manager for the LHA 6 America Class Amphibious Assault Ship and Ship to Shore Connector Programs (PMS 377) on Sept. 28, 2015.

CAPT John Hensel relieved **CAPT Dave Padula** as program manager for the C-9 Replacement Aircraft Program (C-40A) and KC-130J Aircraft Programs (PMA 207) on Dec. 1, 2015.

Should Cost

A Strategy for Managing Military Systems' Money

Jennifer A. Miller



Constituents gawk at the costs that intermediaries sometimes report that the Department of Defense (DoD) spent on goods and services. "A toilet, hammer, toner, etc., shouldn't cost that much," we exclaim. Where and when did we begin to focus on should cost? Great question!

My first introduction to should cost occurred about 5 years ago when holding a nonacquisition billet. This peripheral perspective caused me to reach out to the Defense Acquisition University (DAU) community to learn more. As I recall, one remark about will cost and should cost was that they resembled a kitten with a yarn ball—things would get complex in due course. I chuckled, but I also kept tabs as the next few years passed, and I ended up directly handling should cost for the Air Force Life Cycle Management Center's (AFLCMC) Armament Directorate at Eglin Air Force Base (AFB) in Florida. That is where I got the hot wash of should cost's evolution and quick handoff from a departing Service member who was the primary point of contact since introduction to the weapons portfolio in 2013.

Should cost began as part of an initiative in 2011, followed by appearance in Better Buying Power (BBP) 1.0 and 2.0, and morphed into a "core" initiative of BBP 3.0. Acquisition Category (ACAT) I through ACAT III programs were

Miller *is a Cost Analyst of the National Guard Bureau Headquarters. She formerly served as a financial manager for Nuclear Weapons Center and also supported the Armament Directorate's Should Cost efforts at Eglin Air Force Base in Florida.*

Boeing and the U.S. Air Force achieved the first flight of an unmanned QF-16 aerial target in September 2015.
Photo: U.S. Air Force

to embark on department-wide efforts to drive productivity improvements with should cost analysis. Five programs were identified as pilots for the distribution of funds based on should cost execution baselines for lessons learned that should be shared among DoD constituents. Services received initiative guidance, terms, procedures, reporting, and codification in policy from the Under Secretary of Defense for Acquisition, Technology, and Logistics to begin the will cost and should cost experience.

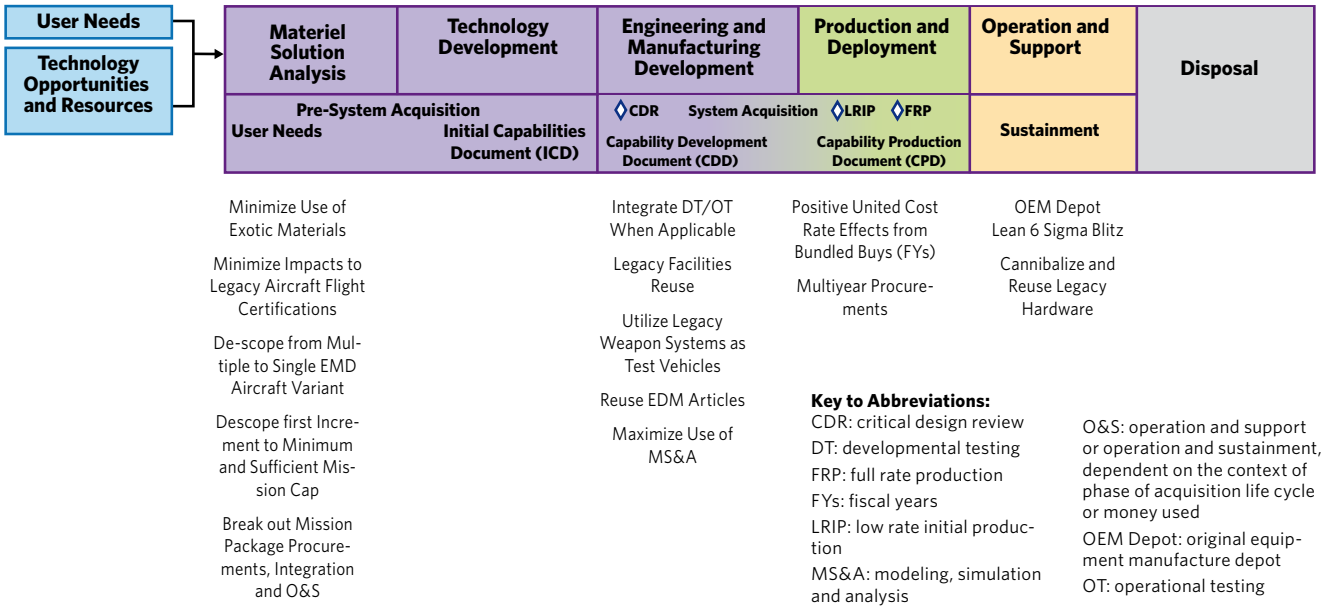
Significance rested with directed control of costs throughout product life cycles, with should cost-based management. Both the Army and the Air Force received scholarly additions to should cost efforts from the University of Tennessee National Defense Business Institute and a should cost management implementation case study published by Naval Postgraduate School (NPS). The practice of should cost in acquisition programs has since soared, with much follow-on discussion and implementation effort.

