

A Guide for DoD Program Managers



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A GUIDE FOR DOD PROGRAM MANAGERS

80 Percent of What Department of Defense Program Managers Need to Know to Run an Effective and Efficient Program

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December 2014

PUBLISHED BY THE
DEFENSE ACQUISITION UNIVERSITY PRESS
FORT BELVOIR, VIRGINIA

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PREFACE

The first responsibility of the key leaders in the acquisition workforce is to think.

-Frank Kendall¹ Under Secretary of Defense for Acquisition, Technology, and Logistics

Please read this first. We say this because we want readers to understand why we wrote this book, for whom we wrote it, and what we acknowledge as the limitations of what we have to offer.

We believe that success as a program manager (PM) begins with the way you think about the job. Toward that end, the goal of this book is to help calibrate your brain for program management duty. Entering into the right frame of mind to execute your responsibilities is not easy, but is vitally important. Even as experienced PMs, we wanted to find a "Program Management for Dummies²" book to check so that we did not overlook something obvious. To our surprise, the book didn't exist.² We believe even experienced PMs can benefit by "recalibrating" their thinking. We hope the book before you will help you understand your role as a PM and successfully navigate the complex and dynamic environment of Department of Defense (DoD) acquisition.

DoD acquisition management demands specialized skills and knowledge, which may find application in other program management environments but which are unique to the DoD acquisition system. Individuals assuming program management responsibility for the first time will be challenged to succeed if they lack a basic understanding of DoD program management principles, processes, and terminology. This book seeks to provide that foundation—a beginners' guide and quick reference to the foundation of good program management.

This book reflects our belief that leadership matters and that effective PMs can significantly influence the likelihood that a program will succeed. Running almost any size program or project entails working with a diverse program management team. It also entails collaborating with other members of the DoD community—users and warfighters (customers, in traditional parlance), program advocates, members of the Service or Joint Staffs, industry representatives, and even members of Congress—whose goals and agendas may or may not align with your own. Whether in guiding your own program management team or seeking solutions with other members of the DoD community, the PM's job requires active and decisive leadership to keep a program on track. You must fos-

Frank Kendall, "The Optimal Program Structure," Defense AT&L 41, no. 4 (2012), pp. 2-3.

² Project Management for Dummies by Stanley E. Portny is available, but it has limited applicability to the structured DoD program management environment.

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ter consensus and support among your staff to ensure program success. Leadership is essential and is discussed in detail among the "intangible" qualities of program management later in this book.

The Defense Acquisition University (DAU), the Program Management Institute, and a variety of other organizations offer countless training courses that go into more depth and detail than we offer in this book. Our own experience with these other training sources has been almost entirely positive, and we strongly encourage readers to pursue more in-depth training from these organizations. The purpose of this book is not to replace or subvert these training and education venues but rather to jump-start and supplement their offerings. We also know that people learn through a variety of ways and hope to provide an aid for those who learn by reading books or stories and those who have time on airplanes to read after reviewing the Sky-Mall catalog sitting in front of them.

We have written the book with an eye toward an O-5- or O-6-level officer (or comparable civilian grade) about to take over a large weapon-system program, but we like to think that most of the ideas in this book are scalable. That is, the lessons and recommendations are nearly as useful for a junior company-grade officer or civilian responsible for a small program or subsystem as they are for a flag-level or general officer responsible for a multibillion-dollar major defense acquisition program (MDAP) or major acquisition information system (MAIS).

Although this book represents more than 45 years of collective experience in DoD acquisition and program management, it's important to understand that it also reflects the unique perspective, experience, and opinions of its two primary authors. Because both authors come from an Air Force background, it reflects an Air Force perspective and, in some instances, Air Force-unique terminology. Although we have attempted to bring a Joint perspective and avoid a Service-specific lens, we acknowledge our bias. By and large we believe there are "right ways" and "wrong ways" to run a program. If a reader disagrees with some of our assertions, that's a good thing. It affirms our belief that program management is a thoughtful discipline that does not lend itself to dogma, "cookie-cutter" solutions, or one-size-fits-all processes.

