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A Navy Lieutenant's Voyage to Cyber Awareness

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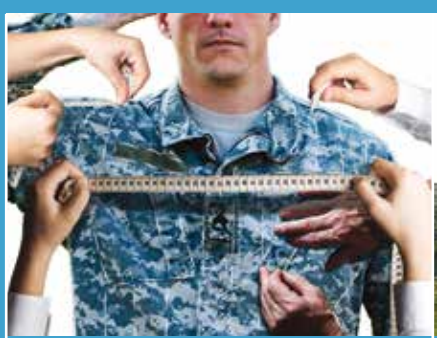

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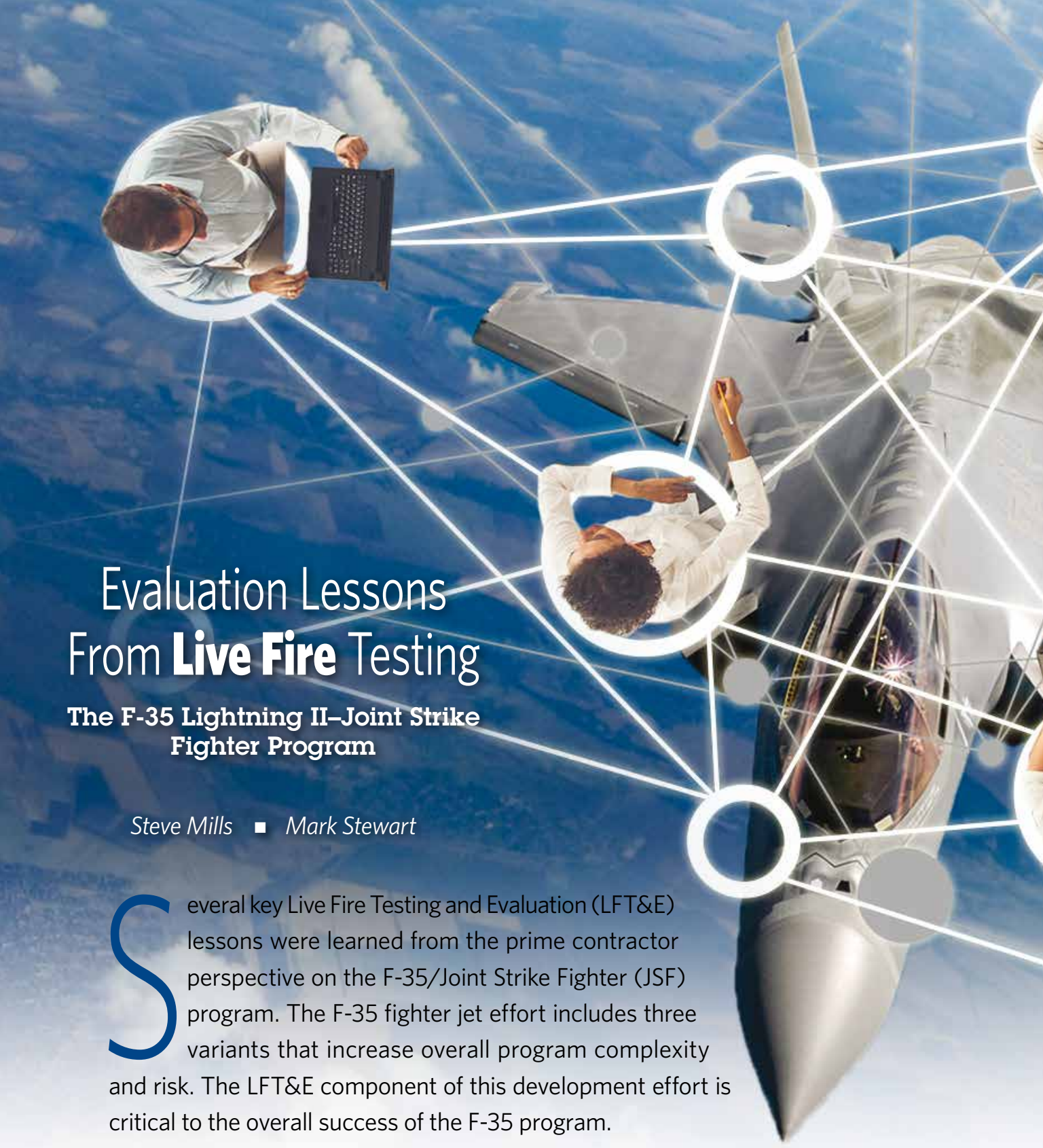


Evaluation Lessons From **Live Fire** Testing

The F-35 Lightning II–Joint Strike Fighter Program

Steve Mills ■ *Mark Stewart*

Several key Live Fire Testing and Evaluation (LFT&E) lessons were learned from the prime contractor perspective on the F-35/Joint Strike Fighter (JSF) program. The F-35 fighter jet effort includes three variants that increase overall program complexity and risk. The LFT&E component of this development effort is critical to the overall success of the F-35 program.

LFT&E is a critical element of the system engineering and test and evaluation processes for Department of Defense (DoD) systems. The current ACQuipedia article on LFT&E provides this straightforward explanation of LFT&E as part of the DoD acquisition process:

Mills *is a professor of Program Management and Cybersecurity at the Defense Acquisition University's South Region in Huntsville, Alabama.*
Stewart *is a Lockheed Martin Fellow specializing in Aircraft Survivability/Vulnerability and Technical Lead of the F-35 Vulnerability Analysis and Live Fire Test Team.*

A test process that evaluates the vulnerability and/or lethality aspects of a conventional weapon or conventional weapon system. LFT&E is a statutory requirement (Title 10 U.S.C. [U.S. Code] § 2366) for covered systems, major munitions programs, missile programs, or product improvements to a covered system, major munitions programs, or missile programs before they can proceed Beyond Low Rate Initial Production (BLRIP). By law, a covered system is any vehicle, weapon platform, or conventional weapon system that includes features designed to provide some degree of protection to users in combat and that is an Acquisition Category (ACAT) I or ACAT II program. (Note: The term "covered system" can also be taken to mean any system or program that is covered by Title 10 U.S.C. § 2366, including major munitions and missile programs.)

LFT&E focuses on evaluating the survivability and lethality of a system. With regard to the F-35 program, these two attributes are paramount to the success of this system operating in its intended environment. Although they are similar, each F-35 variant has its own unique survivability and lethality requirements as well, making this an even bigger challenge to getting it right.

As the DoD moves closer to a full-rate production decision for F-35, the lessons learned from the LFT&E efforts of the F-35 industry team led by the prime contractor, Lockheed Martin Corporation, can provide other acquisition organizations with valuable insight into how best to conduct LFT&E on their respective programs.

LFT&E Lessons Learned From an Industry Perspective

The F-35 LFT&E program was one of the most comprehensive in fixed-wing procurements. The F-35 program consisted of 61 test series, with more than 1,500 events against ballistic threats. The F-35 LFT&E lessons learned

Figure 1. Formal Lines of LFT&E Communication

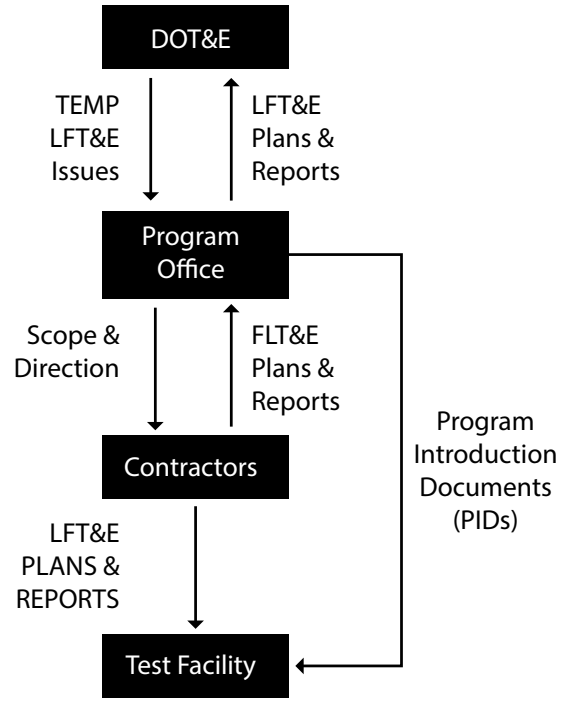
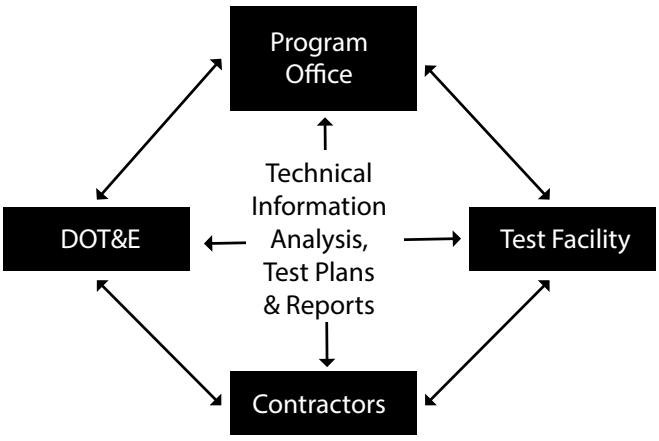


Figure 2. Informal Lines of LFT&E Communication, Fostering Trust and Teamwork



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from the prime contractor perspective may be grouped into two general categories: Government-Industry Teamwork and Limiting Scope.

Government-Industry Teamwork

Lines of Communication. LFT&E requires the efforts of at least four primary entities: The Program Office, Director; Operational Test and Evaluation (DOT&E) Representatives; the primary weapon system contractors; and the government test facility organizations. Contractual relationships provide a formal flow between the four primary entities involved in Live Fire Testing (LFT) (Figure 1), but the formal lines of communication lack the ability to build a team capable of effectively and efficiently executing the LFT Program.

In a previous LFT&E program, the prevailing wisdom was to keep control of the program by only allowing the formal lines of communication between entities; in particular, the intention was to limit communication to DOT&E representatives. Much of the success of the F-35 LFT&E program can be attributed to the open communication and informal information flows that were created and maintained throughout (Figure 2).

Diverse Organizations. Each of these organizations have differing goals and constraints that sometimes make teamwork difficult. Industry partners want to limit company costs and risk while meeting contractual obligations. The Program Office wants to limit program impacts while delivering value to the warfighter. DOT&E's objective is to thoroughly test. Their success is sometimes dependent on "findings": discovering shortfalls or unexpected results. Ultimately, these disparate organizations must come together to produce a test program that meets the objectives while living within the constraints. It is important that each organizational member is at least made aware of the varying goals of the other members.

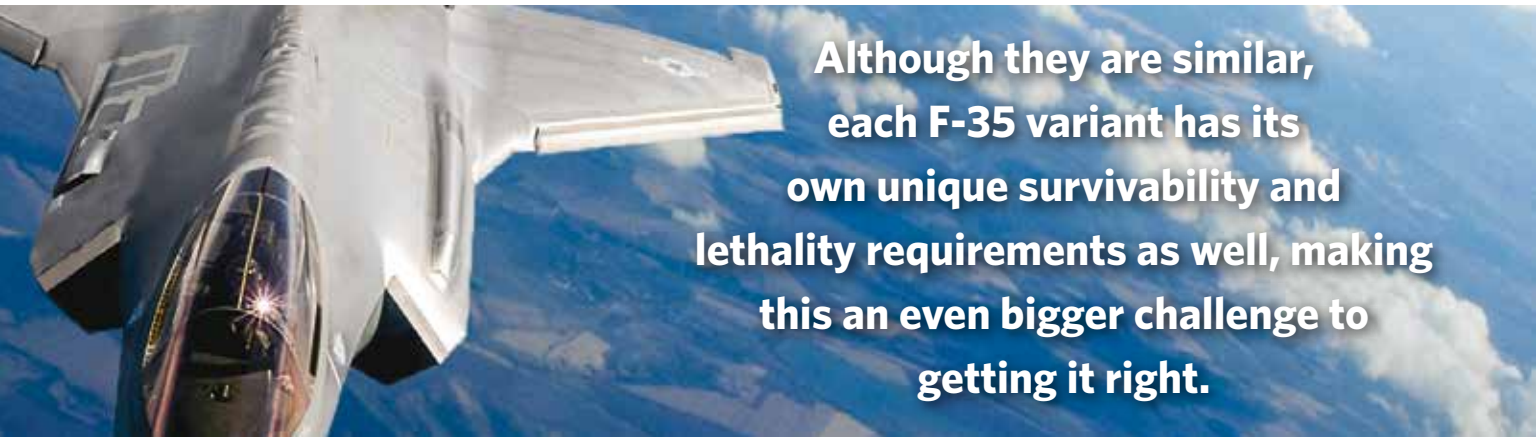
Roles and Responsibilities. It is imperative that roles and responsibilities are established early in the program. On F-35, we determined that the prime contractor should have the responsibility to create all test plans and reports. Test article construction is an activity that should be shared by the contractor and test facilities. The government test facilities have tremendous abilities to quickly design and construct test articles, particularly if these articles are sub-assemblies, and not required to be production representative. The contractors must design and construct the more complicated articles, but can be less efficient in building the simple ones. The test facilities must be the final technical approval for the test plans as they are the ones that must ultimately execute the test. DOT&E representatives must provide timely reviews and constructive comments on each test plan, along with formal signoff on the plans utilizing full-scale and Full-Up, System-Level articles.

Establishing Trust. Trust between team members will be established only through time, with open communication, honest discussions, and mutual respect. On F-35, we established weekly telephone calls with all organizations to foster trust. We also established a collaborative workspace on the F-35

Data Library in order to share technical information in the form of test plans, analyses and test reports. These two forums kept the informal lines of communication open throughout the program.

Limiting the Scope

Scope Creep. One of the most difficult problems encountered with F-35 LFT&E was the need to prevent scope creep. The cost of each test series is highly dependent on the objectives, test matrix, and complexity of the test article. Open communication helps in that each team's organization is able to express their objectives, concerns and constraints. The objectives of the test, if defined in detail, will allow the team to limit the complexity of the test article. Spares to replace damaged components must also be taken into account. The order of the events on each test article requires much coordination but will yield the most data without requiring needless replacements and repairs. There was a transition from simple Test Data Sheets on previous programs to full-up Test Plans which were used on the F-35; these comprehensive documents went a long way to limiting objectives and setting expectations for each test series.



Although they are similar, each F-35 variant has its own unique survivability and lethality requirements as well, making this an even bigger challenge to getting it right.

Objectives. LFT&E issues and sub-issues are provided to the contractors via the Test and Evaluation Master Plan (TEMP), but the issues provided are very general in nature, leaving much room for interpretation. Therefore, each F-35 test series was designed to specifically address a particular set of objectives within the list of LFT&E sub-issues.

Threats. Similarly, the potential threat list is also daunting. It was important early on to define threat types and to limit the scope by addressing only those potential threats (with some exceptions). An underlying purpose of the F-35 LFT&E plan was that the tests were going to meet the objectives in the TEMP as well as provide insights to the F-35 design team. The tests would also provide missing/inadequate data to improve the F-35 vulnerability analysis.

Controlled Damage Tests. The F-35 LFT&E team utilized more than just ballistic tests to address LFT&E issues. Wind Tunnel tests were conducted to determine the controllability of the F-35 after loss of a complete or partial control surface. Man-in-the-loop simulation was used to verify the loss of multiple flight control and electrical power components that were in close proximity. The F-35's Fuel System Simulator was used to provide data on fuel loss and fuel tank explosion prevention. These tests were much less expensive than some of the more complex ballistic test articles, and provided a wealth of information to address many LFT&E issues.

Modeling and Simulation (M&S). M&S, once shunned by the Live Fire Test Office within OT&E, is now being used in a significant way. In the F-35 program, a symbiotic relationship was established early in the program between M&S and LFT&E. Early in the program, the contractor team conducted a unique vulnerability uncertainty analysis that gave insights into which damage mechanisms had the largest potential to affect the F-35's vulnerability assessment results. These uncertainties were folded into the LFT&E test plans, and provided a context for discussions concerning the relative importance of individual test events. For example, testing to determine the vulnerability of the F-35's flight control computers was determined to be relatively unimportant due to system redundancy, which rendered the potential for loss-of-aircraft to be relatively small. All test events were preceded by test predictions, most of which were conducted via M&S. Tests verified the ability of the M&S in some cases, while providing critical data to allow improvements to be made.

Conclusion

DoD acquisition program success hinges on the partnership between both government and industry in the execution of a robust systems engineering process to deliver effective solutions to the warfighter. LFT&E is a key component of this systems engineering effort. This article offers valuable lessons learned from the industry partner perspective on how to effectively execute LFT&E on a very complex acquisition program—the F-35. In the end, the success of our efforts, both government and industry, will be based on our strong partnership, effective communication and teamwork to meet the needs of the warfighter.