Among the abundance and iterations of policy, guidance, and business rules, the Air Force Life Cycle Management Center's Program Executive Office/Weapons Programs (WP) is an example of rising to the should cost occasion. As of 2015, one of many successes rests with Maj. Gen. Scott Jansson, former Air Force program executive officer (PEO) for Weapons, and director of the Armament Directorate, AFLCMC, at Eglin AFB. In April 2015, Brig. Gen. Shaun Morris assumed the position of Air Force PEO for weapons and director of the Armament Directorate with progressive changes of his own to advance the weapon portfolio's should cost achievements. The weapons portfolio currently boasts more than $700 million in should cost savings, a combination of should cost budget savings and should cost avoidance of expenditures. The should cost budget savings and should cost avoidance stem from 48 successful should cost initiatives logged in the Web Comprehensive Cost and Requirement System (WebCCaRS) and reported in Executive CCaRS (EC). Savings stem from strides made in establishing the process of should cost, building on successful should cost initiatives (SCIs), and continuous improvement. As experienced, should cost applies to goods and services, with benefits to government, industry and our foreign partners. While not all SCIs succeed, they all offer learning lessons for the program of record and other programs within the portfolio. One widely shared, successful SCI belongs to the QF-16 program. The QF-16 is also known as a Full Scale Aerial Target (drone) used for combat training and test of U.S warfighters.

In 2015, the weapons portfolio was asked to select an SCI as an exemplar to be featured in a should cost "Train the Trainer" telecom. Of the numerous SCIs available, the chief financial officer for the portfolio chose the QF-16 Engine Management (see photo). The program achieved slightly more than $46 million in realized should cost savings in the Fiscal Year (FY) 2013–FY 2020 period as of February 2015. The primary source of should cost savings was the transfer of Service Life Extension Program candidate engines that had sufficient serviceable cycles remaining in exchange for low-cycle QF-16 allocated engines.

Additionally, the strategic management of the program included establishing formal business agreements with multiple external organic organizations to regenerate Government Furnished Property (GFP) and provide avionics intermediate support. This SCI captured the fact that should cost is not an isolated effort or limited to a program manager's responsibility, though a program manager's rating does incorporate should cost efforts at this time. Instead, should cost spans business partners, internal and external business partners, and years beyond the Fiscal Year Defense Plan. It is no wonder

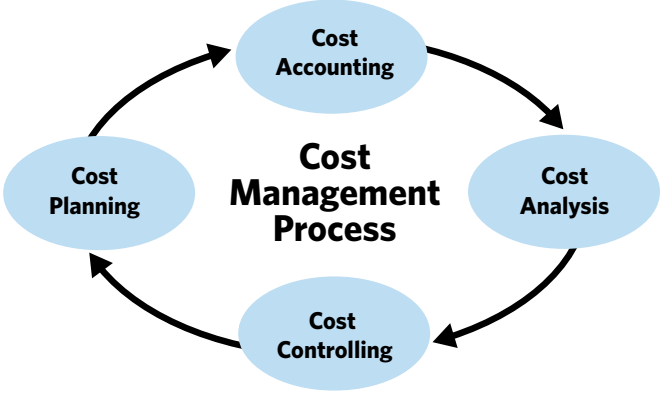
Figure 1. Should Cost Initiative Opportunities



that should cost appears to be gaining momentum rather than fading like a trend.

To satisfy guidance and maintain should cost momentum in the Air Force, use of modifications in WebCCaRS and EC for documentation and tracking emerged. At Eglin AFB, routine division-wide Should Cost Presentations began with a Jansson briefing on will cost, should cost, and open SCIs. The current likelihood of SCI results and proposal for closure of SCIs also would be shared. Content for the presentations mostly came from the systems as did our ad hoc reports to the Assistant Secretary of the Air Force for Acquisitions (SAF/AQ). The division-wide should cost presentations were frequent at first, similar to the abundant brainstorming sessions held to create SCIs and log the SCIs into WebCCaRS. It was something of a litmus test for true innovation that it maintain the spirit and intent of should cost rather than pick low-hanging fruit of easier savings opportunities. Instilling this mentality early throughout the Armament Directorate has benefited and enabled Morris to delegate approval of SCIs to senior material leaders of each division. Should cost presentations for the Armament Directorate have decreased in frequency, but standards remain high. As time has passed, assistance provided through should cost has become robust.

Figure 2. Cost Management Process



AFLCMC should cost resources have expanded to include a SharePoint with events, discussion boards, announcements, tools, templates, and archives of guidance. These should include briefs, articles, news, exemplars, policy, processes, training and contacts. As in all great implementations, continuous monitoring and improvements took place and continue today during our telecoms and network discussions of what has been done and what will come down as future system and policy changes. Iterative results included recognition where possible of strengths and weaknesses with incorporation of suggestions where possible. This approach has resembled the Army's Cost Management Process of cost planning, cost accounting, cost analysis, and cost controlling (see Figure 1).

To date, Morris' (formerly Jansson's) portfolio of Weapon Systems programs continue to generate SCIs of various types to achieve more should cost successes. What remains to be determined is the next program selected as an exemplar to present for their innovative, should cost approaches. After all, a program may find should cost initiatives in any stage of the acquisition life cycle—such as in materiel solution analysis; technology development; engineering and manufacturing development; production and deployment; operations and support; and disposal (see Figure 2). Furthermore, SAF/AQ now