This book was never intended to be a comprehensive "how to" guide or an exhaustive survey of program management topics. More than anything else, it represents a collection of lessons learned in the areas that we believe are critical to program success. This book is intended to provide a way to think about your role as PM and build a foundation of knowledge upon which you can better navigate the endlessly complex DoD acquisition and program management process.

ACKNOWLEDGMENTS

The ideas and lessons contained here are not entirely the authors'. We benefited greatly from the wisdom of numerous PMs and acquisition leaders within the Air Force, Army, Navy, and Marines, as well as among our defense industry partners.

We are particularly indebted to the faculty and staff at DAU. Dr. Roy Wood, dean of the Defense Systems Management College (DSMC) supported this effort from the time he learned of it. He contributed a great deal to ensure the book was published by DAU Press and to the refinement of this book by asking his staff of acquisition experts to review the work, paying special attention to the areas of their expertise. John Krieger, Pat Barker, and Chuck Cochrane were particularly helpful. Mr. Krieger, a contracting expert, reviewed the book with the same attention to detail employed by top contracting officers in reviewing their contracts! Mr. Barker, an Earned Value Management (EVM) expert, ensured the most recent policies and best practices were presented. Mr. Cochrane, a veteran PM, provided a thorough review and greater clarity to our presentation of this complex subject.

We are also in debt to a number of people who reviewed the work for grammatical errors and clarity. Among these reviewers were Dr. Greg Spanjers, Dr. Joel Mozer, Bill Byrne, Dale Hite, and Dave Lewis. We also had Richard Durrett, a sportswriter for ESPN, review the work to leverage his writing expertise and lack of acquisition knowledge, as we hope this book brings some clarity to acquisition beginners.

Finally, we thank our spouses, Janet Cooley and Heather Ruhm, for their patience and support. As acquisition professionals actively engaged with programs, we have worked on this book with fits and starts at nights and on weekends over the past 5 years. Without our spouses' encouragement and great patience, we would never have completed this work. Thank you, Janet and Heather!

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INTRODUCTION

Program management is the toughest noncombat job in the military

-Anonymous

Congratulations on joining the team of PMs in the government. Whether you are a PM for a large program attracting high interest from Congress or a small government laboratory program, you are entrusted to efficiently and fairly spend our country's treasure. As a PM, you must always keep in mind that $by\ law$ you are responsible for the program—period. Its legal execution, cost to the taxpayers, and capability delivered to the warfighter are your responsibility.

Your job as a government PM is important enough that our nation established laws to make sure you are qualified—of all the career fields in the DoD, acquisitions is one of only a few in which Congress specifies qualifications and mandates training for PMs. Fortunately, DAU is charged with this responsibility and offers numerous training classes and volumes of detailed information on program management best practices, lessons learned, statutory and regulatory do's and don'ts, as well as detailed classes in each of the functional areas—contracting, financial management, systems engineering, and more. We mention this to emphasize that the stakes are high, given that a PM is responsible for spending our nation's treasure to procure systems for our nation's defense. This will require every ounce of professionalism a project manager can bring to the job.

Having attended the full complement of DAU courses for PMs, we hope to bring to this book some of the key elements from that formal acquisition education; however, we do not view this book as a substitute. Rather, we hope this book makes some of the important principles easily accessible to novice PMs and provides expert PMs a quick reference to potentially aid their thinking—sort of a beginners' guide and quick reference to foundational principles of good program management.

As you have discovered (or will discover), acquisition in the government is tough and complex. It involves understanding law (statutes); following your department's implementation of those laws (regulations);

³The fundamental framework, tools, artifacts, and intangibles discussed in this book are applicable to DoD/Department of Energy laboratory programs and projects. The Appendix includes a brief but useful framework for laboratory programs.