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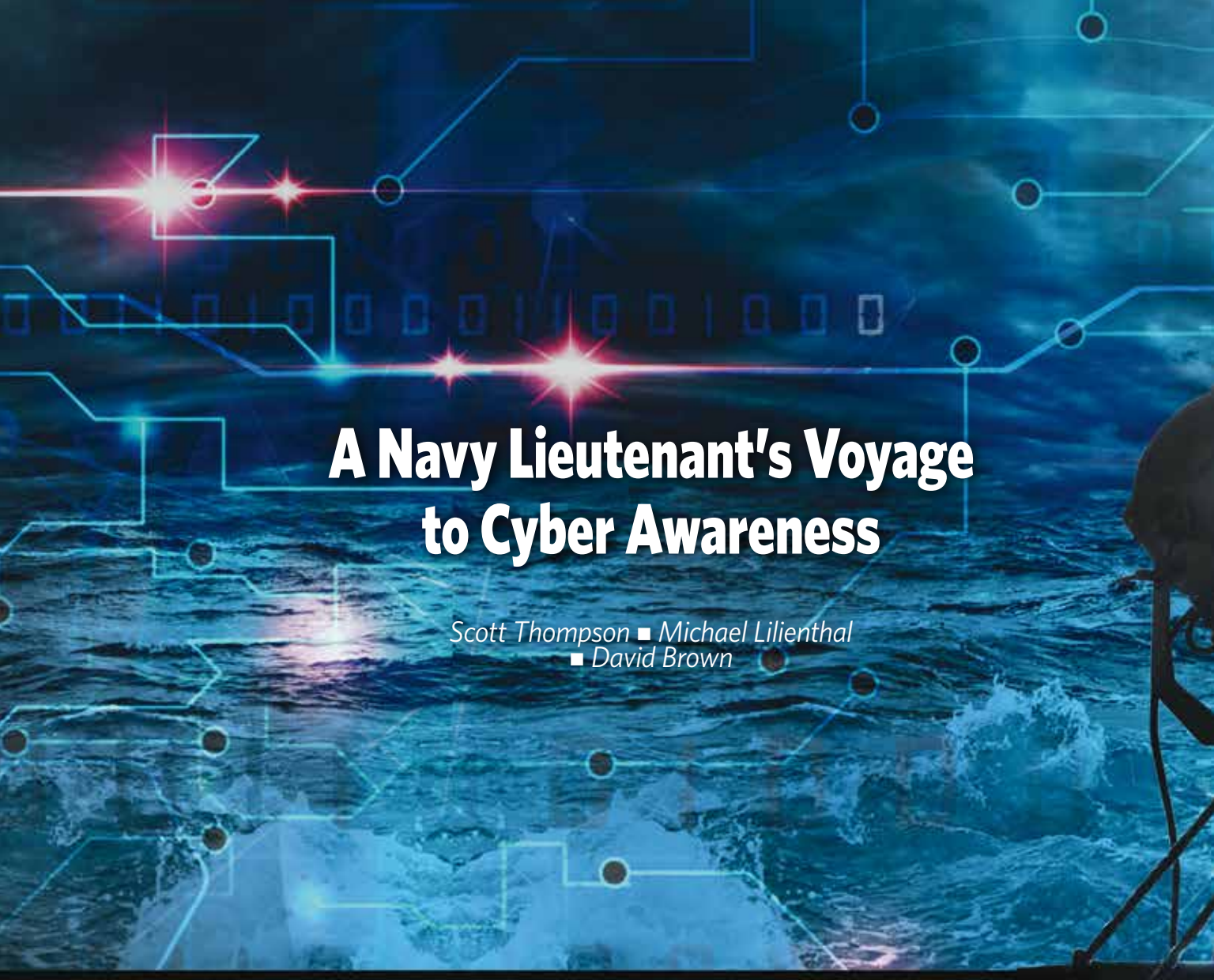


A Navy Lieutenant's Voyage to Cyber Awareness

Scott Thompson ■ Michael Lilienthal ■ David Brown

AUTHORS' NOTE

The following is a fictionalized representation of real cybersecurity issues encountered in the Department of Defense (DoD) and is a sequel to "The Quest for Defense Cybersecurity" article published in the November-December 2017 issue of *Defense AT&L* (https://www.dau.mil/library/defense-atl/blog/The-Quest-for-Defense-Cybersecurity). In that earlier article, the authors examined a process to identify vulnerabilities and develop requirements needed to begin to execute on the DoD's six-phase cybersecurity Test and Evaluation process. In this article, the authors expand their argument to address instilling a "culture of cyber awareness [that] must permeate into all facets of weapons systems acquisition, training, maintenance, and operations."

REUTERS NEWS SERVICE, JANUARY 2020. "The USS *Jimmy Doolittle*, the U.S. Navy's newest and largest nuclear powered aircraft carrier, was recently subjected to an intense 'cyber attack' from a non-nation-state actor. However, due to efforts to understand cyber vulnerabilities and anticipate the effects of successful cyber attacks early in the USS *Doolittle*'s development, this attack was largely mitigated and the combat elements of the *Doolittle* were still able to carry out their missions successfully."

This fictional new aircraft carrier, the *Doolittle*, is 1,156 feet long, has a beam of 150 feet at the waterline and displaces just over 101,000 tons. The *Doolittle*'s mission is to project national power and destroy or neutralize enemy targets ashore and at sea. Specific tasks include Air, Surface, and Antisubmarine Warfare, Command, Control, and Communications (C3), Command and Control Warfare (C2W), Intelligence, Mine Warfare and Strike Warfare. This is in addition to the ship performing Fleet Support Operations, Logistics, Non-Combat Operations, and Naval Special Warfare. In addition to the systems required to perform the above missions and tasks, it requires a secure Command, Control, Communications, Computers, and Intelligence (C4I) system, enclaves for Unclassified, Coalition, Secret and Sensitive Compartmented Information (SCI) environments. It has a common computer domain for conducting command, control, intelligence, business, maintenance, supply, and air wing operations. In addition, the *Doolittle* must communicate with myriad

Thompson, *a retired U.S. Air Force (USAF) colonel, is director of Cyber and Air Force programs at Electronic Warfare Associates, Inc. (EWA), in Herndon, Virginia. He is a graduate of the USAF Test Pilot School and holds a Master of Science in Systems Engineering from the Air Force Institute of Technology.* **Lilienthal** *is the director of Cyber and Navy Programs at EWA. He has a doctorate in Experimental Psychology from the University of Notre Dame. He served for more than 30 years as a Navy aerospace experimental psychologist and worked in program management, test and evaluation (T&E), and training. He is a retired U.S. Navy captain.* **Brown**, *a retired USAF colonel, is EWA's director for Cyber Programs. A graduate of the USAF Fighter Weapons School, he retired as a Command fighter pilot after 30 years of service in both operations and T&E.*

support systems. Many of these support and subsystems are legacy to the Navy and were designed without consideration to cyberattack. And all these systems and subsystems are subject to routine software upgrades.

* * *

Greetings, shipmates! I'm LT Bart Savagewood, USN, and I fly F/A-18 Super Hornets on the USS *Jimmy Doolittle*. I've been asked to write a few words about cyber and what it is I believe is important in the cyber world. As a Nugget, or new naval aviator on my first cruise, I didn't know much about cyber stuff or even care. As I progressed to lieutenant junior grade, I knew that some folks in the Navy, the cyber geeks, I mean cyber warriors, were worrying about cyber. And not too long ago, after I progressed in rank to lieutenant, I heard that the bosses had to worry about something called Section 1647 of the National Defense Authorization Act for Fiscal Year 2016. But not me! I'm an operator! I mean, I fly Hornets off carriers and kill bad guys, so why did I need to know about cyber?

"Besides, I am all about following the cyber rules, and compliance is my middle name. I know that I am not supposed to use thumb drives in my Navy-issued laptops, and I hardly ever do. I know if I am caught, I will get locked out of the carrier's system, which is nothing compared to what the Skipper will do to me. Of course, I know that I should immediately delete any unauthorized e-mails, 'cause if I open an unauthorized e-mail on my government computer and it contains a virus, I will be condemned to a penalty box for up to 2 days of what they call Information Assurance (IA) 'refresher training.' What a pain! I know that I am not supposed to use my personal devices like iPods on any Navy-issued computer. And, like with thumb drives, I hardly ever do so. I know I am supposed to follow certain rules on surfing the Internet and then downloading material onto Navy computers. But when the Executive Officer wants to have a video for the Ready Room by this evening—well, sometimes you 'gotta do what you gotta do.'

"But why should all the cyber heat come down on the operators like me? We use laptops that are 15 years old and they run on Windows XP software and don't even have DVD capability. Our Fitness Reports, Annual Officer Evaluation Reports are created in NAVFIT98A—yes, a computer program from a generation ago that runs on Windows VISTA and XP—whatever they are! Our flight logging program, SHARP, is only 32 bit, which is in the Stone Age compared to the Air Force. The Internet speed onboard ship is pretty bad unless you have commanding officer or department head privileges. So it is nearly impossible for a junior officer (J.O.) as the squadron duty officer to access weather/Notices to Airmen for flight briefings. Of course, to even access a Navy Information Technology (IT) system, you must do annual Information Assurance (IA) training that is like a terrible videogame that hasn't changed in 5 years. Don't they realize that everyone just speed clicks the training and retains nothing from it? And why do they even still use the term IA? Wasn't it supposed to go away a while back when they published Department of Defense Instruction, Number 8500.01 (March 14, 2014), which adopted the term 'cybersecurity' and directed that 'Information Assurance (IA) Implementation' be canceled?

"Deploying aboard the ship always is an IT nightmare. IT is supposed to migrate your shore Outlook, share drive, and e-mail, but I've never seen it work very well. You basically have to burn anything important to a CD and take it with you so you don't lose all the projects you've been working on. And why can't cyber and IT be friendlier to operators like me? I think they mandated the 15-character passwords that are impossible to remember, and have to be changed every 60 days, just to make life difficult for us. Now the IT guys are preaching to me about something they call 'cyber hygiene.' I'm not really sure what that even means other than adding yet more roadblocks and inconveniences to my computer.

"So what is it that I want from the cyber community? To be honest, as a J.O., I would have said all's I wanted out of the cyber geeks was for them to get out of my way and to quit making my job harder. Now, I want nothing less than a culture change in the way the Navy approaches developing systems and adopting operations to succeed in a cyber world.

"What made me change my perspective? After two deployments on another aircraft carrier and a stint as an instructor at the RAG (Replacement Air Group), I was stationed onboard the USS *Jimmy Doolittle*, and things changed in my cyber world. As I came onboard the *Doolittle*, as we affectionately call her, I started hearing a lot about cyber. I was told that the ship's designers and program managers knew that this complex family-of-systems could have been a cybersecurity nightmare. They knew that compliance with the Navy's CYBERSAFE program would guide them to 'provide maximum reasonable assurance of survivability and resiliency of mission critical information technology, in a contested cyber environment in order to maintain mission capabilities.' But more than that, they knew they needed to instill a new culture of 'cyber resilience,' or the ability to successfully execute operations in a contested cyber environment into all facets of ship design, development, testing and operations.

"So, very early in the *Doolittle*'s concept development and design phase, the ship's planners brought together operators, maintainers, systems engineers, testers, and cyber experts to not simply take the approach of compliance with current checklist directives and policies but to approach the design, operation, and maintenance aboard the USS *Doolittle* from a mission viewpoint. To do that, they began a disciplined process they called a Cyber Operational Vulnerability Assessment (COVA). The *Doolittle* COVA is a rigorous process leveraging war-gaming principals that focus on developing an understanding of:

- How personnel actually use and maintain a system to carry out a specific mission

To be honest, as a J.O., I would have said all's I wanted out of the cyber geeks was for them to get out of my way and quit making my job harder. Now, I want nothing less than a culture change in the way the Navy approaches developing systems and adopting operations to succeed in a cyber world.

- How successful cyber attacks degrade or prevent operational mission success
- And how potential actions or workarounds might prevent or minimize cyber effects.

"Leveraging the COVA results, the USS *Doolittle* managers ensured the engineers and cybersecurity personnel worked with those with fleet operational experience so both would have a clear understanding of the technological capabilities of the new system(s).

"The managers demanded all shipboard disciplines work as one team to understand potential cyber effects and mission consequences. Because they routinely participated in onboard COVA events, the *Doolittle*'s cyber warriors now understood the mission, the operational environment and how it might be affected by their controls and protections. The operators, like me, but also including maintainers, supply, ship drivers, snipes, etc., now understand the potential for cyber effects—meaning they understand the controls and protections needed for their own mission success. Together, the cyber and operations communities were able to effectively communicate to program managment the risks, costs, limitations, and alternatives of protections and controls.

"Captializing on this relationship, potential workarounds and engineering options were continously developed and evaluated throughout the acqusition and development process. The ship's designers and operators assumed they were going to be in a cyber-contested environment; that cyber hackers would find new and innovative ways to penetrate vulnerabilities and weaknesses; that all software and firmware were flawed, and personnel who operated the USS *Doolittle* would make mistakes that would enable a cyber attack. They looked at designs and design trade-offs early with that in mind. As system design progressed, they continued the iterative COVA process to include the more mature versions of systems and added additional systems to the process to insure operational relevance.

"The COVA process initiated by the *Doolittle* Program Office was intended to be used throughout the life cycle of the *Doolittle* program—from concept development through operational deployment and sustainment. The rigorous and continued use of the COVA process incorporated cyber awareness into the ship's culture, an awareness that permeated all shipboard operations, including temporarily assigned air wings and support assets. It is from this perspective as a tactical operator onboard the USS *Jimmy Doolittle* that I say I want a cyber culture change in the Navy. The culture change I want is one that will embed cyber considerations into all aspects of operations with a focus on mission impact. I want the cyber warriors to understand what I do. They need to understand how cyber protections affect operators. And the reverse also is true. Operators, maintainers, logistics, and all support folks need to understand cyber effects and how they can influence offensive actions as well as defensive operational impacts.

"There are many offensive and defensive cyber capabilities available for operations onboard the USS *Doolittle*. But the very nature of many of these capabilities means that they will continue to be held at the upper echelons of Naval and National Command. Are there specific capabilities that I want at the tactical level? Of course! But until there is a culture change within the Navy and other Services, cyber will continue to be a friction point within our own operations. A culture change like the one I want will provide a comprehensive cyber focus on mission accomplishment by aiming to detect and minimize mission impact of cyberattacks. ❞

* * *

As a sidebar related to changing the Navy's cyber culture, I believe that Electronic Warfare needs to be considered in tandem with cyber warfare. The use of the Electromagnetic Spectrum (EMS) can be affected or disrupted by cyber or electronic warfare domains. The EMS is critical for communications, command and control, blue force tracking, precision attack, and more warfighting capabilities. Potential adversaries learned from Desert Storm and subsequent engagements how the U.S. military uses and depends on EMS. Today's adversaries know and understand the EMS and will contest U.S. military access to it. The Navy and other Services cannot deal with each warfare domain separately; they must be viewed as complements of each other.

Conclusion

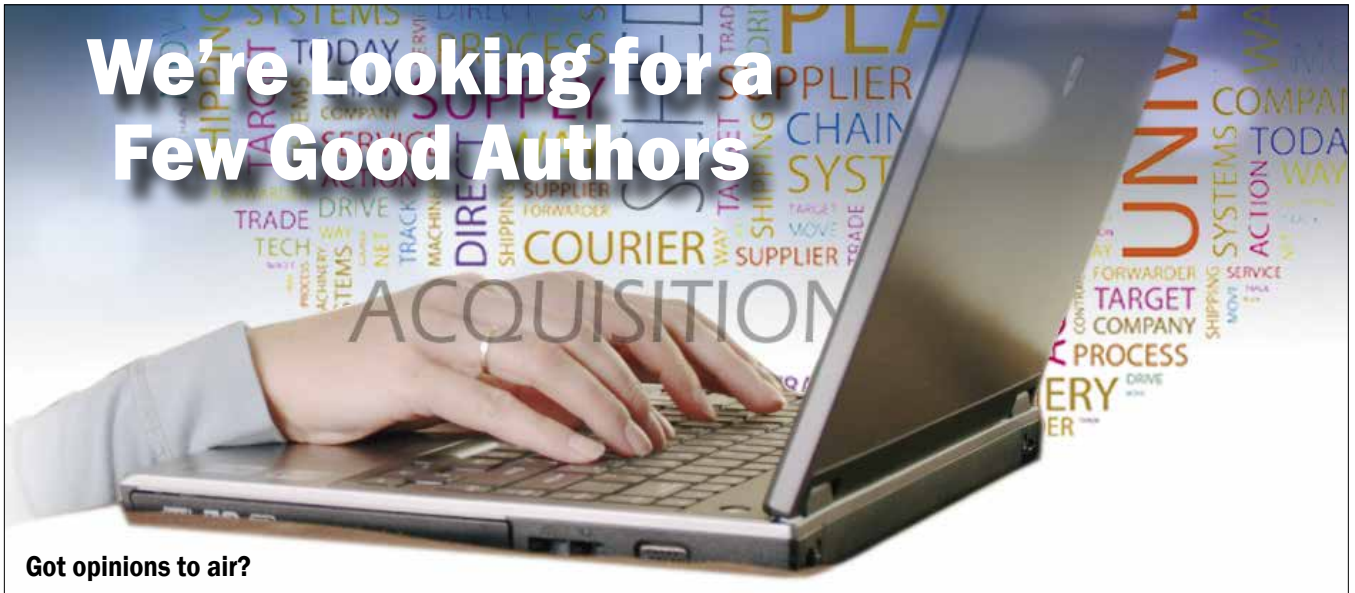
While LT Savagewood and the USS *Doolittle* are fictitious tools for this essay, the solutions discussed to implement a successful cyber culture change are not. The COVA described in this article was developed on the foundation of a cyber tabletop process the U.S. Naval Air Systems Command (NAVAIR) has

adopted as a standard work "best practice" for determining cyber vulnerabilities and requirements. The process was recognized by NAVAIR as an important tool in operational threat risk assessment as well as a catalyst for intellectual change. A senior NAVAIR director offered the following assessment following a recent cyber tabletop excercise:

> The event was a "game changer," in that it not only helped identify vulnerabilities, but it tied them to mission risk and also helped with the culture change necessary to get our entire workforce behind this important topic. Getting our engineers, fleet, and program offices to understand exactly what a potential adversary could do to a ship's ability to safely and efficiently launch and recover aircraft was worth it alone. We will be using the results from this event to drive POM [Program Objective Memorandum] requests, recommend technical fixes, plan further analysis/testing, as well as change some of our internal processes." —by permission, June 12, 2017, Kathleen Donnelly, Senior Executive Service, NAVAIR 4.8, Director, Support Equipment and Aircraft Launch and Recovery Equipment.

Is this culture change advocated by LT Savagewood unique to naval aviation, the U.S. carrier fleet or even the Navy? Of course not! Substitute LT Savagewood for any military operator and substitute the USS *Jimmy Doolittle* for any DoD acquisition program and the analogy fits. The key to achieving a cyber culture change within various Service and DoD programs is implementing a process for embedding cybersecurity across the life cycle of acquisition design, development, testing, and operational employment. A culture of cyber awareness must permeate all facets of weapons systems acquisition, training, maintenance, and operations. A process similar to the *Doolittle*'s COVA must be iterative, expeditious and readily understandable to the operators and cyber experts. It should be implemented early and continuously across the acquisition and operational life cycle to ensure continued success in a cyber environment. It's past time to get started!