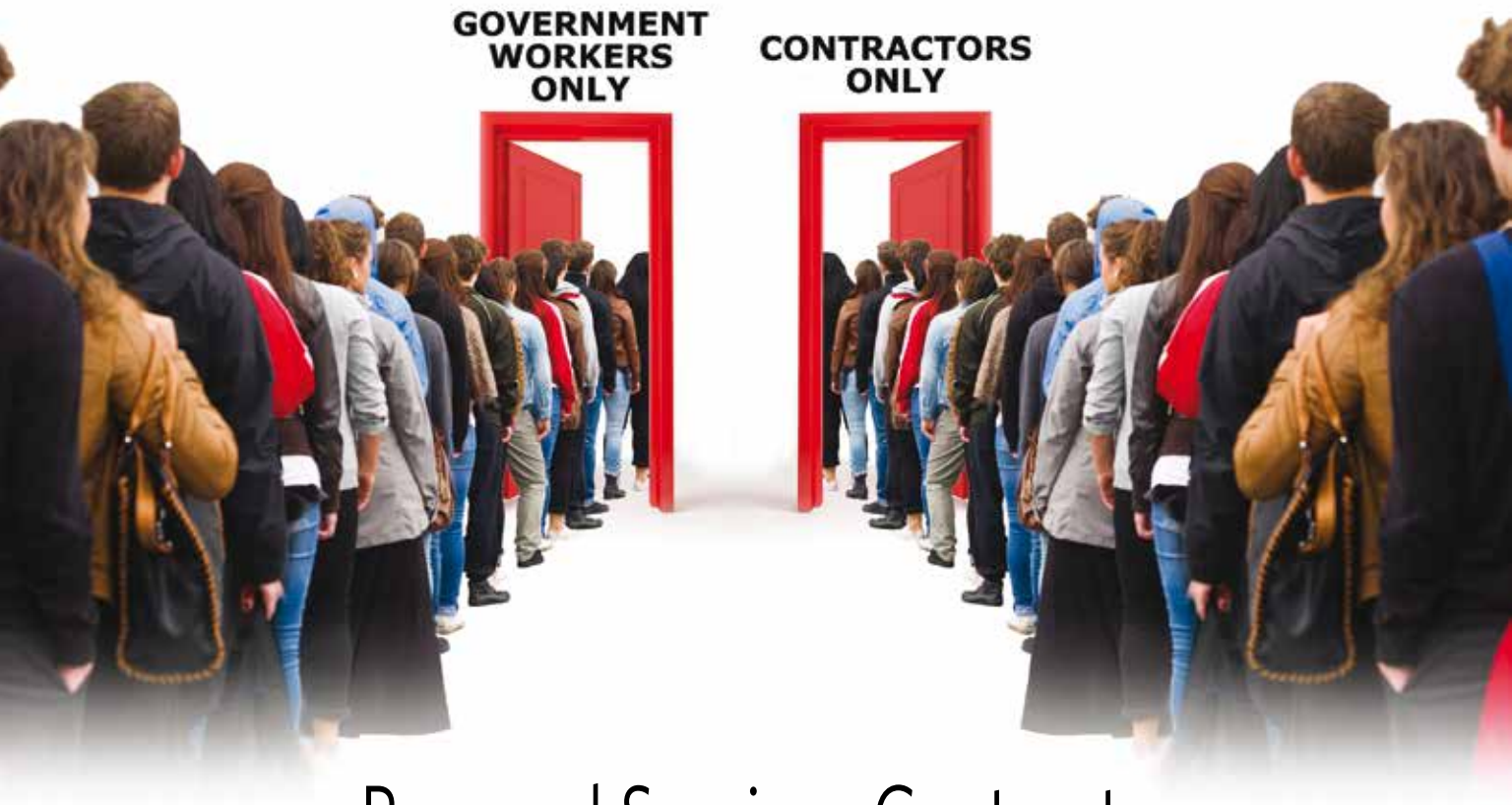
Savings stem from strides made in establishing the process of should cost, building on successful should cost initiatives (SCIs), and continuous improvement.

requires all programs of record to have at least one active SCI at all times, otherwise a Should Cost Waiver must be approved and maintained in the systems of record. Sharing from experience, our weapons portfolio has 15 or so programs that are ripe for presenting another exemplar, as we have a successful SCI to tout from four of the six acquisition life-cycle phases. I have only seen two waivers submitted for approval. Our SCIs span the areas of value engineering change proposals, data-driven contract negotiations, recycling warheads, test efficiencies, business case analyses, and more initiatives that may be leveraged successfully in other portfolios.

Finally, my experience with should cost in the Armament Directorate has been interesting, to say the least. I have kept constituents' remarks in mind as I observed the effort that goes into thinking of an SCI and then performing the calculations to support should cost against will cost and find and allocate savings. Our cost analysts have been absolutely instrumental in determining and executing the system data entries for their programs and our portfolio's should cost credit.

While there was initial frustration, and continued growing pains, I think we have all taken a beneficial, closer look at the line between what things will cost and what they should cost. The savings speak for themselves and have benefited the portfolio via reinvestment in the same program that realizes the savings or shares weapons resources with other programs. On a few SCIs, we even returned funding to the "Big Air Force" budget rather than have funding cut from our programs or portfolio.

The author can be contacted at **Jennifer.A.Miller212.civ@mail.mil**.



Personal Services Contracts

Is It Time to Lift the Ban?

Steven A. Fasko

It is no surprise to those of us in the Department of Defense (DoD) acquisition workforce that contractors are well integrated into our daily routine. The integration of contractors into our DoD workforce has blended it dramatically, changing the landscape of how we provide and manage services. Over the many decades during which this workforce blending has occurred, we have needed to tread lightly in our relationship with contractors in our offices. In fact, Presidents Eisenhower and Kennedy warned of possible difficulties that may occur in contractor integrated offices. One issue has remained unchanged: the risk of creating a *de facto* personal services contract due to this relationship.

Personal Services

In order to understand what constitutes a *de facto* personal services contract, you must first generally understand personal services contracts. There is a two-part definition of personal services. First, in a nutshell, a personal services contract is a type of legal agreement involving someone who provides a unique type of service to another person. This unique type of service cannot be substituted with a common replacement. This definition explains why

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personal services contracts are so common in the sports and entertainment industry. For example, if you bought a ticket to see Elvis Presley in Las Vegas in 1971, it would have been unacceptable for the venue to replace him with an impersonator and expect you to be satisfied. Elvis provided a type of personal service that would have been problematic, essentially impossible, to replace. Second, under U. S. Code Title 10, a personal services contract exists when a contractor employee is subject to continuous supervision and control while performing the contractual responsibilities. Therefore, if a contractor is controlled or supervised as government employees are under a nonpersonal services contract, the contractor's performance becomes a *de facto* personal services.