⁴Title 10-Armed Forces; Subtitle A-General Military Law; Part II-Personnel; Chapter 87-Defense Acquisition Workforce; SubChapter III-Acquisition Corps.

⁵The Defense Acquisition Workforce Improvement Act (DAWIA), initially enacted by Public Law 101-510 on Nov. 5, 1990, and amended in 2003, 2004, and 2006. It required the DoD to establish education, training, and certification for acquisition professionals.

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technical considerations ranging across science, technology, development, engineering, and production to sustainment; business considerations, including financial management and contracting; testing the system throughout development; and stakeholder considerations, just to name a few. As a result, there are many aspects that demand your attention and lots of ways for a program to fail.

FRAMEWORK

Success as a PM requires vigilance, perseverance, and a quality set of tools, along with the knowledge of how to use them. Because of the complex nature and multifaceted considerations of programs, having a useful way to understand your role as PM is helpful. With this in mind, we propose an analogy or framework⁶ to aid your understanding and help you focus your efforts as a PM.

In many ways, a PM is similar to the leader of an expedition, responsible for the safety of the team and overall outcome, but also reliant on team experts to accomplish particular portions of the mission. Examples of expeditions that come to mind include:

- The Lewis and Clark expedition into the American West (1804–1806);
- Sir Edmund Hillary and Tenzing Norgay's successful summit of Mount Everest for the first time in May 1953;
- Norwegian Roald Amundsen and his party becoming the first to reach the Geographic South Pole on December 14, 1911.

Each of these teams employed its expeditionary tools, professional judgment, and hard-won experience as it encountered obstacles and challenges that hindered its progress. Team members relied heavily on the expertise and loyalty of one another. And each team studied and thought very hard about its approach (strategy) to reach its goal, including both small and large (tactical and strategic) considerations.

In a similar way, PMs must employ tools—to manage a program's complexity, ensure efficient use of resources, and assess program progress—and apply professional judgment and experience when issues arise that threaten a program or hinder progress. PMs must also build a loyal team of experts in functional specialties and learn to use their counsel effectively. Similar to expeditionary leaders, PMs must constantly think

⁶The term "framework" is used here to describe a model or simplified approach to understanding the relationship and dependencies in a complex system. A more complex and hopefully useful framework is provided in "The Basics" chapter.

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hard about the approach their program should take for both major and minor decisions.

This is not to imply that the stakes are the same or goals commensurate with the expeditions mentioned above. Clearly, the expeditionary leaders not only had their professional reputation to win or lose, they also risked their lives as they knew well that prior expeditions with the same or similar goals had ended in failure and death.

But the similarities that demand a professional and thoughtful approach are such that we believe the analogy is worthwhile to frame your thinking as a PM. Specifically:

- Dangers and pitfalls exist in every direction programs can fail for a variety of reasons.
- Consequences are significant—the nation's resources are at stake (blood and treasure) in that future lives will depend on the safety and efficacy of your system. And it is funded with government dollars.
- The situation is unique and dynamic—no program team faced the exact same circumstances. Technology is ever-changing, acquisition laws and regulations change, the industry base is always evolving, and the user's expectations are frequently evolving.
- Intangible human qualities such as leadership, integrity, perseverance, and tenacity to reach a goal are key determinants for success.
- Thinking and decisionmaking are keys to success thinking through every step of the program to ensure firm footing, appropriate support, proper use of tools, and continuous sober decisionmaking while underway.

Although we believe the expedition metaphor is applicable, versatile, and helpful to frame your thinking as a PM, any framework may hinder you from seeing issues from a different and perhaps more useful vantage point or through a different "lens." So we caution the reader: Don't become so wedded to a single way of thinking or perceiving that you lose sight of the bigger picture or your responsibilities. Periodically, you should look for blind spots and challenge your thinking. We'll offer more on this idea later, when we discuss independent and external reviews.