The authors can be contacted at **SThompson@ewa.com**, **MLilienthal@ewa.com** *and* **DBrown@ewa.com**.



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Market Research
to Do or Not to Do?

Claude L. Cable, DBA, CFCM

Department of Defense (DoD) acquisition teams currently struggle to obtain clear and consistent market research documentation on a regular basis. They also struggle with the question of whether market research should be completed. And many firms or agencies sometimes become confused somewhere between the market research and the solicitation phases. In 2015, the Government Accountability Office (GAO) completed a review of 28 DoD contracts, at least 50 percent of which had inadequate, inconsistent and unclear market research documentation.

In 2017, the *International Journal of Market Research* noted that no one possesses a "crystal ball" for obtaining information on a specific market, especially given the regular disruptions or changes in various market sectors over the last 30 years. Does your acquisition team have a crystal ball for obtaining information on a specific business market sector? Are your team's research methodology and documentation adequate to get clear and concise results?

Cable *is a freelance author, teacher and acquisition professional. He holds a doctorate of Business Administration and is a Certified National Contract Manager (National Contract Management Association).*

For an interpreter of public contract law and regulations, many more catechisms will come to mind: Do acquisition teams place any value or importance in completing market research? What are the required elements in market research? What is the proper time to complete market research? Should market research be undertaken at all?

Background

The governance statute of market research comes from Competition in Contracting Act of 1984 (CICA). Many sources state that the empirical requirement of market research comes from the Federal Acquisition Streamline Act of 1994, which only clarified the differences between the commercial and noncommercial items. CICA requires research of a market for competition and possible sources for a requirement. The governance regulation for market research is found in Chapter 10 of the Federal Acquisition Regulation (FAR). According to FAR Chapter 10, market research documentation needs to entail and describe requirements from the acquisition team.

One source of guidance provided to agencies is found in GAO's bid decision and case studies. GAO's publication, *Market Research: Better Documentation Needed to Inform Future Procurements at Selected Agencies,* GAO-15-8, describes market research as a dynamic process of examining a marketplace or obtaining intelligence about a sector. The publication, issued late in 2014, noted that market research provides the dynamics "used to collect and analyze data about capabilities in the market that could satisfy an agency's procurement needs."

Decisions in the federal court system, including the Supreme Court, have clarified the role of market research in procurement processes. In 2015, the U.S. Supreme Court ruled in Kingdomware Technologies v. the United States that market research is required in order to understand products and services in a particular market sector.

Observations over the last 30 years indicate that many acquisitions teams "put the cart before the horse" when obtaining the outcome of a hypothesis or question about possible sources for a product or service. These thoughts transcend public and private sector acquisition teams and lack value or purpose in market research. From the start, we need to understand what research entails and its importance.

In 2017, the *Merriam-Webster's Dictionary* noted that research is a planned exploration of materials and sources to establish facts and conclusions. Documentation of research must include methodology, structure and guidance on how to interpret the data. Without a general framework or structure for interpretation, the data collected are worthless to the acquisition teams and customer.

Furthermore, in 1992, *The Journal of Marketing Research* noted there is a relationship between the source and the customer of market research. All stakeholders need to be able to trust the outcome of the market research. Not just the information, but the sources and interpretation of the whole process.

In 2017, *The Balance* website (thebalance.com) noted that the purpose of research on business marketplaces is to narrow results to a specific target in a market. Additionally, in 2017, *Entrepreneur* magazine reported that market research is a dynamic to gather, evaluate, and illuminate market information about a product or service for sale. Also, the term "market intelligence" has popped up in the business world in connection with market research. There is a slight difference between market intelligence and market research. In 2015, *Business News Daily* defined market intelligence as the information obtained to make a business determination—i.e., acquisition strategy.

And in 2017, the Bureau of Labor Statistics classified market research as the process of evaluating market conditions concerning a probable need for product or services by a customer and obtaining data from various sources. This information provides a clear understanding of vendors' marketplace positions and their pricing and ability to perform the work required.

Methodology and the Right Question

Now that there is an understanding the purpose and value of researching a market sector for products and services, your team needs the right tools for acquiring this knowledge. In July 2015, Raconteur's *Future of Market Research* publication noted the five critical steps to obtaining the best outcome of researching a market sector: compute a meaningful topic; compile new or old results; have questions in any survey seek more information than the price; and enable effortless communication of the results.

In 2017, *Entrepreneur* magazine noted that an acquisition professional's research of a business sector would acquire primary and secondary information or data. Primary data is directly received from the source. This information typically derives from a Request for Information (RFI) or Sources Sought (SS), industry days or questioning vendors. Secondary data research assembles information from governmental organizations—e.g., agencies, trade associations and local chambers of commerce.

In developing the requirement, RFI or SS can be complicated and a challenge for most teams. As stated earlier, GAO's case study of DoD's contracting of market research was inadequate in many ways, including its determination of price reasonableness. The typical technique for finding price reasonableness is to look at a vendor's published pricing, historical data or industry surveys. For example, a government survey can ask, "What have you charged for this product or service in the past?"

At times, the acquisition teams forget to ask the right questions. Initially, asking the right questions in developing the market intelligence is very important. The topics should include cost, historical experience information, technical information, and management information.

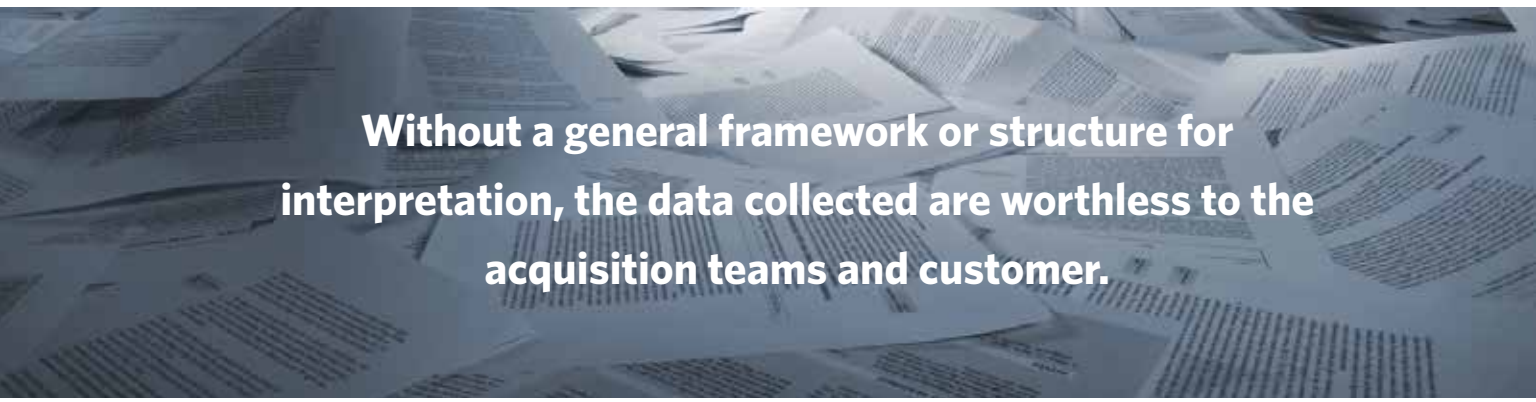
The following additional questions should get your team thinking:

- To what agency have you provided the product or service?
- After reviewing the RFI, SS or draft Performance Work Statement or Statement of Work, is your firm interested in submitting a proposal to the following Request for Proposal [RFP], Request for Quote [RFQ], or Broad Agency Announcement?
- Is your firm interested in Prime or Subcontractor work?

a vendor's response to a customer's need that can affect or improve performance.

Results

Acquisition professionals can use market research results or market intelligence in various ways to arrive at a business decision for the federal government. The data outcome should represent a cross-section of a market sector. The market research processes should have built-in validity and reliability methods to make sure the data represents a particular market sector. The acquisition team should look



Responsiveness Versus Responsibility

From my experience, acquisition professionals use the market research process as a "Down Select" or Pre-Source Selection instead of obtaining market intelligence. Businessdictionary.com defines a "Down Select" as a reduction in sources as the acquisition team proceeds through the process. Acquisition professionals use methodology for determination of responsibility to eliminate a possible source of a product or service that is felt to lack sufficient responsibility. Procurement dynamics of responsibility determination or FAR Chapter 9 requirements need to be completed by the contracting officer and acquisition team later in the process. This step usually is completed after proposals from an RFP or RFQ are obtained, which makes responsibility determination a part of source selection.

In 2011, GAO stated that the contracting officer only needs to make a determination of responsiveness from the market research tools—e.g., RFI, Industry Days. Additionally, the market intelligence will assist in deciding acquisition strategies—e.g., Small Business Set-Asides (SBSA) or Full and Open Competition. For example, the respondent to a RFI or SS need only answer the intent of a question to its fullest, then the vendor's information should go toward an acquisition strategy, such as SBSA. The *Cambridge Dictionary* defines responsiveness by an organization or individual to a communication or request as one that is made in a satisfactory speedy manner. For this discussion, 'respondent' is typically a business or vendor that provides a service or product in a certain market. In 2010, the *Journal of Business & Industrial Marketing* noted that responsiveness consists of at each data point. The market research also needs to address limitations and delimitations. A data point could be anomalous and not genuinely represent a market sector or be generated within a constantly changing industry, such as that of information technology.

Another example of understanding the market intelligence would be the following: The results or market intelligence from an RFI or SS show no responses or interest to provide a service or product. In such a case, an acquisition team typically would go to a different route or source. First, the acquisition team should re-evaluate the requirements package and research methodology for shortcomings, inconsistencies and clarifications. The more information provided to a market sector in market research the better will be the market intelligence that a team acquires.

Conclusion

As public servants, we need to ensure that research and intelligence of the market sector are done completely and thoroughly as outlined in CICA and FAR 10. Also, acquisition professionals need to ask the right questions and provide correct information to the market sector in order to obtain precise results. Furthermore, the market research documentation should always include a robust method, timeframe, analysis of the data, and a recommended procurement strategy.

Passing on a little knowledge provides us with purpose and direction.

The author can be contacted at **clcable12@gmail.com**.

Interdisciplinary Competence

The Key to Exceptional Performance

Carol J. McIlwain, Ph.D.

Interdisciplinary research ... integrates information, data, techniques, tools, perspectives, concepts, and/or theories from two or more disciplines or bodies of specialized knowledge to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline or area of research practice.

—From "Facilitating Interdisciplinary Research" by the National Academy of Sciences, National Academy of Engineering, and Institute of Medicine of the National Academies, 2005.

Various disciplinary approaches exist for integrating knowledge. Research demonstrates that knowledge integration is improved with interdisciplinary and transdisciplinary approaches to problem solving. Integrated and interdisciplinary teams achieve better problem-solving skills by leveraging common knowledge. Results from academic institutions and a 3M Company study support the development

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of depth and breadth in disciplinesto achieve exceptional performance. Academia has established interdisciplinary curriculums and research centers to facilitate greater advances of knowledge and technology.

Solving complex problems requires different thinking than finding solutions to simple problems. Today's problems are complex and require a balancing of multiple conflicting or competing objectives and constraints. A problem limited to a single disciplinary field is solvable by experts in that field. Complex problems cross disciplinary fields and require the use of multiple disciplines to develop a solution. Integrated product teams (IPTs) are multidisciplinary and include experts from several functional areas. However, an IPT is challenged to fuse knowledge across disciplines (Figures 1 and 2).

An interdisciplinary perspective requires bridging knowledge between disciplines to address complex problems. Successful teams integrate multiple disciplines to frame a problem, agree on a methodological approach, and collaboratively analyze data. Exceptional teams do a better job of integrating knowledge.

Through cross-disciplinary, interdisciplinary or transdisciplinary concepts, the acquisition workforce develops a systemic view and problem-solving skills using fused knowledge and can develop a multiple disciplinary understanding. Greater integration of disciplinary knowledge enables the development of more effective critical thinking and innovative ideas than are possible in traditional multidisciplinary teams.

An intradisciplinary approach relates to a single discipline. A multidisciplinary approach is an integrated team that gains multiple views from members grounded in different disciplines. Cross-disciplinary views one discipline from the perspective of others, which is sometimes described as akin to looking through a lens. Interdisciplinary approaches use synthesis to integrate knowledge

Figure 1. Separate Areas of Knowledge

Source of figures: Department of Defense

Figure 2. Interdisciplinary Fusing of Knowledge

A discipline is a specific field of learning or body of knowledge with defined elements such as phenomena, assumptions, epistemology, concepts, theories and methods that distinguish it from other fields or bodies of knowledge. The pursuit of further knowledge and exploration typically deals in depth within one field to gain further understanding. The concept of interdisciplinary studies requires not only depth but also breadth across one or more disciplines to understand the integration of knowledge between disciplines. The term "career fields "describes areas of acquisition categories such as budgeting, engineering, logistics, contracting, manufacturing, test and evaluation, etc. In Department of Defense (DoD) acquisition, functional areas are synonymous with career fields that define knowledge areas.

Being a trained expert is a disadvantage in some situations; competence bias hinders thinking beyond that single view. People educated in multiple disciplines are better able to design and apply a process based on certain conditions and constraints. This produces flexible thinking that challenges trained specialists. Using a multidisciplinary approach through a team of disciplinary or functional experts does not achieve integration or synthesis of knowledge because there is no common ground. A common ground provides the linkage between disciplines and creates insight and an ability to gain multiple perspectives and use knowledge in multiple applications.

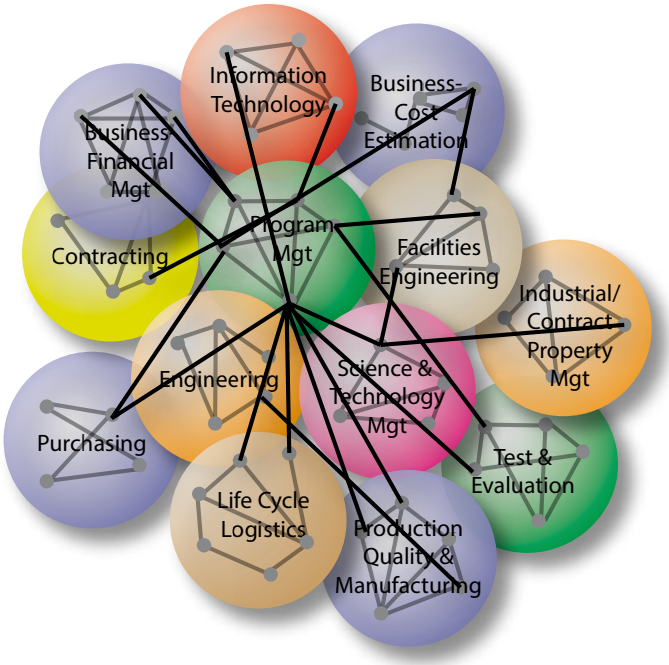
The interdisciplinary knowledge requires that planners know at least two discipline areas in order to be able to establish linkages across those areas. In a knowledge sphere, nodes are the knowledge base and linkages create insight between knowledge bases. The common ground attained through linkages provides the means to gain insight between disciplines.

Teams of experts produce a multidisciplinary approach, viewing a problem from their own discipline and recommending solutions based on their particular areas of expertise. An integrated team lead either selects one solution or needs to merge the multiple solutions into a single fused solution, requiring an interdisciplinary approach and accompanying knowledge of the various functional areas to develop a single, comprehensive solution. A fused solution is different from any single functional solution.

The team lead typically lacks interdisciplinary knowledge, selecting the one solution that appears to offer the most

from different disciplines (Figure 3). A transdisciplinary approach integrates to the extent of producing a new discipline that provides insight into an area not previously understood. Examples include biochemistry, biomedical, political ecology, educational psychology, and neuropsychology.

Figure 3. Interdisciplinary Knowledge Integration



advantages for one functional area with fewer disadvantages for the other areas. This is not an integrated solution. A true IPT lead would have an interdisciplinary background with knowledge and experience across pertinent areas. Therefore, program managers benefit from interdisciplinary competence.

Jay Forrester of the Massachusetts Institute of Technology developed the system dynamic concept as a theoretical approach to understanding complex systems. He initially developed the tool in the engineering domain but later applied it to the business world. The system dynamics paradigm concluded that decisions produce disappointing results because important casual relationships are overlooked or misread—usually by assuming a linear or unidirectional relationship versus a nonlinear and multidirectional relationship. Applying an engineering systems perspective to business operations is an interdisciplinary approach. Specialist- or expert-dominated organizations often simplify problems and reduce them to linear, unidirectional casual relationships, even if the problem is more complex and multidirectional. A simplified problem can lead to solving the wrong problem. Research laboratories recognize the need to solve complex problems with complex solutions.

An example of an interdisciplinary application is the National Synchrotron Light Source (NSLS) at Brookhaven National Laboratory of Upton, New York, on Long Island. The device produces synchrotron radiation, or light produced by charged particles bending in a magnetic field. Although initially established to support physics-related research, NSLS has evolved into an interdisciplinary laboratory:

- It is a single facility that supports multiple projects in different fields.
- Each project, large or small, requires integration of knowledge, techniques and perspectives from several disciplines or specialized fields.
- A few of the projects are creating new disciplines.
- Many projects require more than a single instrument and incorporate knowledge, techniques and perspectives from additional facilities at Brookhaven and other laboratories.

Common ground for integrating disciplines is attainable through mathematics and statistics, which cross many disciplines, including natural and physical sciences, social sciences, humanities, and applied professions. The interdisciplinary field of survey research merged the fields of sociology and political science and created specialists in data collection. Computers transformed areas of multivariate data analysis and mathematical modeling as a foundation for operational research across multiple areas: economics, sociology, political science, engineering, business and military operational planning.

Game theory merged economics and psychology, evaluating strategies based on predicted behavior, and has become foundational for strategic negotiations in business, political science, international relations, and military operational planning. Mathematical modeling, game theory and statistical analysis are tools to create common ground for interdisciplinary learning.