Unenforceable Contracts

Except for a few exceptions, such as specialized medical resources, personal services contracts are banned in the DoD and the rest of the Federal Government. This ban has roots tracing back to the Thirteenth Amendment of the U.S. Constitution enacted in 1865. The law treats services involving personal services contracts differently than its treatment of ordinary services. The courts have ruled that it may be unconstitutional to enforce a personal service contract. The common interpretation is that enforcing specific or continued performance of such a contract falls under the Thirteenth Amendment's prohibition of involuntary servitude. In other words, personal service contracts are banned in the DoD because they are unenforceable since the Constitution trumps the obligations of the contractual parties. In the Elvis example, if the substitute's performances did not fulfill the patrons' expectations, he could not be forced to perform to a certain level of satisfaction. In addition, if Elvis were too ill to perform, he could not be forced to do so. This differs greatly from nonpersonal services since the common solution would be to replace the underperforming or ill employee with another person in order to avoid defaulting on the contract.

Control and Supervision

According to the Government Accountability Office (GAO) 2015 High Risk Report to Congress, the DoD obligates more than $300 billion annually to contracts for goods and services, including major weapon systems, support for military bases, information technology, consulting services, and commercial items. These contracts include activities in support of contingency operations, such as those in Afghanistan. Except for some specialized health care and contingency services, personal services are unallowable under the vast majority of these contractor-provided services. Naturally, we want to ensure that the services provided under this $300 billion expenditure are performed to the highest standards and on budget. Therefore, we strive to maintain control and supervision over the services for which we are responsible. In recent years, several GAO reports have indicated there have been such problems as unauthorized, borderline and unreported personal services, conceivably involving more than 100,000 contracts. Obviously, there is a problem. This may indicate several different or combined complications, such as the following:

- We don't know there is a ban.
- We don't understand what constitutes personal services.
- We don't care.
- We have no clue as to the location of the invisible line.
- It is too difficult to contract for services without giving up control and/or continuous supervision.

Whatever the reason, we need to figure it out as long as the ban on personal services contracts remains in place.

Managing a Blended Workforce

One thing is certain: Program managers need to manage their programs; contracting officers need to manage their contracts, and so on. Complications are imminent in a blended workforce, especially for those who manage the workforce day to day. Instead of managing an organization or department as a whole unit, we must treat the two different sectors of the blended workforce separately. At present, we manage ourselves, and contractors manage themselves, although both may perform the same work in the same department. In fact, a contractor employee may sit at the same desk, doing the same job, that a long-time DoD employee performed just a week earlier. As soon as we begin supervising that contractor employee like the previous government employee, we may have crossed the invisible line and created a *de facto* personal services contract.

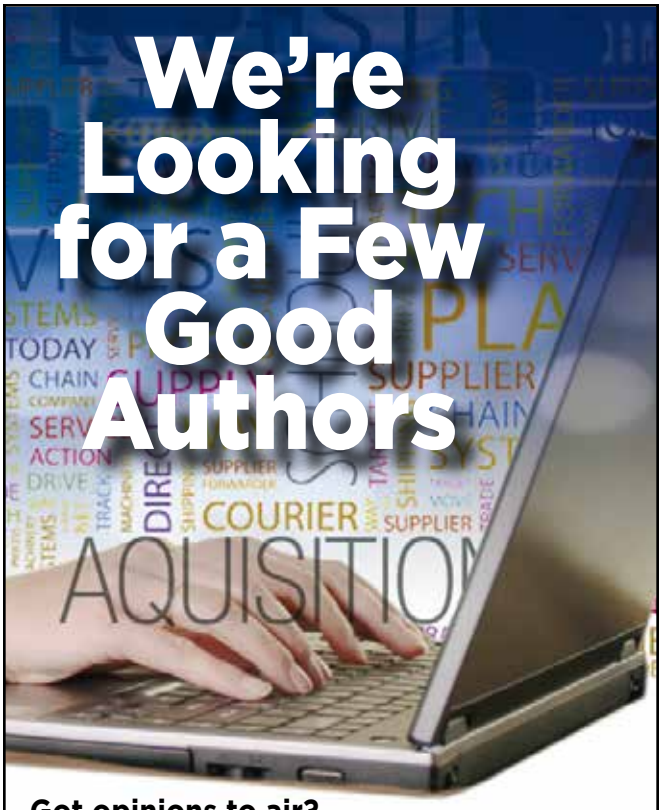
Contract Requirements

Crossing the invisible line into a *de facto* personal services contract need not result directly from our supervisory actions. The line may be crossed inadvertently because of how our contract requirements are written. As mentioned earlier, we in acquisition desire to control the particular elements for which we are responsible. Therefore, it is natural for us to build control and supervision into our contract requirements. Our responsibility for contractor employees is limited to monitoring their performance. Supervision and control are left to the contractor organization. We must not cross the invisible line when we write the contract requirements. This line is not easily avoided, but we must review our performance work statements (PWS) thoroughly to ensure that we are not requesting personal services. All PWS language must be written to maintain contractor control and supervision of the workers performing under the contract.

Crossing the Invisible Line

I have mentioned several times an invisible line dividing nonpersonal and personal services. As the GAO has observed, many contracts straddle the line and, therefore, are "borderline" contracts. Here is a list of actions that surely cross the invisible line:

- Determining who should perform contract tasks or how they should be done.
- Pressuring and/or influencing the contractor to use "favorite" employees, or insisting on particular personnel actions.



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Write an article (1,500 to 2,500 words) and *Defense AT&L* will consider it for publication. Our readers are interested in real-life, hands-on experiences that will help them expand their knowledge and do their jobs better.

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- Using government and contractor personnel interchangeably.
- Supervising contractor employees.
- Rating individual contractor employee performance.
- Requiring out-of-scope work or the contractor's performance of inherently governmental functions. Required services are specified in the contract; there are no "other duties as assigned."