Like an expeditionary leader, PMs must be familiar with a variety of tools and techniques, have detailed intimate knowledge of foundational documents, and bring their personal skills for working with others to navigate a program to success. Accordingly, this book is divided into three main sections following the introductory material and a short re-

view of program management basics. The three sections are: (1) *Tools of the Trade*; (2) *Critical Artifacts*; and (3) *Intangibles*.

Tools of the Trade (section 1) is the longest and is intended to provide a foundational understanding of key functional areas for all programs—financial management, contracting, and systems engineering. We also provide a brief discussion of three other "tools" that we have found very useful—"battle rhythm," earned value management, and independent reviews of the program.

Critical Artifacts (section 2) identifies the documents to which you as a PM need to pay particular attention as they will very likely determine your success or failure. The four documents that we have found most critical for program success are the acquisition strategy, the Acquisition Program Baseline (APB or just "Baseline"), the Integrated Master Plan (IMP), and the Integrated Master Schedule (IMS).

Intangibles (section 3) may be the most important section of the book (we debated moving it to the front for this reason). Section 3 discusses ways to think about the role of PM. We do this by looking closely at integrity (three subtly different definitions of the word); leadership; and collaboration and compromise.

Beyond the basic structure, this is intended to be a practical book to help you in your job. Although we have tried hard to provide valuable insight to help you succeed in your career, and are convinced you should read this book cover to cover, we realize few people—especially PMs—have time to read every page of prose. As a result, we hope to keep the book readable and easy to follow with easy-to-digest features, including quotations that encapsulate important ideas, proverbs and checklists for PMs, and short vignettes that illustrate in story form the key ideas.

PROGRAM MANAGEMENT —THE BASICS

Cost, schedule or performance ... you can have any two but not all three.

-Anonymous

Cost, schedule, performance, and risk define the basic dimensions of program management. We mean several things when we say this. First, PMs are evaluated primarily by their ability to remain within cost and schedule bounds while achieving performance objectives and managing risk. Acquisition program baselines track program compliance with established cost, schedule, and performance targets—and PMs are held accountable when they exceed cost or schedule or fall short of per-

formance targets.

Cost, schedule, and performance also establish the basic "trade space" within which PMs work. PMs and their customers might accept increased costs to meet additional performance requirements, or sacrifice performance objectives to remain within a fixed budget or schedule. PMs sometimes pursue higher-risk strategies that forgo incremental development or robust testing if they are pressed to fit within a fixed delivery schedule. Under different circumstances, they may choose to increase schedule duration (and cost) to mitigate known technical risks. In the technology domain, programs might choose to stick with proven technology solutions—and compromise performance—rather than be the first to adopt higher-risk, "high-tech" solutions that promise greater performance. The PM must navigate through this option space, keeping in mind that long-term results count.

Despite the fundamental role that cost schedule, performance, and risk play in program management, the terms are often misunderstood or applied inaccurately. This chapter seeks to establish a basic understanding of cost, schedule, performance, and risk.

COST

"Cost" and "price" are interchangeable terms in most people's day-to-day life. When we ask "what does it cost?" it's the same as asking "what is the price?" Not so in DoD program management, where contract price can fluctuate based on complex calculations involving both direct and indirect costs, overhead rates, fees, incentive payments, and other billable expenses. A PM often won't know the final "price" associated with a contract until the effort is complete (if then). The discussion of costs is further complicated by the need to differentiate between contract costs, program costs, and life-cycle costs. Within acquisition program management, there is no easy answer to the question, "What does it cost?"

Contract Costs

On a cost-based contract in particular, "costs" typically include all billable and unbillable charges or expenses that a contractor incurs during the course of work it undertakes on behalf of its DoD customer

⁷This discussion does not apply to firm-fixed-price contracts. In these instances, unless the government changes the requirements for a product or service, the total price is agreed to at the outset, contractors do not report costs to the government, and no fee calculation is necessary. The contractor is paid a lump sum (typically in the form of "progress payments") for its work, and the government has little insight (or concerns) about whether the contractor realizes a profit or suffers a loss.