A joint effort by the National Academy of Sciences, National Academy of Engineers, and the Institute of Medicine's Committee on Facilitating Interdisciplinary Research and Committee on Science, Engineering, and Public Policy studied the concept of interdisciplinary research and published the results in the book, *Facilitating Interdisciplinary Research*, to document the benefits that interdisciplinary studies provide for academic understanding.

Although the findings focused on academic application for universities, institutes, and laboratories, they are easily transferable to government organizations and industry efforts to solve problems and improve the management of projects and programs. Complexity theory yields nonlinear results, creating the need for interdisciplinary approaches and crossing disciplines to leverage multiple benefits. Defense acquisition benefits from this objective, leveraging initiatives across multiple functional areas for technology development and achievement of nonlinear results.

A workforce skilled in single disciplines challenges the integration of complex technology development. Defense acquisition benefits from an interdisciplinary approach led through systems engineering and program management. An interdisciplinary workforce facilitates technology development, first by integrating the individual's knowledge within him- or herself and then integrating individual knowledge across the team.

Unconscious bias limits recognizing multiple solutions, resulting in a reversion to the current knowledge base without pursuing further information.

Systems engineering facilitates common ground across development disciplines, and program management facilitates common ground across an entire acquisition team.

When someone is involved in innovation, existing brain connections (neurons) must significantly change and cross wider areas of the brain dealing with different types of knowledge and problems in order to assimilate very different concepts and challenge long-held assumptions. Tara Swart's book, *Neuroscience of Leadership*, states that "working at the interstices of domains of knowledge can also create dissonance, and being engaged and interested in a wider range of activities than just one's own domain is also often a mark of exceptionally creative people." The strengthening of neurons in the brain creates bias and limits problem solving. Unconscious bias limits recognizing multiple solutions, resulting in a reversion to the current knowledge base without pursuing further information.

Interdisciplinary Results—3M Company Study on Innovation

Innovation relies on an individual's expertise to generate new knowledge or create new ideas through recombining ideas to create innovative applications. In the research paper, "Balancing Breadth and Depth of Expertise for Innovation: A 3M Story," the authors state:

> Even though many inventions are created when individuals work in teams, studies allude to the observation that individuals are effective in combining existing knowledge to generate new knowledge and innovations. Innovative ideas and insights first occur to individuals, before such ideas are subsequently shared at the group levels and institutionalized at the organizational level. Fundamentally, this highlights that individuals are the basic unit in which knowledge integration and knowledge creation takes place, regardless of whether individuals work alone or in teams.

If innovative ideas are not created at the unit level, they will not be created at the team level.

A study of how inventors' breadth and depth of expertise influence innovation at 3M exceeded previous research focused on a single indicator—technical success achieved by the inventor. The 3M study examined three indicators:

- The number of inventions generated.
- The extent to which the inventor has a significant impact on the technical domain.
- The inventor's career success, in terms of commercial value brought by converting the inventions into products that generate sales for commercial organizations.

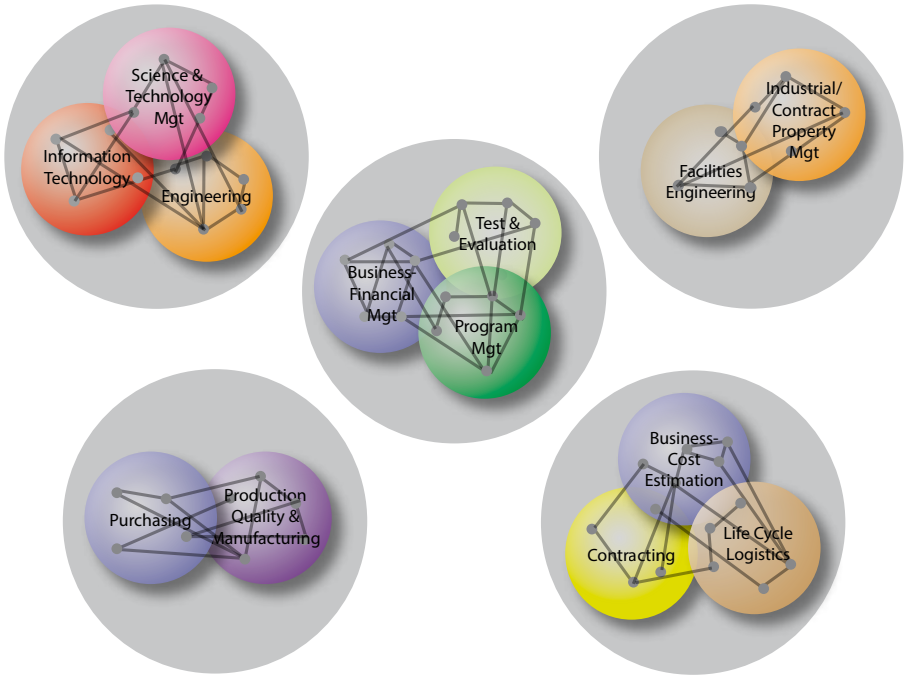
The study concluded that generalists (breadth) create many inventions that are not technically influential; specialists (depth) create fewer inventions but these are technically influential. The combination of breadth and depth (polymath) of expertise creates the most valuable inventors that have established a record for effectively converting inventions into commercially successful products. In other words, the polymath earned the most money for 3M by producing the most marketable inventions.

A "specialist" achieves very deep knowledge through study and experience. Studies found that specialists acquire ability for detailed and accurate analysis that lead to solutions of difficult technical problems in their areas of expertise. Specialists also make difficult trade-offs, and through deep knowledge can better predict what will go wrong. They create groundbreaking innovations by persistently exploring more deeply in a particular area.

Generalists have knowledge in a broad range of areas but lack expertise in any particular area. Generalists tend to enjoy new work and become bored when confined to one area; this inhibits their ability to develop the specialist's depth. Generalists focus on the application of technologies to useful products and integration of multiple technologies into a product, creating innovation through a broader focus.

Polymaths have acquired significant depth and breadth by first becoming experts in one area and then expanding their expertise into other areas. One polymath inventor at 3M had described the benefits of both in the study: "his depth of expertise plays a key role in identifying the technical contributions of an idea, while he draws upon a breadth of expertise to evaluate the potential ways the invention can impact different industries." By balancing the combination of depth and breadth, polymath inventors become astute at applying, integrating and recombining technology of their domains across other technologies and applications. Generalist inventors focus on finding new applications for a developed technology

Figure 4. Lack of Linkage Between Integrated Functions



develop the interdisciplinary perspective faster.

Rockefeller University

Rockefeller University (formerly the Rockefeller Institute) in Manhattan has implemented a unique approach to biomedicine research. The university holds more major discoveries in biomedicine than any other such research institute. Its faculty, fellows and alumni have included 27 Nobel laureates in physiology or medicine and chemistry, 22 Lasker Award recipients, five faculty members named as MacArthur fellows, 20 recipients of the National Medal of Science, and 18 National Academy of Medicine members. The joint National Academy of Sciences study said of the university that "major discoveries occurred relatedly because there was a high degree of interdisciplinary and integrated activity across diverse fields of science, and because of leadership that gave particular attention to the creation and maintenance of a nurturing environment, though with rigorous standards of scientific excellence ... there are three important characteristics: a high level of scientific diversity, low levels of internal differentiation, and visionary leadership." The university has 13 interdisciplinary centers dedicated to investigating the interstices between general areas of study, such as physics and biology or biochemistry and structural biology. Other centers focus on multidisciplinary methods of addressing specific biomedical problems.

but lack the depth to develop a new technology. Specialists develop the technology but lack the breadth needed to adapt it to various applications.

How are polymaths developed? The acquisition of depth probably precedes the acquisition of breadth. Once depth is acquired, the polymath can use that learning to accelerate the achievement of depth in other areas—acquiring the ability to go deep and then applying that ability to go broad. When breadth is established without first acquiring depth, depth probably will never be attained.

The study concluded that organizations need specialists, generalists, and polymaths but that "both breadth and depth of expertise are required to effectively convert inventions into commercially successful products that bring sales and value to the organization. The polymaths contributed not only by generating inventions, but applying these inventions widely to multiple parts of the organization, integrating with multiple technologies, thus becoming the most valued scientists of 3M."

This combination is created through starting careers that go into significant depth in single areas. Over time, significant knowledge and experience outside that one domain is acquired. By leveraging an understanding about how one becomes an expert, expertise is developed more quickly in other areas.

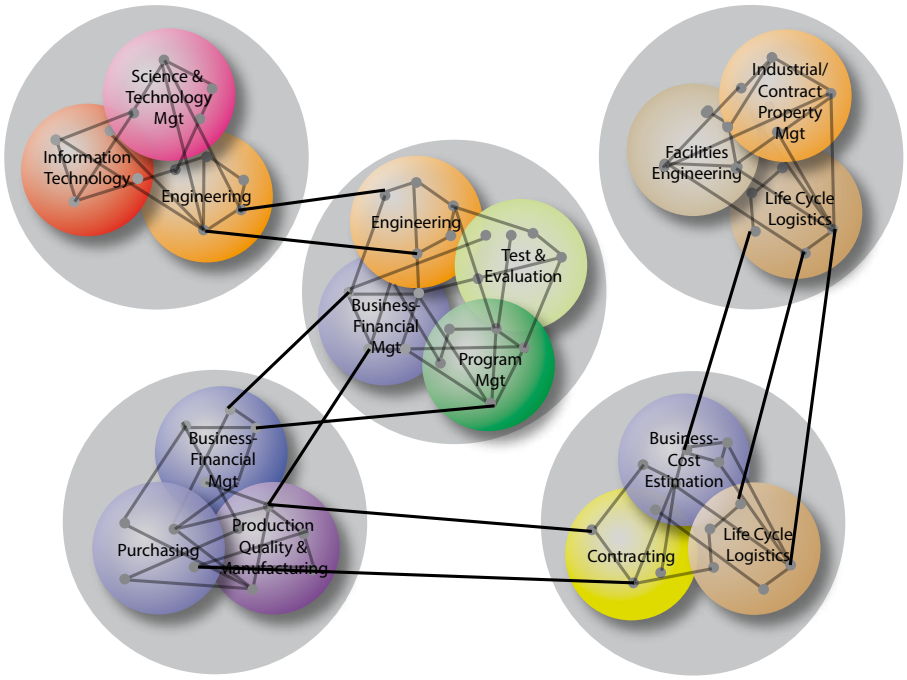
A polymath develops an interdisciplinary perspective by attaining depth and breadth across multiple disciplines, leveraging the knowledge interface between functional areas to

This performance was achieved by recruiting researchers with diverse scientific and cultural backgrounds, most of them working in fields that crossed disciplines. The university did not organize around academic disciplines but instead around a laboratory environment deemed "without walls" to promote cross-knowledge utilization of scientists on research projects.

The Army's *Campaign Planning Handbook* recognizes a multidisciplinary perspective for solving complex problems in the counterinsurgency mission. A system-of-systems concept overlaps the six areas of political, military, economic, social, information and infrastructure and aligns with those disciplines. An interdisciplinary approach integrates the knowledge across these functional areas.

For teams to be effective, team members need common ground in order to develop fused ideas. Greater depth is developed in each discipline through linkages of the knowledge nodes. A team's work likely will evaluate solutions based on a particular functional approach when there is little common ground (few linkages) between the functions (Figure 4).

Figure 5. Knowledge Merger Among Team Members



An interdisciplinary team merges knowledge across multiple disciplines; each team member's knowledge crosses at least two disciplines (Figure 5). For complex problems, greater insight is gained through crossing disciplines. The need to acquire breadth, even when pursuing advanced degrees, is recognized in recommendations for a new vision on the part of the academic institutional structure. As cited by the National Academy of Sciences:

> A matrix structure in a university might include many joint faculty appointments and Ph.D.s granted in more than one department which would enable participants to address cross-cutting questions more easily. It might create numerous interdisciplinary courses for undergraduates, provide mentors who bridge the pertinent disciplines, and equally important, offer faculty numerous opportunities for continuing education whereby they could add both depth and breadth of knowledge throughout their careers.

Implementation of interdisciplinary competence requires changes in current management recruitment, retention and promotion policies within the human resource management area. Position selections require criteria that balance specific skills for the current position with the ability to grow beyond that position through a breadth of knowledge and experience. Acquisition development requires special recruitment policies to target polymath individuals for certain senior positions. Incentives are needed in recruitment and selection to attract the best individuals for key positions. This means that, for vertical and horizontal development and advancement, a paradigm shift is needed away from traditional thinking. Expertise in acquisition policy should merely complement one's primary functional expertise.

Promoting development of a primary field for the workforce establishes expertise—and then secondary field certifications develop breadth. Integrated interdisciplinary teams leverage the connections of knowledge and provide a means for "seeing the space between nodes of knowledge." Common ground connects two different areas sharing modeling or statistical tools; analytical tools should complement training curriculums and position assignments. Interdisciplinary individuals resolve complex problems across multiple disciplines through the internal fusion of knowledge and understanding. Common ground is developed through linkages established between functional areas.

DoD's complex technological advancement requires a paradigm shift from previous knowledge-based training and learning. An interdisciplinary program manager can facilitate the integration of a team's knowledge. In the case of both societal problem solving and technological advancement problem solving, it has been proved that the interdisciplinary approach enables exceptional performance unattainable through a single disciplinary or multidisciplinary approach.

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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 recent such changes of leadership for both civilian and military program managers.

Navy/Marine Corps

CAPT Christopher DeSena relieved **CAPT Joseph Kan** as program manager for the Mobile User Objective System (PMW 146) on Sept. 1, 2017.

CAPT Andrew Gibbons relieved **CAPT Mark Glover** as program manager for the Navy Multi Band Terminal (PMW 170) on Nov. 16, 2017.

Including Cybersecurity in the Contract Mix

Kimberly L. Kendall ■ *William E. Long, Jr.*

Cybersecurity is a team sport that requires Program Management, Cyber/Information Technology, Engineering, Test and Evaluation, Finance, Logisticians and Contracting. In order to improve the survivability of our Department of Defense (DoD) systems under cyberattack, we must consider cybersecurity in the earliest phases of contract planning—from acquisition planning to contract maintenance and closeout.

If cybersecurity isn't properly integrated into the solicitation process we won't (1) know if the offerors are capable of delivering our cybersecurity requirements, (2) be able to discriminate between offeror proposals or (3) be able

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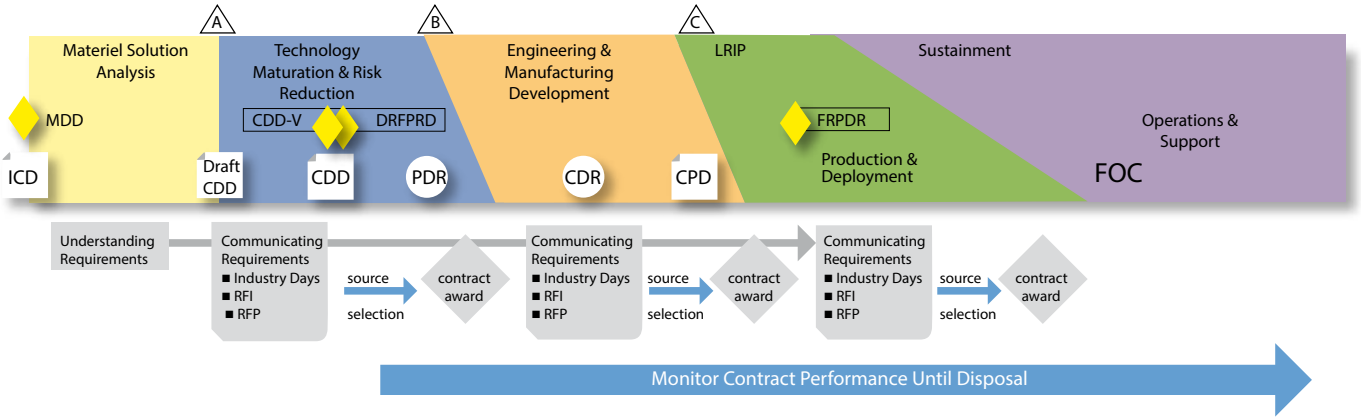
Figure 1. Contracting Touchpoints Across the Acquisition Life Cycle



Key to Figure: ICD=Initial Capabilities Document; CDD=Capability Development Document; CDD-V=Capability Development Document Validation; CPD=Capability Production Document; CDR=Critical Design Review; DRFPRD=Development Request for Proposals Release Decision; FOC=Full Operational Capability; FRPDR=Full-Rate Production Decision Review; LRIP=Low-Rate Initial Production; MDD=Materiel Development Decision; PDR=Preliminary Design Review; RFI=Request for Information; RFP=Request for Proposal

Source: Adapted by authors from DAU's Cybersecurity and Acquisition Life-cycle Integration Tool

to provide the proper oversight since we may not have asked for the appropriate data to monitor contract performance. Ensuring cybersecurity is appropriately addressed in the solicitation process involves more than selecting Federal Acquisition Regulation (FAR)-Defense Federal Acquisition Regulation Supplement (DFARS) clauses!

Cybersecurity requirements, like other system requirements, underpin the solicitation process. Early involvement by the contracting officer is the key to successful incorporation of cybersecurity requirements into the Request for Proposal (RFP), source selection and post-award contractor execution activities. Additionally, contracting officers need to understand a program's cybersecurity requirements and risks to inform contract type selection. Figure 1 shows touch points in the life cycle where contracting solicitation activities should include cybersecurity considerations.