Even granting "59 minutes" of early departure from work or instructing a contractor employee to attend a mandatory organizational picnic cross the line into personal services. Allowances for these types of activities would need to be written into their contract. In other words, if it's not in the contract, it's not allowed.

Is It Time to Lift the Ban?

The answer depends on whether it is worth the consequences. In 2014, the DoD reported to the GAO that an estimated 629,000 contractor full-time equivalents (FTEs) are working for the DoD under contracts. These FTEs cost a total of $123 billion, nearly half the $300 billion that the DoD spends on contracts. This is 629,000 contractor employees working on behalf of the DoD but not under the government's direct supervision or control. Lifting the ban on personal services may allow us to supervise these employees as if they were our own and thereby gain and maintain control. This could reduce government spending dramatically by cutting contractor employee management and oversight costs.

On the other hand, enforceability is an issue. In the event a dispute over contractor performance makes its way into the courts of law, will the courts just turn their heads? This could leave us in an untenable position regarding failed contractor performance, as well as contract termination issues.

Conclusion

Perhaps it's time for a closer look at the areas in which personal services are authorized and investigate the outcomes. This may give us a clearer picture of potential problems and successes. Looking into the handling and disposition of contract disputes within specialized medical resources could provide some insight into other well-integrated personal services operations. The personal services contracts within the DoD's designated operational areas overseas could show us how we can use personal services for Stateside logistical and construction contracts.

Finally, the personal services contracts we use in our intelligence and counterintelligence communities may reveal how other services may fare in sensitive situations. It may be worthwhile to consider whether we should lift the ban on personal services contracts. It may be that the time for such a ban already has passed. On the other hand, perhaps it should stay as it is.

The author can be contacted at **steven.fasko@dau.mil**.

2015 Defense Acquisition Workforce Awards

WORKFORCE ACHIEVEMENT AWARDS 2015

The Defense Acquisition Workforce Individual Achievement Awards were established to recognize and motivate individuals who have demonstrated excellent performance in the acquisition of products and services for the Department of Defense (DoD). This program recognizes DoD military members and civilian personnel who represent the best in the acquisition workforce.

The primary judging criteria include one or more of the following:

- Specific achievements within the functional area/category during the period of July 1, 2014, to June 30, 2015.
- The value of the nominee's contributions during the award period to themission of the organization and to outstanding development, acquisition,and/or sustainment of products and services for DoD.
- Leadership, by example and through mentoring, provided to others in the organization and toward achievement of organizational objectives.

WORKFORCE ACHIEVEMENT AWARDS 2015

Acquisition in an Expeditionary Environment
Major Rowdy E. Yates, U.S. Air Force
(Left to Right): Under Secretary of Defense for Acquisition, Technology, and Logistics Frank Kendall, Jr. and Major Rowdy Yates

Auditing
Mr. Peter Herman, Defense Contract Audit Agency
(Left to Right): The Honorable Frank Kendall, Jr., and Mr. Peter Herman

Contracting and Procurement
Mr. Ryan Connell, Defense Contract Management Agency
(Left to Right): The Honorable Frank Kendall, Jr., and Mr. Ryan Connell

Engineering
Dr. James C. Kirsch, U.S. Army
(Left to Right): The Honorable Frank Kendall, Jr., and Dr. James C. Kirsch

Facilities Engineering
First Lieutenant Jose M. Rodríguezpeña, U.S. Air Force
(Left to Right): The Honorable Frank Kendall, Jr., and 1st Lt. Jose M. Rodríguezpeña

Financial Management
Mr. John R. Carlson, U.S. Air Force
(Left to Right): The Honorable Frank Kendall, Jr., and Mr. John R. Carlson

Photos by Leroy Council Jr., Department of Defense

WORKFORCE ACHIEVEMENT AWARDS 2015

Industrial Property
Mr. Rodney D. Felder, Missile Defense Agency
(Left to Right): The Honorable Frank Kendall, Jr., and Mr. Rodney D. Felder

Information Technology
Captain Ryan Atkinson, U.S. Air Force
(Left to Right): The Honorable Frank Kendall, Jr., and Captain Ryan Atkinson

Life Cycle Logistics
Mr. Everett F. Smith, U.S. Army
(Left to Right): The Honorable Frank Kendall, Jr., and Mr. Everett F. Smith

Production, Quality, and Manufacturing
Ms. Marsha Barron, Defense Logistics Agency
(Left to Right): The Honorable Frank Kendall, Jr., and Ms. Marsha Barron

Program Management
Ms. Laura M. Price, U.S. Air Force
(Left to Right): The Honorable Frank Kendall, Jr., and Ms. Laura M. Price

WORKFORCE ACHIEVEMENT AWARDS 2015

Requirements Management
Commander Scott Wilson, U.S. Navy
(Left to Right): General Paul J. Selva, Commander Scott Wilson and the Honorable Frank Kendall, Jr.

Science and Technology Manager
Dr. David M. Hone, Defense Threat Reduction Agency
(Left to Right): The Honorable Frank Kendall, Jr., and Dr. David M. Hone

Services Acquisition
Mr. Emilio Varcarcel, U.S. Air Force
(Left to Right): The Honorable Frank Kendall, Jr., and Mr. Emilio Varcarcel

Small Business
Mr. Douglas Packard, Defense Information Systems Agency
(Left to Right): The Honorable Frank Kendall, Jr., and Mr. Douglas Packard

Test and Evaluation
Ms. Anastasia Dimitriu, U.S. Navy
(Left to Right): The Honorable Frank Kendall, Jr., and (accepting on behalf of Ms. Dimitriu) Ms. Lynn Collins

2015 Defense Acquisition Workforce Awards

WORKFORCE DEVELOPMENT AWARDS 2015

The Defense Acquisition Workforce Development Awards were established to recognize those organizations that are achieving excellence in developing their employees as acquisition professionals, leaders, and our future acquisition workforce. Additionally, the award serves our community by identifying best practices for other organizations to adopt.