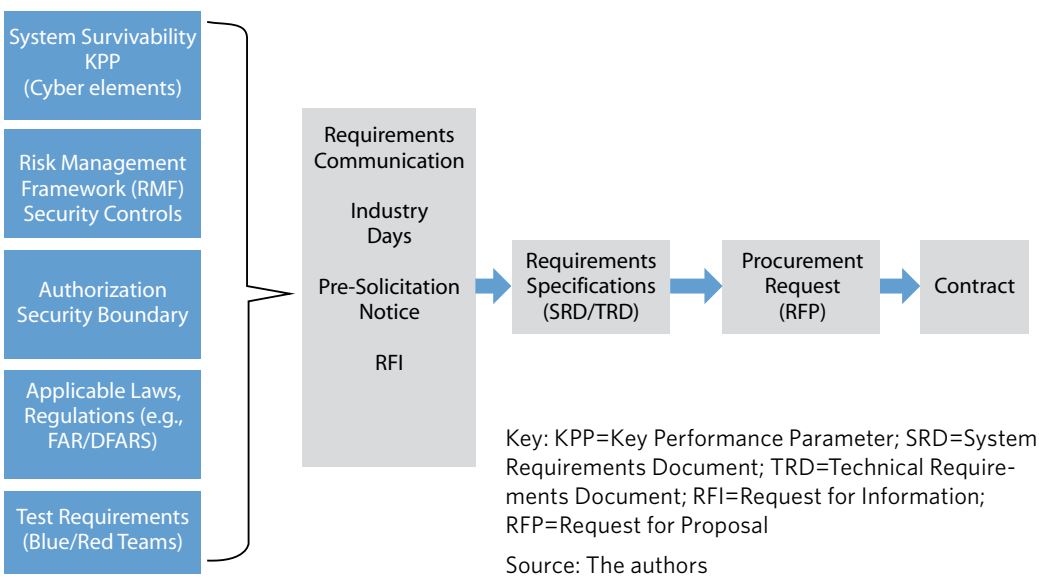
Understanding and Communicating Requirements

Contracting for cybersecurity begins in the Requirements Phase. It is imperative that the contracting officer understand the program's cybersecurity requirements and construct a contracting strategy to determine whether offerors are capable of delivering those requirements.

Many cybersecurity requirements are included in the mandatory System Survivability Key Performance Parameter (KPP) because Cyber Survivability is now a key element. All cybersecurity-required capabilities (including those derived from the Risk Management Framework [RMF] process) are decomposed into the government-owned technical requirements baseline. Traceability and balance between cybersecurity requirements, security controls and mission needs is of critical importance. This is where the contracting officer can help the program manager (PM) make informed trade-space decisions.

Cybersecurity requirements should be communicated with industry through various forums (e.g., Industry Days, Sources

Figure 2. Putting Cybersecurity Requirements on Contract



Key: KPP=Key Performance Parameter; SRD=System Requirements Document; TRD=Technical Requirements Document; RFI=Request for Information; RFP=Request for Proposal

Source: The authors

Sought Synopsis, Request for Information (RFI), one-on-one meetings, Draft RFP, Preproposal Conferences, etc.) and ultimately included in the final RFP. This will provide industry with a better understanding of the breadth and depth of cybersecurity requirements. See Figure 2.

Source Selection

Clearly communicated cybersecurity requirements provide potential offerors information on which to base their proposed solutions and provide DoD with measures to evaluate offeror capability and solutions. Cybersecurity risk should be a consideration when determining evaluation criteria to provide discriminators among proposals. The following are just a few resources providing examples of cybersecurity considerations that can be incorporated into the RFP: the DoD Program Manager's Guidebook for Integrating the Cybersecurity Risk Management Framework (RMF) into the System Acquisition Lifecycle; the Guide for Integrating Systems Engineering into DoD Acquisition Contracts; Suggested Language to Incorporate System Security Engineering for Trusted Systems and Networks into DoD Requests for Proposals; and https://shortcut.dau.mil/ncma/cyber_contracts. Table 1 is a sampling of these considerations.

FAR/DFARS Clauses and Public Law

The procurement team should work together, but the contracting officer has the ultimate responsibility for FAR and the Defense FAR Supplement (DFARS) requirements. DoD Instruction (DoDI) 5000.02, Change 3, Enclosure 14, specifically calls out the following:

- FAR Clause 52.204-2 Security Requirements
- FAR Clause 52.204-21 Basic Safeguarding of Covered Contractor Information Systems
- Section 933, National Defense Authorization Act, FY [Fiscal Year] 2013, Public Law 112-239—Improvements in Assurance of Computer Software Procured by the Department of Defense
- DFARS Clause 252.204-7012 Safeguarding Covered Defense Information and Cyber Incident Reporting
- Section 937, National Defense Authorization Act, FY 2013, Public Law 113-66—Joint Federated Center for Trusted Defense Systems for the Department of Defense

Additional cybersecurity-related DFARS clauses include:

- DFARS Clause 252.204-7008—Compliance with Safeguarding Covered Defense Information Controls
- DFARS Clause 252.204-7009—Limitations on the Use or Disclosure of Third-Party Contractor Reported Cyber Incident Information
- DFARS Clause 252.239-7009—Representation of Use of Cloud Computing
- DFARS Clause 252.239-7010—Cloud Computing Services
- DFARS Clause 252.239-7017—Notice of Supply Chain Risk
- DFARS Clause 252.239-7018—Supply Chain Risk

The foregoing is not an all-inclusive, one-size-fits-all list, and contracts should be based on individual program requirements and risk!

Effective Cybersecurity Government Oversight

To determine if cybersecurity requirements are being implemented effectively, the right data and tools need to be written into the contract. The following are examples of data, artifacts and/or activities that we might monitor:

- Software vulnerability scans (static and dynamic)
- Formal code inspections
- Software quality measures and configuration control
- Test coverage

Incentivize Cybersecurity Performance

Incentives are fundamental elements of any contract. The contract itself motivates successful performance from a monetary standpoint, future relevant work and "brand" reputation. However, since cybersecurity historically has been treated as a compliance checklist, perhaps we need to incentivize contractor efforts beyond "check the box" minimum performance by incorporating specific incentives designed to encourage exceptional performance. In the face of ever-increasing cyber threats, cybersecurity may be a critical risk area necessitating extra effort to mitigate those risks.

There can be a combination of financial and nonfinancial incentives, including improved cash flow, increased business

Table 1. Request for Proposal (RFP) Sample Cybersecurity Considerations

Request for Proposal	
Section B	Supplies or services and prices/costs • Review all CDRL deliverables for inclusion of cybersecurity execution support (e.g., data rights, test data, test plans, source code deliveries, prototype quantity, and delivery times and/or locations).
Section C	Description/Specification/Statement of Work • State—in performance-based terms—cybersecurity requirements levied on the contractor. • Include cybersecurity system/technical requirements in the SRD/TRD. • Identify the system RMF categorization, overlays, RMF security controls to inform scope. • Identify any specific design, contractor testing or artifacts that enable compliance with cybersecurity requirements.
Section E	Inspection and acceptance • Ensure that a quality assurance surveillance plan exists to monitor contractor performance, including cybersecurity.
Section F	Deliveries or performance • Ensure that cybersecurity-related items are addressed like any other type of requirement (e.g., test article delivery, contractor support for repair, etc.).
Section H	Special contract requirements • List applicable cybersecurity special contract requirements (e.g., handling of data, software license management and maintenance, use of contractor facilities for cybersecurity testing).
Seciton I	Contract clauses • Cybersecurity-specific contract clauses should be considered.
Section J	List of attachments • Consider applicable cybersecurity attachments (e.g., a DoD component RMF Guide, Program Protection Plan).
Section K	Representations, Certifications, and Other Statements of Offerors or Respondents • Include requests for certification that support the cybersecurity strategy (e.g., National Security Agency certifications of cryptographic algorithms or equipment, and certification of cross domain solutions).
Section L	Instructions, Conditions, and Notices to Offerors or Respondents • Describe the experience of cybersecurity staff, predicted staffing levels, and the application of cybersecurity best practices and its alignment with the contractor management structures for SSE and T&E. • Define the contractor's responsibilities for cybersecurity and the alignment of those responsibilities in contrast to the government for required SSE and T&E activites (e.g., contractor cybersecurity testing, developmental testing, and integrated testing). • Describe the contractor's approach for technical data, including management, ownership, control, timely access, and delivery of all cybersecurity data, including raw test data, to support the evolving technical baseline. • Define CDRLs and select applicable DIDs. Identify any cybersecurity-related data products contractors must provide. • Describe contractor's approach for satisfying the Program Protection Plan. • Describe contractor's approach for detecting counterfeit components and use of cyber-certified products for hardware and software. • Describe the contractor's access to government cyber ranges, use of commercial and/or government Blue and/or Red teams during cybersecurity testing.
Section M	Evaluation Factors for Award • Prior performance in integrating cybersecurity considerations into the program's SE, SSE and T&E processes. • Meet cybersecurity workforce certification and training requirements in DoDD 8140.01 and DoD 8570.01-M, and investigative requirements per DoDI 8500.01. • Prior support to government achieving cost-effective cybersecurity authorizations to operate. • Define measures and metrics clearly to evaluate qualification of contractor cybersecurity staff. • Degree to which cybersecurity is included in design trade analysis. • Degree to which security testing is integrated into software development. • Degree to which supply chain risk management ensures security and integrity of sourced components. • Degree to which supply chain diversity is implemented.

Key to Table: CDRL=Contract Data Requirements List; DID=Data Item Description; DoDI=DoD Instruction; DoDD=DoD Directive; RMF= Risk Management Framework; SE=Systems Engineering; SRD=System Requirements Document; SSE=Systems Security Engineering; T&E=Test and Evaluation; TRD=Technical Requirements Document.

Sources: *DoD Program Manager's Guidebook for Integrating the Cybersecurity Risk Management Framework (RMF) into the System Acquisition Lifecycle*; the G*uide for Integrating Systems Engineering into DoD Acquisition Contracts*; *Suggested Language to Incorporate System Security Engineering for Trusted Systems and Networks into DoD Requests for Proposals*; and https://shortcut.dau.mil/ncma/cyber_contracts.

base and stable workforce employment. Incentives also can be either positive, negative or a combination of both. They should be applied selectively to motivate contractor efforts that otherwise might not be emphasized and to discourage suboptimal performance.

When it comes to incentives, we must always strive to have a better understanding of what incentives do and make sure that we're incentivizing the correct behavior. Early market research is the key to doing this successfully. For one thing, in using multiple incentive arrangements, we need to ensure that we always include a cost incentive so that the contractor doesn't exceed contractual costs by chasing that incentive. We also need to ensure that multiple incentives are not driving suboptimal performance in other areas—or contradicting one another.

The development of an effective acquisition strategy begins with understanding the program's cybersecurity requirements and making a thorough evaluation of risk. Contract incentives must properly motivate the contractor. Hence, we must understand factors that are most important to the contractor.

Contract Type Challenges for Cybersecurity

Factors to consider when selecting a contract type include (1) performance risk and uncertainty, (2) urgency, complexity and stability of the requirement, (3) competition and (4) technology maturity. A challenge for cybersecurity is the availability of historical cost and pricing data as we build cybersecurity into the design of systems as opposed to using a previous compliance checklist approach. The ever-increasing cyber threat drives up uncertainty as new vulnerabilities are discovered daily. As we tackle this threat, the contract type needs to give us the flexibility to make adjustments as we learn what is feasible and affordable.

Summary

The contracting community has a crucial role to play in ensuring cybersecurity requirements are effectively included in the contract. This starts with gaining a complete understanding of the program requirements so that the solicitation can be effectively constructed to differentiate between competing offerors' proposals and determine their capability to deliver cybersecurity. The program management office needs to effectively communicate requirements to industry partners so they understand the scope of those requirements. This cannot be done effectively without early engagement on the part of the contracting officer.

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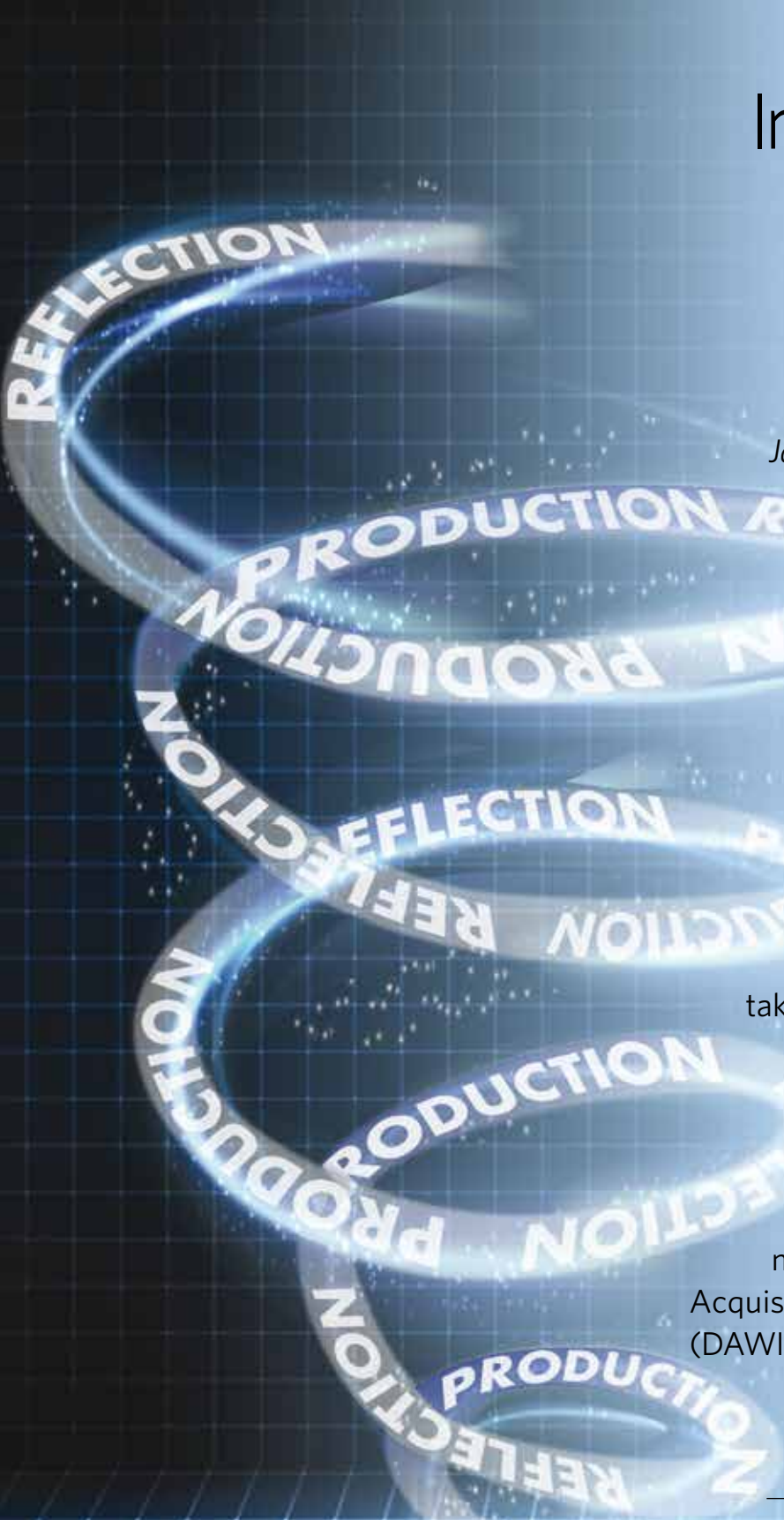
Instruction, Direction and Correction

Improving the Acquisition Culture

James N. Phillips Jr., DBA, PMP, CFCM



Criticism of the acquisition profession commonly focuses on sustained performance and positive outcomes. The problem appears to be that our acquisition culture suggests that it is unnecessary to take time to improve people and processes. The acquisition field is replete with courses offered by government and industry on foundational learning subjects that are required by the Department of Defense under the Defense Acquisition Workforce Improvement Act (DAWIA) and by the Federal Acquisition Institute for civilian agencies. With so

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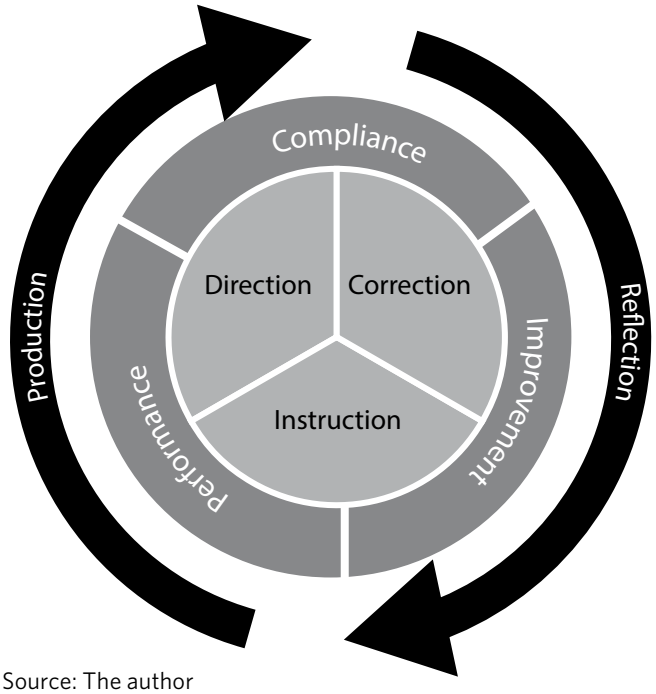
Figure 1. Supervisory Management Wheel



Source: The author

many courses available, why are there still problems with acquisition performance and outcomes?

Perhaps the answer lies in a holistic understanding of how managers and supervisors value learning, both foundational and applied. Presently most training is linked to the attainment of certifications—i.e., DAWIA Level III or Federal Acquisition Certification in Contracting (FAC-C) Level III—rather than building the professional's qualifications. The current thinking seems to be built on the assumption that acquisition professionals are to be regarded as universally competent once they are FAC-C Level III or DAWIA Level III certified.

This belief is rooted in the faulty notion that certification equals qualification. This tendency to focus on the certification leaves out the unique contribution that qualification brings. So how do we bridge the gap between foundational learning and applied learning?

The Value of Reflection

A colleague once shared with me a pertinent perspective:

> Would we allow a newly minted second lieutenant start to fly a $100 million aircraft without first completing specific training? So why would we allow an inexperienced contracting officer to "'fly" a $100 million procurement?

In fact, the pilot would never fly the jet without having been qualified on a simulator. However, the expectation is not the same for contracting officers and their acquisition teams. In 2015, I created the Supervisory Management Wheel (hereafter referred to simply as Wheel) to help better understand the relationship between Outcome (Production) and Continuous Improvement (Reflection). I particularly wanted to study the opposite side of the coin—Reflection—which includes critical thinking, problem-solving, and continuous improvement.