The 2015 Defense Acquisition Workforce Development Awards Program focused on three major contribution areas:

- Talent Management;
- Knowledge Transfer, Partnering, and Sharing of Workforce Best Practices; and
- Workforce Development and Recognition Initiatives.

Gold Award, Large Organization: Space and Naval Warfare Systems Center, Pennsylvania
(Left to Right): The Honorable Frank Kendall, Jr., Captain Kurt Rothenhaus, Ms. Lynn Collins and Ms. Angela Hanson

Silver Award, Large Organization: Missile Defense Agency
(Left to Right): The Honorable Frank Kendall, Jr., Mr. John James, Ms. Donna Davis and Ms. Angi Carsten

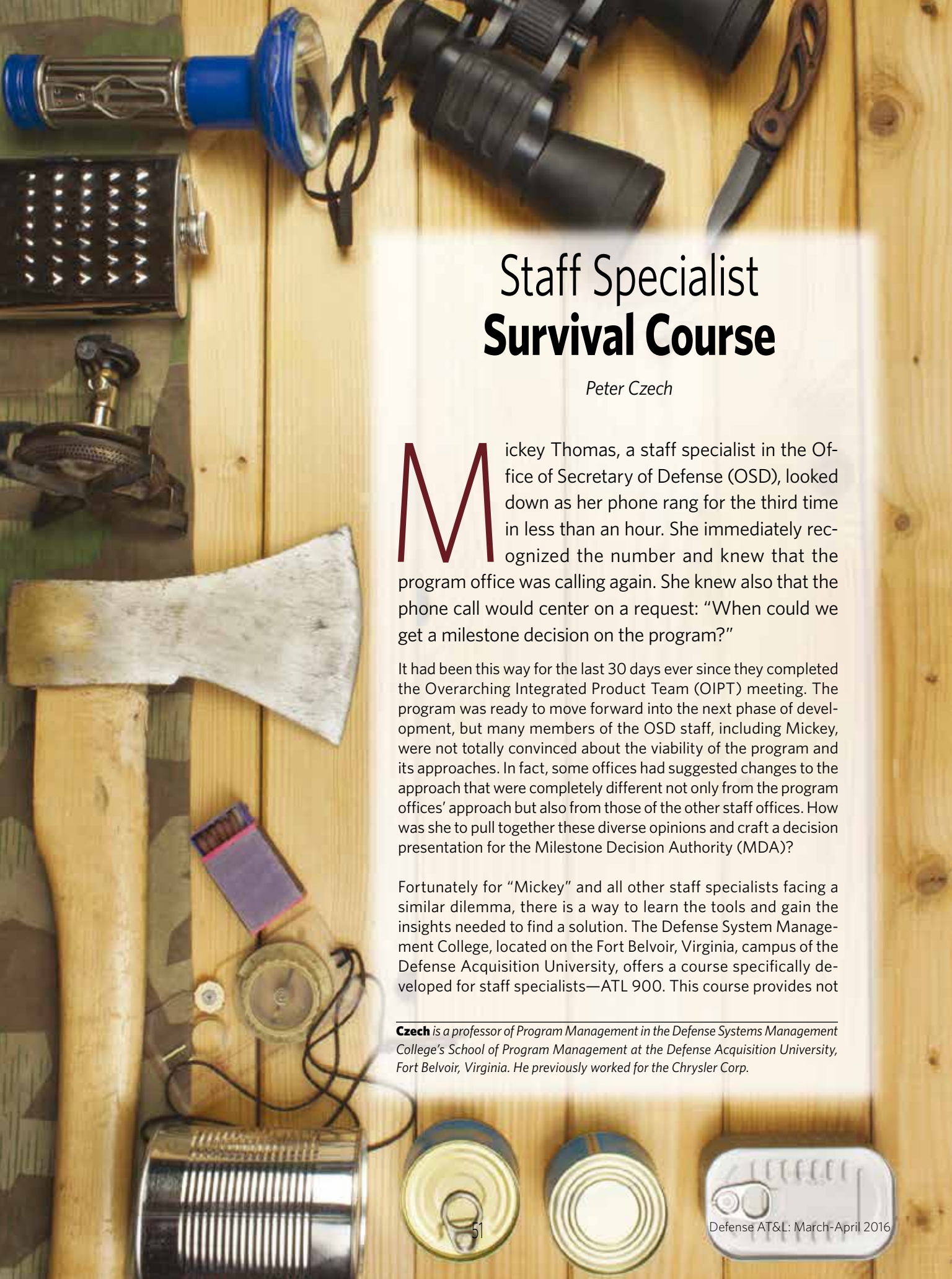
Photos by Leroy Council, Jr., Department of Defense

WORKFORCE DEVELOPMENT AWARDS 2015

Gold Award, Small Organization: United States Special Operations Command, Special Operations Forces Acquisition, Technology, and Logistics
(From Left to Right): Lieutenant Stephen M. Eggan, the Honorable Frank Kendall, Jr., Mr. James Geurts, Lieutenant Colonel Louis J. Ruscetta, Ms. Erinn E. Grahs and Captain Tyler Hough

Silver Award, Small Organization: Air Force Sustainment Center—Engineering and Technical Management
(From Left to Right): Ms. Laurie Beebe, the Honorable Frank Kendall, Jr., Mr. Jeffrey Catron, Mr. Michael Schneider and Mr. Norman LeClair

Bronze Award, Small Organization: Progam Executive Office, Enterprise Information Systems Sea Warrior Program
(From Left to Right): Mr. Kenneth Johnson, Mr. Scott Dunlap, the Honorable Frank Kendall, Jr., Ms. Laura Knight, Mr. Patrick Fitzgerald and Ms. Tammy Daul



Staff Specialist **Survival Course**

Peter Czech

Mickey Thomas, a staff specialist in the Office of Secretary of Defense (OSD), looked down as her phone rang for the third time in less than an hour. She immediately recognized the number and knew that the program office was calling again. She knew also that the phone call would center on a request: "When could we get a milestone decision on the program?"