Outcome is based on performance, which is linked to foundational and workflow learning and Continuous Improvement is found in Reflection and is rooted in performance learning. The Wheel is a model and offers plenty of overlap to its application, so it serves as a guide and not as an absolute.

The Wheel's Center

The Wheel begins with three fundamental actions that any supervisor or manager must conduct when managing outcomes. These actions are Instruction, Direction, and Correction. Instruction is where foundational learning and certifications reside. Instruction is the "how to" part of performance in a theoretical sense. Direction, on the other hand, reflects actual performance of work or applied knowledge. It is in Direction that the supervisor defines work-flow to standardize practice and outcomes. Finally, in Correction, performance learning occurs! This is where the system corrects and improves itself by questioning its methods and practice. It is in Correction that continuous improvement resides.

The First Ring Segments

The first ring segments overlap the actions of the center, for instance, the fruit of Instruction and Direction is Performance. Performance suggests foundational learning, and workflow learning to produce an outcome. Compliance combines both Direction and Correction, suggesting workflow learning and performance learning; and the Improvement segment completes the ring.

Improvement combines the elements of Correction and Instruction, in that order. Improvement is the fruit of Correction and Instruction updating. It is in the Improvement segment that challenges to work processes are brought to light and that there is continuous improvement analysis. Consider the following scenario:

Julie is a contracting officer with a DAWIA Certified Level III (Instruction) and assigned to an important project for her agency (Direction). After receiving her marching orders, Julie discovers that the agency's process, which she was following, no longer makes sense in the situation. Julie reviews the matter and then offers alternatives that will reflect certain performance economies (Correction). After discussing her work with her supervisor/manager, Julie is able to document the file and make the changes in the process.

Julie is required to follow the prescribed contracting processes. Julie also is empowered to question the processes and is encouraged to offer alternative solutions for consideration.

Production-Reflection Balance

Finally, two arrows encircle Wheel, and these involve Production and Reflection. The arrows suggest the Wheel has a dynamic characteristic similar to the ebb and flow of outcomes; it is the consummate yin and yang relationship. In contracting, there are times to produce and times to reflect, a fact that Julie understood.

One often hears talk about work-life balance. It is recognized that balancing work and personal life is essential to a healthy employee and positive outcomes. Similarly, an understanding is needed that another balance must be struck when an employee is at work. Supervisors and managers must allow for time to reflect, which is captured in the phases illustrated in the Production-Reflection dynamic relationship found in the Wheel.

This balance is theoretical. Unfortunately, the scale often is tilted toward the Production phase rather than giving equal time in the Reflection phase where continuous improvement lies and where performance learning occurs. Reflection supercharges understanding and re-energizes the willingness of the individual to exercise greater initiative. In his book *Seven Habits of Highly Effective People*, the late Dr. Stephen Covey noted that one of the habits is "Sharpening the Saw," which is particularly relevant here. In "Sharpening the Saw," Covey reminded the reader of the importance of down time and preparation for work. Deliberately taken down time affords time to reflect, recharge, and renew a person's view of his or her work.

Discussion

The Wheel is a conceptual model, an image of ideal operational culture and its interrelationships. It lays out in simple imagery key actions and relationships on which supervisors and managers of acquisition personnel must focus.

Acquisition excellence does not happen in vacuum. Acquisition excellence is created when the culture within the contracting department and acquisition community takes time to reflect. This means analyzing past performance by using critical thinking skills to formulate a plan for the future. This may sound familiar as it reflects the PDCA (Plan-Do-Check-Act) and is captured in the Sprints used in Agile Software Development.

The Reflection phase is where continuous improvement occurs and is tested and recommended for implementation. Following Lean principles, there must be time set aside to reflect so that learning can occur. For the contracting supervisor and manager, this is where cataloging Corrections and Compliance concerns can be turned into learning moments where Improvement may occur. Consider the following scenario:

Joseph is a contracting officer with a DAWIA-certified Level III and was recently reassigned from a station level contracting shop to an important contract in the F-35 program office. While Joseph was certified, he was not fully qualified for his new role as he had no program environment background. In his new assignment, the program manager (PM) made certain that he had instruction on the basic understanding of the program and its contracts (Compliance segment). The PM then ensured that Joseph had applied his new knowledge of the program on challenging, but familiar, contracts so that Joseph could understand how business was done at the program office. Finally, Joseph was given more complex contracts and had greater responsibility for the outcome. Joseph was learning and applying the lessons learned to future contracts (Improvement segment), and sharing the lessons learned with his colleagues and helping them along (Performance segment).

Ideas on Reflection

The Reflection phase includes lessons learned, which is a retrospective understanding of prior actions, and simulation, which is a prospective view of what is to come. Both lessons learned and simulation will aid in developing greater contracting situational awareness when facing new procurement actions. Supervisors and managers must use both to prepare acquisition professionals for the challenge of new procurement, and this can best be performed during the Reflection phase.

Final Thoughts

The Wheel should be a staple item for all supervisors and managers, as well as mentors and coaches. It visually conveys an understanding of the relationship of the Reflection phase to the whole of employee development. The design of the Wheel illustrates the many overlapping elements. The Wheel when viewed from the center presents interconnected building blocks necessary for good outcomes. When viewed from the outside in, the Wheel presents a tapestry of interconnected relationships that are crucial for sustaining outcomes.

Supervisors and managers create meaningful and relevant learning opportunities when the learning is planned. I found the Wheel most useful in its elevation of the value of the Reflection phase to the same level as the Production phase. The Production phase is designed to produce, not change on the fly. Production is the fruit of foundational learning, instructions, standard work, leading to a positive outcome; whereas Reflection focuses, improving the outcomes either by better compliance or improved processes. As referred to earlier, in the "down time" of Reflection critical thinking is performed and alternatives are discovered. This is the home of continuous improvement and also where simulation lives. The second lieutenant mentioned above definitely would be put in a simulator before actually flying the $100 million aircraft. We should make certain that the same deliberate, planned learning occurs before a contracting officer jumps into a $100 million procurement. In final reflection, the Wheel provides acquisition professionals a balanced understanding with which to work (Production) and to prepare for work (Reflection).

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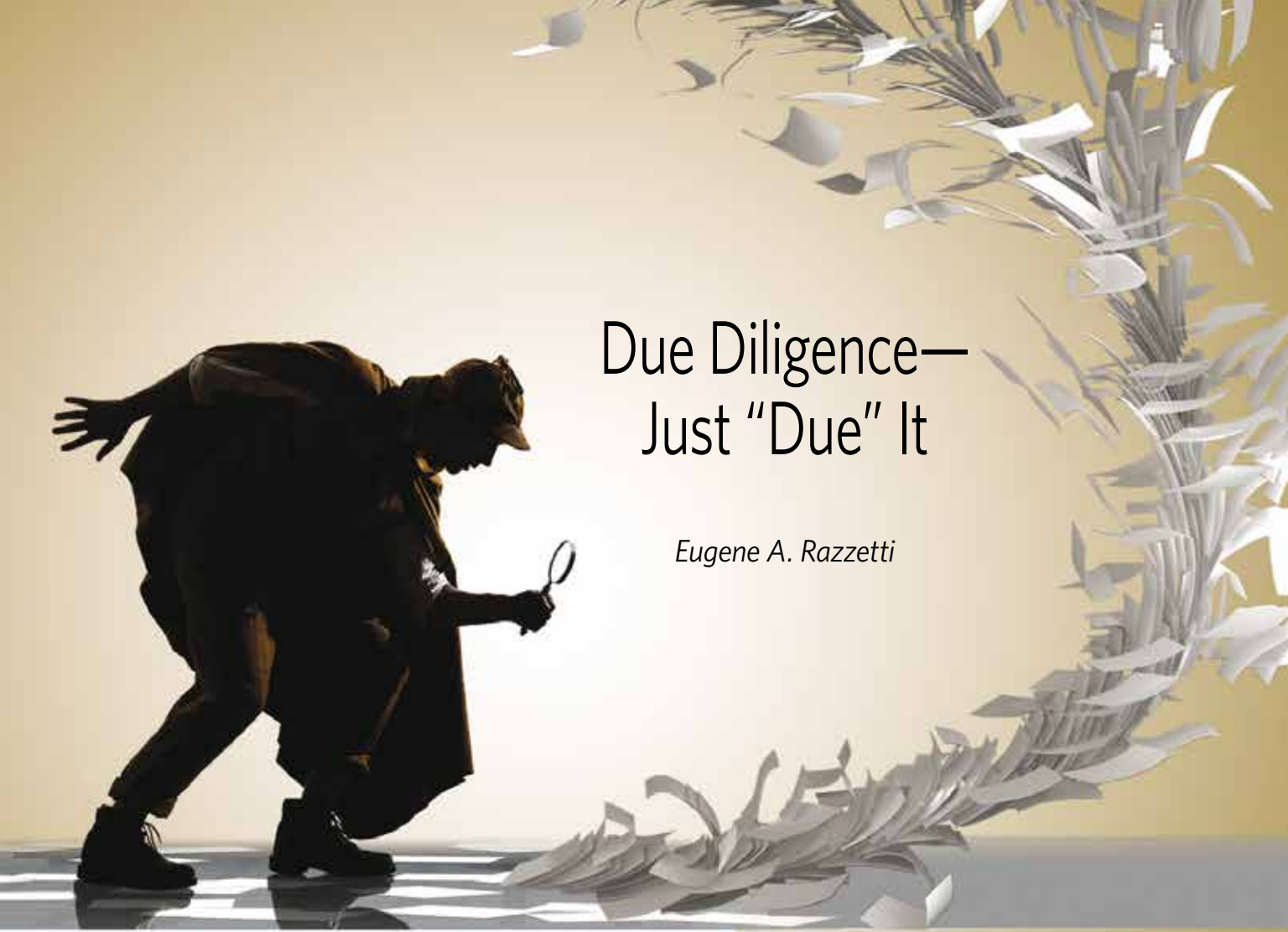


Due Diligence—Just "Due" It

Eugene A. Razzetti

Successful Department of Defense (DoD) acquisitions are the product of comprehensive, structured and ongoing due diligence strategies, custom tailored for each phase of each program. Program managers (PMs) are only half right to believe that due diligence is reactive and starts with the proposal.

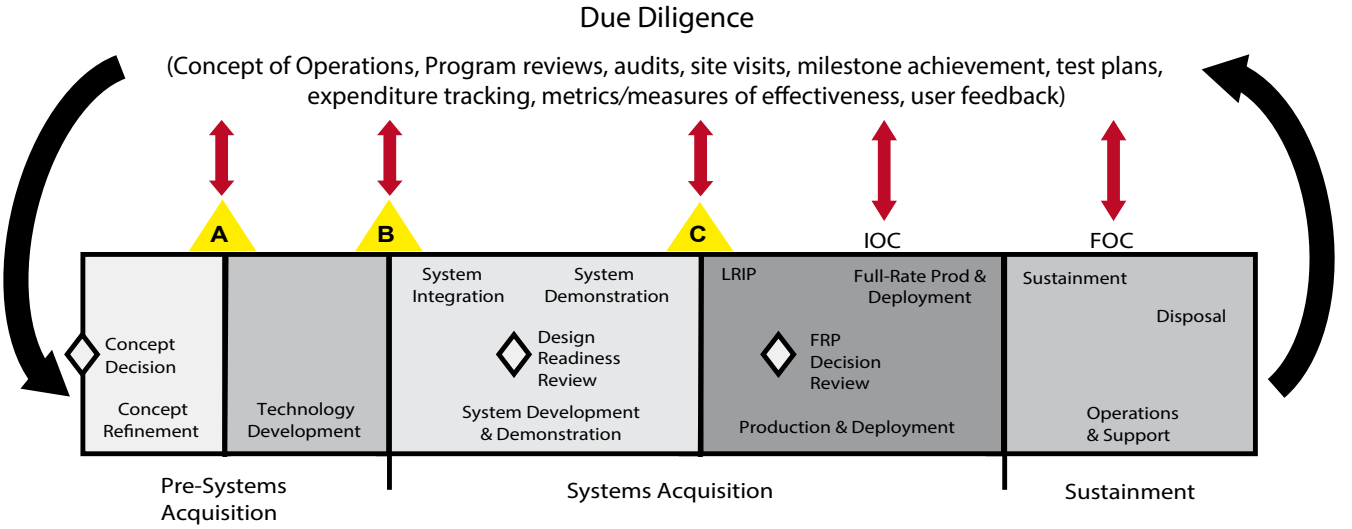
Due diligence must be proactive as well and start with the Needs Assessment. PMs must be equally industrious when initially identifying needs and developing the requests for proposals (RFPs)—and then throughout the remaining acquisition process.

Razzetti *is a retired U.S. Navy captain, management consultant, auditor, and military analyst. He is the author of five management books, including a book for the military: "Hardening by Auditing—A Handbook for Measurably and Immediately Improving the Security Management of Any Organization" and has served on the advisory boards of two business schools.*

"*Quality* products that satisfy user needs with *measurable* improvements to mission capability and operation and support, in a *timely* manner at a fair and *reasonable* price."

—Department of Defense Directive 5000.1
(Italics added for emphasis)

Figure 1. Due Diligence in Every Step



FOC=Full Operational Capability; FRP=Full Rate Production; IOC=Initial Operating Capability; LRIP=Low-Rate Initial Production

Source: Adapted by the author from *DoD Directive 5000.1.*

Figure 1 outlines a generic DoD acquisition process, suggesting to PMs that there is both a need and an opportunity for due diligence at every program phase.

Management books define due diligence as "investigation by or on behalf of an intended buyer of a product or service to check that the seller has the desired assets, turnover, profits, market share positions, technology, customer franchise, patents and brand rights, contracts and other attributes required by the buyer or claimed by the seller."

In the private sector, designated due diligence personnel (e.g., a team of financial, technical and/or legal experts) review and analyze all operative documents submitted by potential contract awardees. Moreover, growing numbers of business enterprises are pursuing additional legal protection for themselves in order to shield themselves from harm if their due diligence efforts fail to uncover serious problems with mergers or purchase transactions.

For our purposes, due diligence in acquisitions means making certain that all the facts regarding an organization are available and have been measurably verified. More on this later.

Effective due diligence processes include Environmental due diligence, like environmental site assessments to avoid liability under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly referred to as the "Superfund law." Manufacturing due diligence involves a number of concepts regarding either the performance of source inspections or surveillances, such as quality system audits. Due diligence in contractor quality is the effort made by safety, quality and environmental professionals to validate conformance provided by sellers to purchasers. Investigative due diligence involves a general obligation to identify true root causes for noncompliance on a standard or contract requirement.

Failure to exert due diligence may (and perhaps should) be considered negligence.

In performance, due diligence audits are very similar to any other audits. I advise clients that it may be less complicated just to think of due diligence as a part of their day-to-day management strategy, like any other internal control.

Identifying the Requirement—First Things First

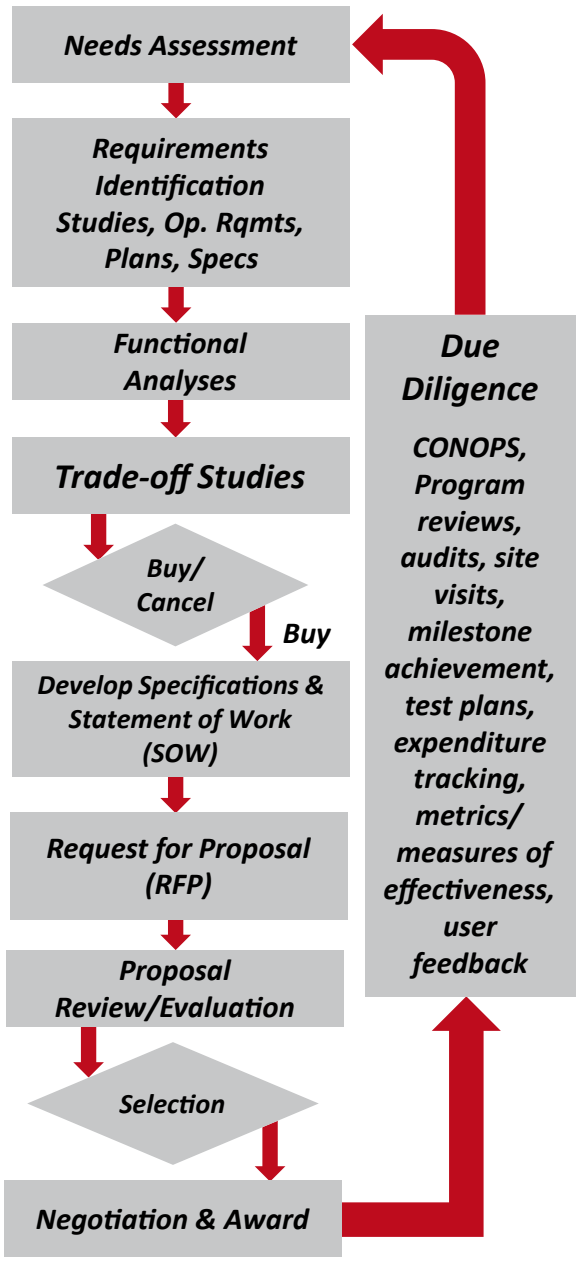
DoD cannot expect contractors to create spot-on products or actionable services unless it is precise in the development and specification of its requirements. The Needs Assessment and the research it both entails and generates impose ongoing due diligence demands and expectations on DoD. Only the most scrupulous developmental processes will do for the "Buy or Cancel Decision," and a flawed Statement of Work will inevitably produce a flawed product or service. See Figure 2.

All this before the contractor even gets a peek at the RFP.

The RFP

A great deal has been written about the RFP process, primarily regarding the U.S. Government and its formal acquisition programs. You can find just as much written about how contractors answer RFPs with (seemingly) credible and executable proposals and their plans to achieve the success expected following contract award. We could discuss that all day, but we will stay with what you need to do to impress upon contractors that to bid for DoD business is to perform in an atmosphere of mutual honesty, mutual understanding, and mutual benefit. DoD must impress on contractors its seriousness and

Figure 2. Due Diligence Throughout the Acquisition



Source for Figures 2 and 3: The author.

commitment—and that, if the product does not achieve the goals for which it was built, a heavy cost could be exacted in mission failures and losses of life.