It had been this way for the last 30 days ever since they completed the Overarching Integrated Product Team (OIPT) meeting. The program was ready to move forward into the next phase of development, but many members of the OSD staff, including Mickey, were not totally convinced about the viability of the program and its approaches. In fact, some offices had suggested changes to the approach that were completely different not only from the program offices' approach but also from those of the other staff offices. How was she to pull together these diverse opinions and craft a decision presentation for the Milestone Decision Authority (MDA)?

Fortunately for "Mickey" and all other staff specialists facing a similar dilemma, there is a way to learn the tools and gain the insights needed to find a solution. The Defense System Management College, located on the Fort Belvoir, Virginia, campus of the Defense Acquisition University, offers a course specifically developed for staff specialists—ATL 900. This course provides not

Czech *is a professor of Program Management in the Defense Systems Management College's School of Program Management at the Defense Acquisition University, Fort Belvoir, Virginia. He previously worked for the Chrysler Corp.*

only problem-solving solutions, critical thinking skills and the latest on acquisition topics but also networking opportunities for civilian and military officers assigned to the OSD staff. The syllabus for this 4.5-day course addresses the challenges for today's staff specialists and provides not only hands-on review of actual artifacts but also case studies to enhance learners' actual experiences.

Background

The course was designed to magnify the staff specialist's skills in acquisition acumen and critical thinking. These areas of expertise add to the staff specialist's tool box. We enhance the experience with the case study techniques to provide the experience without exposure to failure.

Acquisition Acumen—It's All About the Risks

Risk Management is at the heart of the product development process and is the essence of the Milestone A, B and C decisions

- Has risk in all its forms been reduced to the level needed to make the next major commitment?
- Are the plans to mitigate risk going forward sound?

— Under Secretary of Defense for Acquisition, Technology, and Logistics Frank Kendall, July 2013

Understanding risk in all its various forms (technical, financial, and schedule) provides the core of the initial learning plan. This involves not only risk identification but an evaluation of the risk assessment made by the program office. A staff specialist looks for risks in the various artifacts that the program produces as it moves toward a milestone decision. The ability to understand, compare, and contrast the contents of the documents is a key staff specialist skill. Using real versions of these documents in the classroom exposes the learner to the documents' intent and provides an understanding of the formats used.

Building Critical Thinking Skills

The ability to think critically is the basis for making good decisions. Rather than just accept the alternative delivered for your consideration, shouldn't you ask why this is the best alternative? Understanding the costs and benefits of any alternative means that you not only need to understand why the protagonist is putting it forward but also its benefits to other interested parties—the stakeholders. This includes how the proposed government action impacts industry or how it would be perceived by industry—our business partners in any acquisition action.

Finally, before you evaluate any proposal, you need to understand the biases we all carry in our virtual backpacks. Unknowingly applying a sunk cost, confirming evidence, or status quo bias can trap a decision maker or staff specialist in a decision that is not justified. Knowing your biases and those of others in the decision chain can allow you to shape the discussion so that the best option at least gets considered.

Experience Without Exposure

The case study method is a time-tested means of providing learners with hands-on experience in a safe academic environment. The prestigious Harvard Business School uses this method of teaching to provide captains of industry the knowledge and experience to manage multinational corporations. Using similar teaching methodology, the staff specialist is immersed in cases that provide real (but disguised) acquisition decisions. This process not only allows the learner to make proposals and decisions based on the evidence at hand (a very real situation for any staff officer) but also provides a sense of realism that would be lost in a purely academic exercise. Fortunately, the environment faced by today's staff specialists is ripe with opportunities for providing case experience. As a culmination to each of the case exercises, following a general discussion about the findings and recommendations, one of the teams provides its recommendation to an MDA (either a DAU or OSD-level executive). This final presentation requirement provides the added dose of realism for each of the learners.

Some Recent Student Assessments of the Course

"Coming into this course—I thought it was going to be a waste of valuable and limited time. However, this course has actually been beneficial especially the interactions with others I typically don't interface with as well as a refresher on functional areas (FM [Financial Management], SE [Systems Engineering], TE [Test and Evaluation], etc.)."

***

"Very useful, I learned new techniques and now have a plan to improve the manner in which I advise on major programs. Thanks again for the investment."

***

"It has been a good use of time. I have greatly benefited from the senior level experience and discussion about how to look at problems."

Summary

Fortunately, Mickey was a recent graduate of the ATL 900 course. Using the skills she learned and her network of other graduates on the OSD staff, she was able to quickly consolidate the disparate comments and provide a sound recommendation for the MDA. In the end, the right decision was reached. Although not everyone was happy (satisfaction never is universal), all agreed that they had had a fair opportunity to be heard.

If you think this class will make a difference in your career, contact course manager Peter Czech at (703) 805-4973 (or email Peter.Czech@dau.mil) to apply for the ATL 900 class.

The author can be contacted at **peter.czech@dau.mil**.

Whipping Procrastination

Roy Wood, Ph.D.

I would have written this article earlier, except I was procrastinating. This happens to me a lot, which is surprising since many consider me to be fairly productive. I believe we are all subject to the why-do-today-what-you-can-put-off-until-to-morrow syndrome. I manage to get out of the doldrums most times with a few tricks I've developed over the years. Here are some of those … .

Play the to-do game: I keep a project list and a master to-do list of all the things I think are important. I draw from those lists at the beginning of each day to create a daily to-do list of things I intend to accomplish. I make accomplishing those items a sort of game and challenge myself to see how many of them I can check off by the end of the day. I use paper lists because I like the feel of physically crossing off things off, and therefore I receive the penalty of having to rewrite and relist items I don't do for the next day's list. Finishing items so I don't have to rewrite them is a motivator for me, too.