The RFP's size and complexity are functions of the work requested. However, regardless of the physical size, the RFP must include many fundamentals, each well-researched and unambiguous. Technical specification of the required product or service desired should be as precise as possible. Include an abbreviated management plan, again containing material previously developed (e.g., objectives), plus organizational responsibilities, interfaces, reporting requirements, regulatory requirements and schedules.

The RFP is the sum of all the research, analyses, and intelligence collection that you have done. It must be scrupulously performed and just as scrupulously reflected in the RFP, if the acquisition is expected to obtain the product or service that the troops need.

How well the contractor understands and is willing to comply is the subject of the next section.

The Proposal

An ethical contractor, like an ethical management consultant, should never bid on a job he or she cannot do well.

Proposals must do more than answer the mail—they must answer the need.

Upon receiving the RFP, it is hoped that the contractor will analyze it thoroughly to determine whether there is an advantage to be gained in responding with an offer of work. The contractor's proposal should address every point of the RFP, in accordance with the stated provisions.

Some companies have business development personnel ready to respond to any RFP, either by themselves or with a staff of nameless, faceless, "cut and paste" commandos. Resulting proposals often are mosaics of favorite blurbs from previous proposals. The objective: Get the contract first, and then worry about how to perform the work. Be afraid—be very afraid!

Proposals require the greatest possible due diligence from both the contractor and the DoD PM. Review must go far beyond block-checking and page-counting by cubicle-dwellers. Proposals must be more than just correct and comprehensive. They must be forthright, straightforward and free of deception, credible beyond question, and scrupulously reflect the state of the contractor's organization and management approach. The Proposal is "cradle to grave"; it should describe the entire life cycle of the product or service.

The Statement of Work must be as it was written, but now with the contractor's description of how it will perform your tasks. This is critical. The proposal must be responsive to the DoD's needs as specified in the RFP, complete with performance requirements and measures of effectiveness.

The Management Approach—again restating yours but with the contractor's execution plan, specifies that the design process (if appropriate) is adequately defined and incorporates appropriate technologies, such as computer-aided design; databases are comprehensive and test and evaluation procedures are established or confirmed, and life-cycle requirements are defined.

A comprehensive proposal also should include (in some format or another):

- A quantifiable summary of the organization's performance track record with similar projects
- Adherence to statutory and regulatory requirements
- A vision of the outcome
- Products and services and their end uses
- Comparison of the organization's products and services with those of potential adversaries
- Warranties, guarantees, and follow-on service
- Synergies and innovations
- A formidable understanding of the threat necessitating the product or service and whether the products or services address the threat for which they were developed
- Post-delivery service support (hotline, maintenance, complaints, upgrades, acquisition from stateside sources not deployed forward, etc.)

There should also be evidence (often separately provided) of contractor soundness and the assumptions underlying that soundness (i.e., will the contractor go under if it does not win the contract?).

A contractor, in order to get the job, may underbid (i.e., "low ball") the competition, often expecting to recoup lost money in amendments, modifications and extensions. They often succeed, but they just as often wind up working nights and weekends "for free" because the money to pay for all those deliverables simply isn't there. Another unacceptable reaction is for the contractor to assign the work to less-qualified personnel because the cost is less than that of the original personnel assigned. When this is planned at the outset, it's often called "bait and switch" and is unethical. In any event, this risks delivering a low-quality product or service, not what is being paid for—and, even worse, not what the troops need.

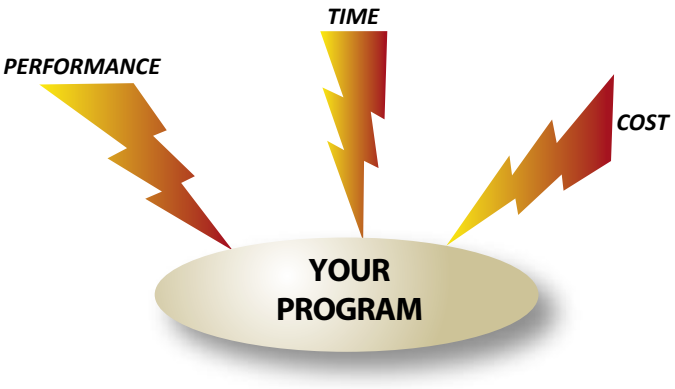
When the contractor complains to his or her congressman, you really need to have your act together.

Review the proposal carefully, to ensure that you will be getting exactly what you asked for within the time, funding, and quality constraints you stated—before you sign on the dotted line.

Execution

From the first moment of the acquisition process, PMs operate in a "triple threat" environment, as gloomily described in Figure 3. Performance is critical, and the reader is reminded that there should be no doubt in anyone's mind about what the product is supposed to do. That's why the Concept of Operations and the Statement of Work must be scrupulously developed, understood and followed. Time and cost often have an inverse relationship with performance. That is, the contractor often wants more time and funding, in return for lower product expectations. Again, program success in the triple threat environment requires due diligence in internal controls—constant and unwavering.

Figure 3. The Triple Threat Environment



And all credible organizations, military and civilian, require comprehensive and meaningful internal controls. A due diligence audit of these controls should judge not only the products of the controls (e.g., records and reports), but also the sufficiency and comprehensiveness of the controls themselves and the level of importance and relevance attached to them by the contractor. Private sector organizations that let their internal control processes slide, or do not take action on problems surfaced by the controls, deservedly lose their credibility—maybe even their existence.

Acquisition managers may need outside help from additional personnel with specialized experience, expertise or certification.

Summary

Many organizations in both the public and private sectors undertake the due diligence process with insufficient vigor. In some cases, the prevailing culture suffers from malaise and views due diligence as a perfunctory exercise to be checked off quickly. In other instances, the outcome of the due diligence process may be tainted (either consciously or unconsciously) by stakeholders who stand to benefit personally or professionally from contract awards.

DoD must guard against such casual or flawed attitudes from impacting its programs. A robust and actionable DoD due diligence strategy can prevent costly failures—measured both in lives and funds. Moreover, failures and/or shortcomings in one mission area (e.g., intelligence collection) also can adversely impact related missions (e.g., power projection). Those same failures will have profound consequences not only on our security, but on our national posture and international reputation.

I close with my favorite quote from 19th-century jurist Edmund Burke: "The only thing necessary for evil to triumph is for good men to do nothing."

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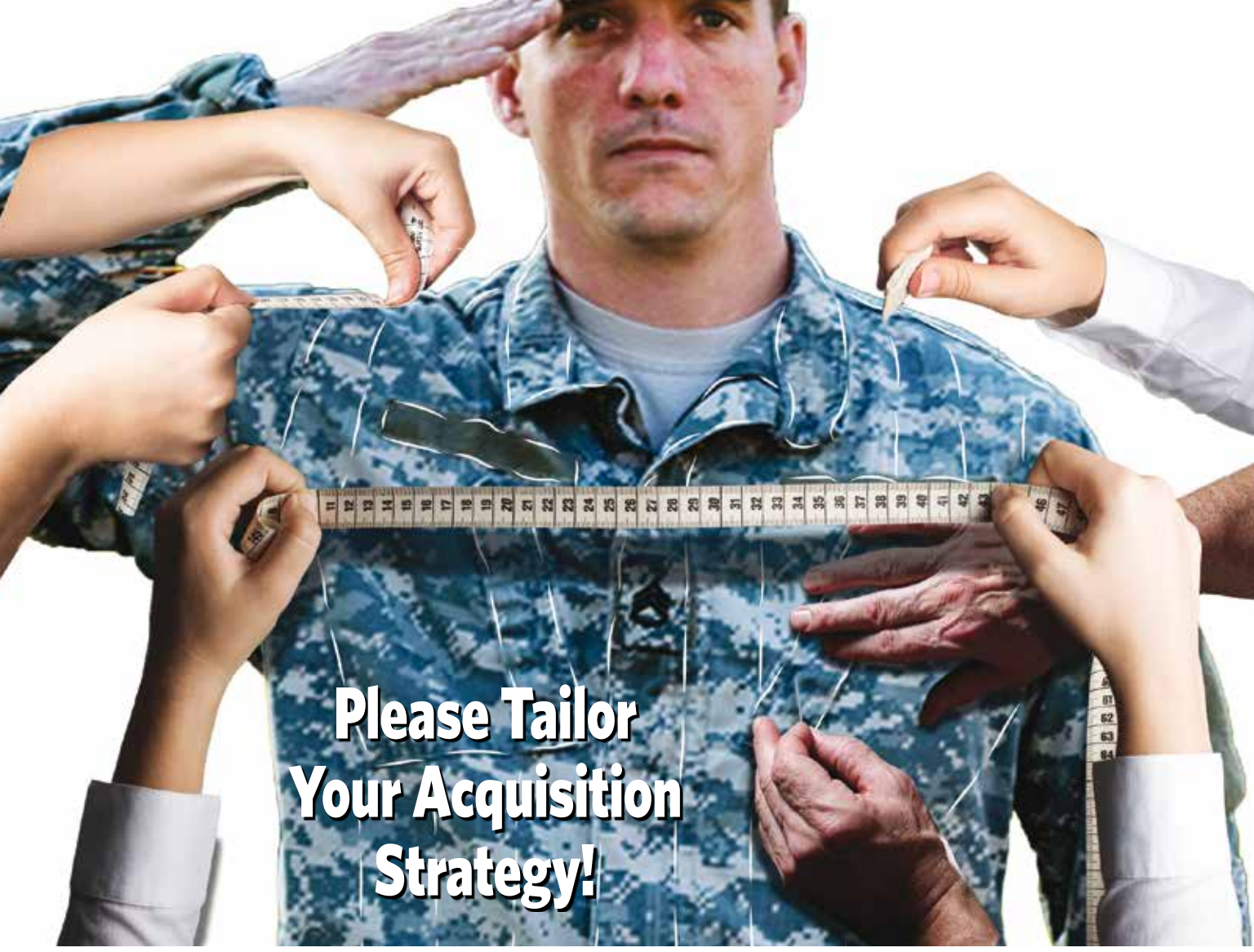


Please Tailor Your Acquisition Strategy!

Brian Schultz

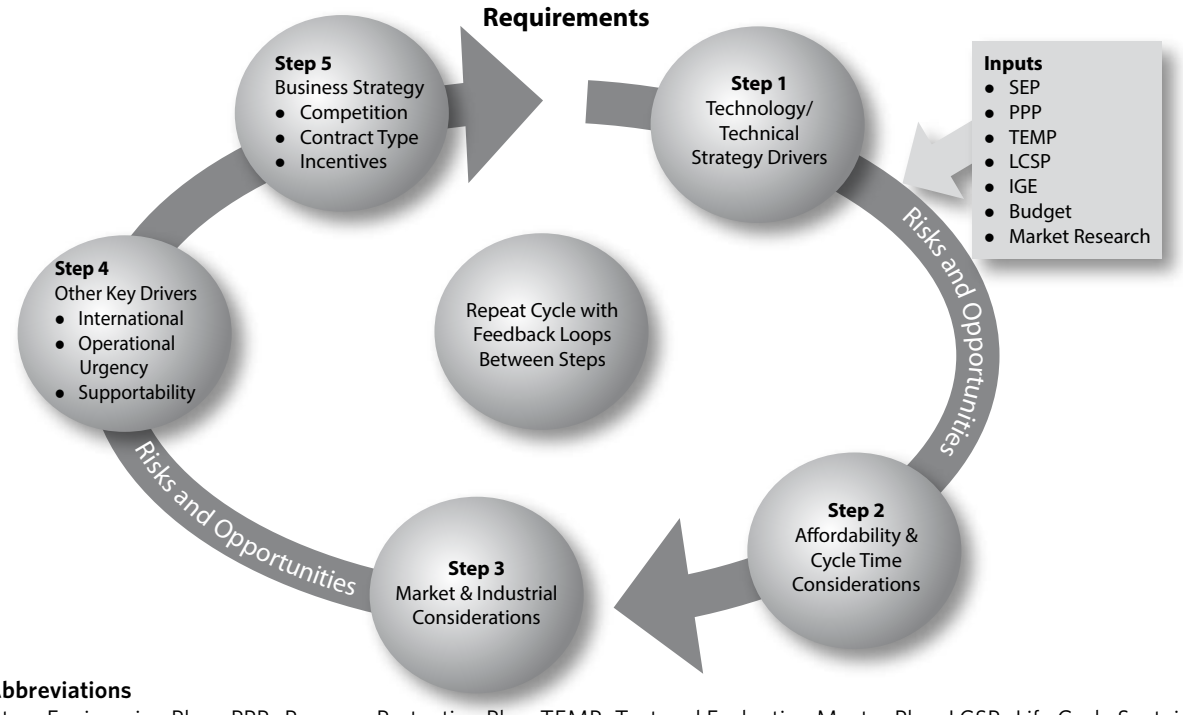
"Strategy 101 is about choices: You can't be all things to all people."

—Michael Porter, noted academic expert on strategic thinking

The guidance from Department of Defense (DoD) leadership is very clear when it comes to developing acquisition strategies. Every program should consider and propose tailoring of information, work efforts, and decision reviews if this tailoring will result in a more cost-effective approach. The words tailor and tailoring appear 48 times in the Aug. 10, 2017, DoD Instruction 5000.02. However, as is the case with most complex acquisition tasks, no single cookbook solution will work for every program.

Schultz *is a professor of Program Management at the Defense Acquisition University's Fort Belvoir, Virginia, campus.*

Figure 1. Integrating Acquisition Strategy Elements



Key to Abbreviations
SEP=System Engineering Plan; PPP=Program Protection Plan; TEMP=Test and Evaluation Master Plan; LCSP=Life Cycle Sustainment Plan; IGE=Independent Government Estimate

Source: WSM 014 Integration Topic (Defense Acquisition University workshop)

As the Michael Porter strategy quote suggests, an important part of any strategy is making good choices, including what not to do or pursue. In the context of a corporate business strategy, a company typically will determine what it is good at and then use that core competency as a competitive advantage to grow its business and increase shareholder value. Companies realize they cannot be everything to everybody, so they play to their strengths and choose to avoid opportunities where they are weak. This mind-set of playing to strengths, choosing opportunities carefully, and determining what not to pursue also applies to DoD acquisition. DoD program managers (PMs) should consider similar factors when developing an acquisition strategy.

When I participate in workshops, courses, and other training events with DoD acquisition workforce staff, I often am asked how we should go about streamlining and tailoring the program's acquisition strategy. This topic is the central theme of our Acquisition Strategy Development Workshop (also known as WSM 014 in the Defense Acquisition University i-catalog). The following discussion captures some of the many of the points I try to convey based on my PM experiences. While the final strategy will reflect the key tailoring decisions, there are some fundamental building blocks that should be considered.

Start With Program Priorities. It may seem obvious, but PMs need to determine the priorities that will drive their strategy. These priorities are not to be confused with understanding and analyzing user requirements and the resultant trade-space, some of which will be executed after contract award in a development effort. The starting point should be the upfront analysis to assess the relative importance of cost versus schedule versus performance. For example, there are trade-offs associated with prioritizing schedule over cost and performance and this determination will drive the overall strategy and tailoring decisions.

On the other hand, a program may be more willing to accommodate some schedule slippage and cost growth to achieve greater technical performance. Understanding this relative importance can drive other strategy considerations, including scope, constraints and even contract type and structure. This analysis should involve acquisition leadership, user and test communities to ensure a common understanding and alignment of stakeholder expectations. The government is required in the request for proposal (RFP) to state the relative of importance of cost versus no-cost factors, but this should be determined well in advance of developing the RFP. It is useless to tailor a strategy without thinking through the cost, schedule and performance priorities upfront.

A few years back, my team managed an urgent surveillance radar program that was to be deployed to support emergent combat operations. Based on the importance of schedule, we structured the program to accelerate tasks and conduct concurrency in site design and radar production. We recognized

that some aspects of the program, including quality and cost, would not be optimized based on rushing everything from contract award to production sequencing and site deployment.

I have observed programs that were essentially procuring commercial-off-the-shelf (COTS) equipment but had program constraints that resulted in a longer-than-expected fielding cycle. An example was a program with a requirement to conduct a significant operational test on the COTS equipment before it was approved for full-rate production and fielding. This testing would add at least 18 months to the schedule for initial operating capability. Rather than wait for a limited procurement of the COTS items as test assets, followed by a gatekeeper event like Initial Operational Test and Evaluation, this program could consider an alternate path. Since the item is COTS and is used by others, its effectiveness and suitability already have been demonstrated for those users who are operating it. Assessing the test and operational data available from these existing users could eliminate the need for another lengthy test cycle. Using new COTS equipment in operational demonstrations and exercises also could supplement the existing test data to help assess whether the COTS equipment should be acquired.

Perform Prerequisite Tasks and Employ Critical Thinking

In order to make informed tailoring decisions, PMs should examine evidence that supports the proposed tailoring. In the context of the acquisition strategy, tasks such as market research, identification of framing assumptions, and risk and opportunity management are good starting points to provide that evidence. PMs and their teams may have some preconceived notions about the best alternative for the strategy and some tasks that could be tailored. While these notions may be based on experience and good judgment, PMs should keep an open mind as to other alternatives and new possibilities. The pace of technological change is so rapid that previously unassessed new approaches now may be relevant for consideration.

As an example, consider software reliant programs. The traditional waterfall method has been used in DoD (and industry) for decades, and has wide acceptance. Based on recurring information technology acquisition problems, the traditional waterfall method now is being challenged by new methods such as Agile and Agile DevOps. These innovative software development methods are based on the Agile Manifesto and may require policy or regulatory waivers, depending on how the method is implemented. The acquisition strategy is an appropriate vehicle to obtain these waivers but should be based on a sound business case.

Many commercial companies have employed cloud computing technology, automated test and development tools, and new methods to rapidly develop and deliver software to their users and customers. Likewise, many DoD programs now either are migrating their existing processes or starting out with this new method.

Critical thinking is necessary since it enables a disciplined, rational and structured approach to help design the way forward. There are many critical thinking tools available and we address one in detail during the WSM 014 workshop. The team developing the strategy should ensure that all the key players involved in developing the strategy have the appropriate training in the particular critical thinking approach employed. This will help ensure a clear focus of the thinking process.