Wood *is the acting Vice President of the Defense Acquisition University and former Principal Assistant Deputy Under Secretary of Defense. He is a retired U.S. Navy officer and acquisition professional.*

Make a promise: If I promise to do something for someone, I go ahead and schedule a later meeting with that person to discuss the results. It's amazing how motivating it is to have a deadline on the calendar where I have to publicly produce something or be embarrassed. I do this now with my subordinates. I assign a task and set a meeting with them to let them show me the results. That gives them firm deadlines, keeps them motivated, and prevents procrastinating.

Chunk the work: I break big tasks down into smaller ones that are not quite so intimidating. Some people get really sophisticated and use outline tools (in MS-Word, for instance) to create a bunch of subtasks for each big job they have. I prefer to create a mind map of the job and all its little tasks, then move these to my master to-do list. If you aren't familiar with creating mind maps, see https://en.wikipedia.org/wiki/Mind_map. Sometimes, though, the thought of the work required to break down the job into its components stops me in my tracks! At those times, it is easier to kick-start myself into action by just thinking about the next step that would move a particular task forward. If I add the next step to my to-do list and then go work on that, it can get me moving in the right direction. Often, the momentum of finishing the next step encourages me to think about—and do—the next step, and the next, etc. Next time you are getting nowhere on a particular task, ask yourself, "What's the very next step?" Doing so may break the logjam and help you focus on the next small step that you can easily do. Pretty soon, when you can add up all the next steps you've completed, your overwhelming task is done. Magic, huh?

Do the hard stuff first (or the easy stuff): Lots of people like to tackle the hardest tasks on their daily to-do list first. They pick the most challenging or even the most dreaded task on the list and try to get that finished first. Brian Tracy, author and productivity guru, calls this "eating the frog," because once you've done that (yuck!), everything else you have to do appears to be a lot easier.

I respect this approach, but it isn't for me. I prefer to take the other tack and start out with a simple and easy task go get moving ahead. This seems less daunting to me and helps build momentum so I can tackle the harder things. Whether you decide to eat the frog or do the easy task first, choose a method of getting started that works best for you. Remember, the right thing to do is whatever it takes to get going and move your work along.

Practice good time management: I get a lot of things accomplished in the seams between meetings, on my daily train commute (where I'm writing this), and in other situations that would otherwise be lost time. See my three short articles for some good time management tips in the *Defense AT&L* magazine that include:

- Speeding through your reading, and managing your email and smartphones (November–December 2013)
- Using "wasted" time, the evils of multitasking, and going paperless with Microsoft OneNote (September–October 2014)

Next time you are getting nowhere on a particular task, ask yourself, "What's the very next step?" Doing so may break the logjam and help you focus on the next small step that you can easily do.

- Using a to-do list and managing your calendar (July–August 2015)

Reward yourself: Promise yourself an appropriate reward for finishing a tough task that has you procrastinating. Plan a trip to the local ice cream shop after you finish cleaning the garage, or lavish yourself with that new computer you've been wanting after you pull your dusty old manuscript out of the closet and finish writing that book. Delay your gratification by promising yourself you can spend an hour on social media, but only after you finish that quarterly report for the boss. Use rewards—large and small—as incentives to get important things done and help develop good work habits.

Procrastination is something we all are prone to do, but indulging it keeps you from accomplishing those things you know need to be done. Whipping procrastination is a lifelong struggle, but using tips like mine and developing good work habits will help you overcome procrastination and achieve the things in life that are important to you.

The author can be contacted at **roy.wood@dau.mil**.

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Defense AT&L

Writers' Guidelines in Brief

Purpose
Defense AT&L is a bimonthly magazine published by DAU Press, Defense Acquisition University, for senior military personnel, civilians, defense contractors, and defense industry professionals in program management and the acquisition, technology, and logistics workforce.

Submission Procedures
Submit articles by email to datl@dau.mil. Submissions must include each author's name, mailing address, office phone number, email address, and brief biographical statement. Each must also be accompanied by a copyright release. For each article submitted, please include three to four keywords that can be used to facilitate Web and data base searches.

Receipt of your submission will be acknowledged in 5 working days. You will be notified of our publication decision in 2 to 3 weeks. All decisions are final.

Deadlines
Note: If the magazine fills up before the author deadline, submissions are considered for the following issue.

Issue	Author Deadline
January–February	1 October
March–April	1 December
May–June	1 February
July–August	1 April
September–October	1 June
November–December	1 August

Audience
Defense AT&L readers are mainly acquisition professionals serving in career positions covered by the Defense Acquisition Workforce Improvement Act (DAWIA) or industry equivalent.

Style
Defense AT&L prints feature stories focusing on real people and events. The magazine seeks articles that reflect author experiences in and thoughts about acquisition rather than pages of researched information. Articles should discuss the individual's experience with problems and solutions in acquisition, contracting, logistics, or program management, or with emerging trends.

The magazine does not print academic papers; fact sheets; technical papers; white papers; or articles with footnotes, endnotes, or references. Manuscripts meeting any of those criteria are more suitable for DAU's journal, *Defense Acquisition Research Journal (ARJ)*.

Defense AT&L does not reprint from other publications. Please do not submit manuscripts that have appeared elsewhere. *Defense AT&L* does not publish endorsements of products for sale.

Length
Articles should be 1,500–2,500 words.

Format
Send submissions via email as Microsoft Word attachments.

Graphics
Do not embed photographs or charts in the manuscript. Digital files of photos or graphics should be sent as email attachments. **Each figure or chart must be saved as a separate file in the original software format in which it was created.**

TIF or JPEG files must have a resolution of 300 pixels per inch; enhanced resolutions are not acceptable; and images downloaded from the Web are not of adequate quality for reproduction. Detailed tables and charts are not accepted for publication because they will be illegible when reduced to fit at most one-third of a magazine page.

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