Another suggested technique is the use of powerful questions related to the strategy from reviewers independent of the program team. These questions can create new awareness and challenge the status quo, generating additional ideas that can help design an effective strategy. The questions help us to think about possibilities to overcome any obstacle that will negatively affect cost, schedule and performance expectations. The WSM 014 workshop conducts topic exercises around questions for the team to consider and they are tailored to fit the program circumstances.

Several years ago, my team used brainstorming and critical thinking questions to help identify a way ahead to renegotiate a contract that was tainted by fraud involving a senior DoD acquisition official. What initially seemed an impossible task was unexpectedly executed with very little difficulty. We even reduced the contract price by more than $12 million!

Consider the Industry Perspective

Since the targeted customer of the acquisition strategy (and subsequent RFP) is industry, looking at the strategy through their lens is vital to future success. DoD teams that have little or no industry experience should seek assistance with this task. Erroneous assumptions about industry contractors, including their commitment, incentive to control costs, and capability to provide the product or service within the contract terms, can lead to disaster. I suggest to the teams that soliciting comments on a draft RFP is only a small part of this effort.

The following are a few examples of pre-RFP information that should be considered and can often be obtained through appropriate research efforts:

Financial situation and motivations. Not every company is motivated to control costs with a cost or incentive type contract. I worked in a business unit at a commercial company that made great profit margins on most of our work. I often was more concerned about growing my sales numbers at the expense of margin on many DoD contracts. Teams also should consider a company's ability to absorb losses on a risky fixed price contract.

Strategic alignment. Companies tend to focus on opportunities that are closely aligned with their corporate strategy. PMs and their teams should understand where the new program fits within company priorities. In some cases, industry will invest to not only win the contract but also to enhance the product or service.

Leverage. We'll define leverage as the relative bargaining power of industry to DoD and to a company's competitors. Knowledge of the mission area and corporate market share are good starting points to consider. Leverage can also apply based on time pressures and ability to meet financial goals. When I worked in industry, I could offer substantial discounts at the end of the quarter when I was trying to hit my new booking goal.

Suppliers and outsourced content. Given the ramp-up in outsourcing across multiple business domains, DoD teams need to understand both the potential prime and key suppliers. Many programs have seen cost and schedule issues associated with subcontractors and were surprised at the extent of the prime's outsourcing. Several strategy considerations will be affected if significant outsourcing is expected. Multiple tools exist that can assist teams, but the supplier management risk mitigations, to be effective, must be planned early and be included in the RFP and contract.

The imperative to better understand industry perspectives is gaining momentum. In addition to the DAU course ACQ 315, Understanding Industry, initiatives such as Reverse Industry Days are becoming popular. A Reverse Industry Day is intended to provide an opportunity for government employees to listen to senior industry speakers discuss industry's view of market research, bid process, evaluation criteria, incentives, bid pricing, and similar topics.

Iterate and Integrate the Strategy

The acquisition strategy typically involves a very broad and far looking approach. Bringing everything together in an integrated manner is one of the bigger challenges. The flow of content development depicted in Figure 1 represents one way to develop this integration. The flow begins with requirements and then begins with the technical strategy that often drives other, following strategy elements, including tailoring of these elements to support the technical approach. It is similar to the systems engineering process in that this should be an iterative and recursive effort, repeating steps and at different levels in order to optimize the strategy.

Final Thoughts

Developing a tailored and streamlined acquisition strategy often is a difficult task. While many tools and template are available to assist in the development, there is no one-size-fits-all approach. The upfront planning and data gathering are critical and should be aimed at determining parameter importance, conducting prerequisite planning tasks, using critical thinking, and considering the industry perspective.

There are not a great deal of data and research on tailoring approaches, lessons learned, and benefits realized. I am very interested to discuss and review your thoughts, lessons learned, and experiences on this subject. Thanks in advance for your consideration.

The author can be contacted at **brian.schultz@dau.mil**.

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How Commercial Space Spurred DoD Innovation

Michael Schlacter

Photo courtesy of the Missile Defense Agency.

Anyone who has spent an appreciable amount of time in Department of Defense (DoD) procurement knows that the subject of acquisition reform surfaces from time to time. Common critiques are that the process is slow and unresponsive to the demand signal, or that the capabilities are expensive and unaffordable. The corporate process responds to these critiques and implements changes of varying scales with the hope that, this time, the changes will be long lasting.

No mission area seems to be immune from this feedback, and space in particular has been under the microscope in recent years. The Government Accountability Office (GAO) has reviewed major, non-launch space programs more than a dozen times since 2010, comparing them by their relative cost overruns and schedule slips. Space was also featured in the Fiscal Year (FY) 2017 National Defense Authorization Act, Section 1616, in which legislators asked the DoD to look at the management and organization of national security space activities.

On the other end of the spectrum is the coverage of rapid capability organizations such as the U. S. Air Force's Operationally Responsive Space and Rapid Capability Office organizations. By highlighting these organizations, writers seem to say there are places where development can occur quickly and costs can be contained. Are there other places where this can happen? Yes, it's commercial space.

Commercial space has transformed how the DoD looks at the overall space industry. In the past, the DoD relied mostly on large satellite programs with military-specific hardware and software. Today large satellites, small satellites, hosted payloads and managed services all have the ability to fill military niches for which they are uniquely suited, and the explosion in commercial space lift is nothing if not exciting.

Can commercial space encourage the DoD to change? Absolutely—and not just on the surface like the DoD using a commercial products and services contract strategy. Instead, the change can occur at the fundamental management level by suggesting a new, innovative way to lead DoD space projects.

One DoD space program matched the speed of its commercial partners and gained benefits when it achieved that speed. Maybe this is a story of acquisition reform after all—how a single program decided to reform itself.

Schlacter *joined the Missile Defense Agency in 2006 and currently is the deputy director of the space systems program office. He has been the Spacebased Kill Assessment program manager since 2014.*

Spacebased Kill Assessment

Since the 1980s, experts have known the benefit of having a battle damage sensor observe a national missile defense engagement. That benefit is the ability to answer the question: Did we destroy the lethal object?

To study that question, the Ballistic Missile Defense Organization conducted experiments to study the signature of a high-speed collision in space. The Missile Defense Agency (MDA) continued that work by building models that explained the physics of a high-speed collision and developing a test sensor called the Kill Assessment Sensor Package, or KASP, that supported maritime tests for over a decade.

In 2014, MDA started Spacebased Kill Assessment, or SKA, with an aim to provide a kill assessment capability from space. At its core, SKA has two fundamental tenets in its approach: First, it builds upon the previous physics-based collision modeling and the KASP sensor design heritage to reduce risk. Second, the network of SKA sensors are to be hosted on commercial satellites as MDA's pathfinder for an alternative to the traditional, large satellite space program.

During the SKA design concept phase, it became clear that nearly every technical challenge would pale in comparison to the schedule challenge MDA would accept when it selected the host for the SKA sensors. Compared to a traditional DoD launch schedule, the commercial host's launch schedule is fixed, meaning SKA sensors delivered late would miss their ride into space.

Just as important, the schedule was highly compressed. For example, it forced the sensor development to be accomplished in 15 months and required MDA to deliver flight hardware to the satellite integrator starting at month 19. Ultimately, MDA triumphed over those challenges. This raises two questions: (1) How did SKA become a fast program; (2) and what were the benefits of being a fast program?

How To Be Fast

Programs just starting are in the unique position of being able to establish a business culture more effectively than programs already under way. This is because the programs under way cannot just establish a business culture—instead they have the harder task of changing one already in use. The MDA leadership team exploited the opportunity of starting a program with a clean slate when it crafted the SKA business rules from scratch in 2014 and specifically employed several techniques to proceed rapidly. The techniques listed below were among the most effective and are portable to nonspace programs.

Technique 1: Establish program priorities. Establishing priorities seems like a common-sense approach. However, it came as a surprise to learn how few programs actually do that. Without established priorities, program execution can quickly become focused on delivery of all the desired program performance with little regard to cost or schedule; in other words, an all-access pass to a Nunn-McCurdy breach. To guard against that, on the first day of the program, the leadership team established the following priorities:

- Schedule
- Cost containment
- Performance

Schedule obviously was the highest priority because SKA sensors delivered late would miss their ride into space; the other two priorities were assigned their order because of their alignment with the SKA acquisition strategy and existing MDA acquisition culture, respectively.

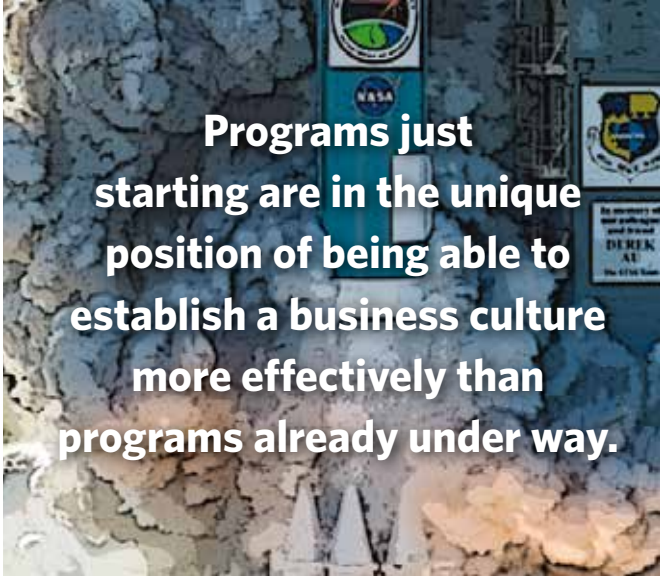
Establishing priorities had the benefit of creating decision-making space for the program to trade cost or performance to ease schedule pressures. Having trade space is absolutely paramount to program managers because the best shape of any program will be on the eve before the program starts. As soon as the program is under way, it cannot avoid the fate predicted by Helmuth von Moltke the Elder that "no plan survives contact with the enemy" and program managers need internal trade space to find resources to apply to challenges.

On several occasions, the program spent funds (priority No. 2) and adjusted performance (priority No. 3) to stay inside the schedule box (The No. 1 priority). In retrospect, it would have been nearly impossible to go as fast as the program did without having a priority-based system in place to support trade studies.

Additionally, establishing priorities gave the program complete alignment—among the staff within the MDA team, among the staff within the development team and between the two teams. Team misalignment creates friction in the gears—decision-making becomes difficult and slows the progress once a decision is made. MDA observed that the government and developer teams worked faster by themselves and with each other once they embraced the prioritization schema. This accelerated pace occurred because there was never a lengthy discussion on what the priority was (schedule) and what resources were candidates for donation (cost and performance).

All in all, MDA saw that once the program became more comfortable with the priority-based trade process, lengthy discussions and program misalignments occurred less and less frequently. Challenges were overcome at the lowest possible level, and it seemed as if the seas of program execution were becoming calmer as the program continued its voyage.

Technique 2: Unrelenting pursuit of decision-making speed. Traditional decision-making routines can be good because they bring regularity to management teams. However, some decision-making routines can be bad if their cadence is too slow and teams have to wait too long before the next session to make a decision, or if the routines themselves generate unnecessary work. To that end, the MDA team threw tradition



out the window and put business rules in place to increase decision making speed, for example:

The MDA developer team increased the frequency of decision-making forums. In lieu of monthly or quarterly program management reviews, the full SKA team met weekly to make decisions. Each meeting was a raw, unvarnished review of progress, and meeting weekly minimized the amount of time issues sat idle.

The government leadership team met twice each week to discuss "What did you learn recently?" This practice is similar to one commonly used in operational units called "stand ups." This session kept issue status up to date and ensured that the management team shared a common operating picture.

SKA avoided practices that robbed speed and employed other practices that increased speed. With government purpose rights in place and easy-to-use online documentation, sharing and storage, the program limited the number of contractual plans and reports to five. In addition, no meetings required read-ahead material nor did any meetings require a "pre-meeting" to get organized. Additionally, the government program manager was onsite at the developer location 1 day per week, with some engineers being onsite up to 3 days per week, effectively creating a badgeless work environment where decisions could be made face-to-face and nearly as quickly as sending an e-mail or text message.

The Benefits of Being Fast

Keeping on schedule while rapidly delivering a capability should be sufficient satisfaction. However, the program also noticed other benefits of being fast—some quantifiable, others intangible.

Cost containment. Early in the program, a cost estimator told the SKA leadership team that the greatest cost driver on development programs is the salary of the "standing army" that must be paid even if the schedule slips to the right. It follows that if a program can stay on schedule, then cost containment is easier to achieve.

That was true in SKA's experience. By staying on schedule, additional costs for salary were contained. In fact, the overall program cost increased less than 5 percent with the major contributor being price increases for electronic parts. The bottom line is that the labor costs for the development team typically will surpass the costs for parts and raw materials, fees for outsourced services, etc., so that priority attention to schedule and mindfulness of the costs of the standing army will contribute greatly to cost control.

Increased credibility. Knowing how to go fast allows programs to create schedule reserve against unforeseen challenges, and judiciously using that reserve allows programs to stay on schedule.

Staying on schedule can be one of the best ways to gain credibility with those who have a role in DoD acquisition programs—the joint warfighters, Congress, the GAO, etc. That credibility can forge solid relationships between stakeholders when things are going well, and can buy the program additional time when things are not going so well.

Benefits to joint and enterprise partners. In today's world of increased interoperability within a joint or enterprise architecture, programs easily can be affected by the performance of their interfacing neighbors. That means a lagging program providing products or services to the enterprise will affect all interfacing programs' ability to meet schedule and therefore affect their cost bottom lines due to the expense of their own standing armies.

In SKA's experience, the speed the program created had a cascading effect: Speed allowed SKA to keep schedule, which provided products and services to interfacing programs on the timeline it promised, therefore minimizing cost impacts to those same programs. In a broader sense beyond SKA, for an agency managing a diverse enterprise, the cost savings are magnified and can be impressive if all interfacing programs are managed to this common goal (i.e., schedule speed).

Conclusion

SKA learned that immediately establishing and sticking to program priorities as well as an insistent pursuit of decision-making speed provide incredible program advantages that went beyond the obvious advantage of maintaining an aggressive program schedule.

Rapid capability organizations are not new in the DoD and there are numerous examples of how military space programs succeeded in going fast. Their stories should be read and scrutinized for what worked and what didn't work. The Spacebased Kill Assessment story is proof that nearly any program can go fast—all it takes is courage, decisiveness and the willingness to try something new or different. Maybe this is what real world acquisition reform looks like after all.

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2017
THE DEFENSE ACQUISITION WORKFORCE AWARDS

The Honorable Ellen Lord, Under Secretary of Defense for Acquisition, Technology, and Logistics (USD[AT&L]) hosted the ceremony. She emphasized that "Defense acquisition success is critical to providing the warfighters what they need quickly and at the lowest possible cost. Our success is dependent on the outstanding capability and performance of our people." The Honorable Patrick Shanahan, Deputy Secretary of Defense and ceremony distinguished guest, echoed those sentiments, stating that the acquisition workforce will "help [the Department of Defense] become even more competitive than we are today."

The Defense Acquisition Workforce Individual Achievement Awards highlight premier individuals who demonstrate the highest levels of excellence and professionalism in the acquisition of products and services for the Department of Defense. These awards recognize individuals in each of the acquisition functional disciplines.

The Defense Acquisition Workforce Development Innovation Awards were established to recognize excellence by acquisition organizations in developing unique and innovative solutions to ensure that their workforce is well equipped to deliver world-class capabilities to the warfighter. The award highlights demonstrated exceptional outside-the-box thinking and progress in tackling workforce development challenges.

INDIVIDUAL ACHIEVEMENT AWARD WINNERS

The Honorable Ellen Lord presented the awards, accompanied by the Honorable Patrick Shanahan; and Lieutenant General Anthony Ierardi, U.S. Army, Director, Force Structure, Resources and Assessment (J8) Joint Staff.

Lieutenant Colonel
Thomas A. Atkinson
U.S. Special Operations Command |
Program Management

Mr. Ulises Cartaya
U.S. Special Operations Command |
Services Acquisition

Mr. Lee R. Rosenberg
Missile Defense Agency |
Small Business

Photos by Specialist Tammy Nooner, USA.

Mr. Thomas Sachse
U.S. Navy | Test and Evaluation

Mr. Skip Hinman
U.S. Air Force | Requirements Management

Gunnery Sergeant
Tamalia C. Adams
U.S. Marine Corps |
Acquisition in an
Expeditionary Environment

Ms. Melissa Panarelli
Defense Contract Audit Agency |
Auditing

Mr. Gary V. Trimble
U.S. Navy | Contracting and Procurement

Dr. Wilson Rosa
U.S. Navy | Cost Estimating

Lieutenant Colonel
Andrew R. Vrabec
U.S. Air Force | Earned Value Management

Mr. Daniel M. Carroll
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U.S. Army | Facilities Engineering

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Mr. George N. Graham, Jr.
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Life Cycle Logistics

Captain Charles M. Stuart
U.S. Navy | Production, Quality, and
Manufacturing

Dr. Charles A. Bass, Jr.
U.S. Army | Science and
Technology Manager

DEVELOPMENT INNOVATION AWARD WINNERS

Large Organization

Defense Contract Management Agency, Fort Lee, Virginia
The Honorable Ellen Lord; Kathleen Butera; Marie Greening; Chris Zubof; the Honorable Patrick Shanahan, Deputy Secretary of Defense; and Lieutenant General Anthony Ierardi, Director, Force Structure, Resources and Assessment (J8), Joint Staff

Small Organization

U.S. Army Contracting Command, Orlando, Florida
Front Row: Patricia Neal, Kimberly Tedeschi, Servola Frazier, Rosa Rivera, Jeff Claar
Back Row: Kristie Brandon; the Honorable Ellen Lord; Joseph Giunta, the Honorable Patrick Shanahan; and Lieutenant General Anthony Ierardi.

Photos by Dirke Williams, Department of Defense.

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 e-mail to datl@dau.mil. Submissions must include each author's name, mailing address, office phone number, e-mail 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
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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.

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