(Figure 1). These costs include both direct costs and indirect costs. Direct costs are further subdivided between material, labor, and "other direct" costs. Direct material costs are costs directly associated with the material necessary to build a product, including raw materials, purchased parts, and subcontracted items required to manufacture and assemble completed products. Similarly, direct labor costs include engineering, manufacturing, material handling, management, and other types of labor services directly associated with producing an end item or service. "Other direct costs" (ODCs) include items or services, such as tooling or consulting, that are neither material nor direct labor but that do not qualify as indirect costs because they are attributable only to a single effort.

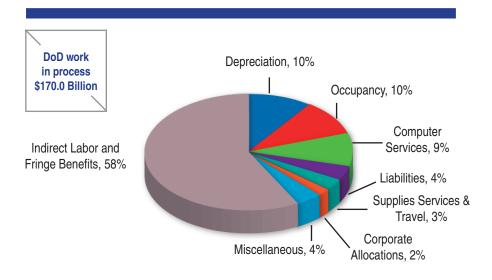
Indirect costs are typically associated with services or expenses that benefit multiple efforts and are thus borne by multiple contracts. Though the allocation of indirect costs is a complex and closely monitored process, generally speaking indirect costs are allocated to different efforts based on relative direct cost. Indirect costs include "plant wide" expenses such as utilities, wages for supervisory personnel, insurance, fringe benefits, and other expenses that support an effort produced within a facility or organization.¹⁰ General and administrative (G&A) costs are special subsets of indirect costs. G&A costs are not only distributed across a facility or plant; they are distributed across an entire company. An example of G&A is the chief executive officer's salary, or other corporate salaries. Three other types of indirect costs are internal research and development (IR&D), bids and proposals (B&P), and cost of money (COM). DoD policy allows contractors to add these indirect costs to DoD efforts because it is recognized that these policies increase the technology base and number of contractors participating in DoD technology programs. 11 While the benefits accrue to DoD as a whole, individual programs bear the burden of funding these costs through indirect charges on every DoD contract.

⁸Indirect-Cost Management Guide: Navigating the Sea of Overhead, 3rd ed. (Ft. Belvoir, VA: Defense Systems Management College Press, 2001). Web edition only (not in print), available at http://www.dau.mil/publications/publicationsDocs/icm_guide.pdf

⁹Ibid, p. 3-1.

¹⁰ Ibid, p. 2-3.

¹¹Ibid, p. 6-11.



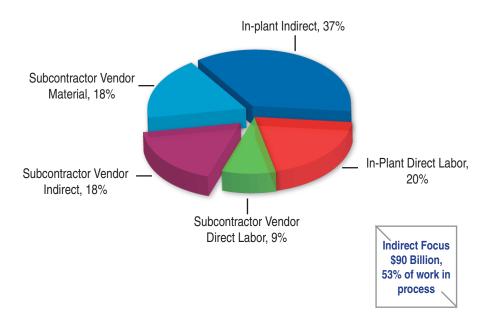


Figure 1. Cost Components of DoD Programs

Saved by Contractor G&A Adjustments

The Joint STARS Prime Mission Equipment Diminishing Manufacturing Sources (PME DMS) program was facing dire straits. In the final year of its System Design and Development (SDD) phase and as it approached Developmental and Operational Testing (DT/OT), the program absorbed a \$13 million congressional cut against its original \$46 million budget. That's a cut of more than 25 percent. The PM spent months trying to fend off the reduction and was now forced to complete his developmental effort with substantially less funding than he had originally budgeted and contracted for. To make matters worse, he was in the final year of a 3-year, incrementally funded, cost-plus contract, and he had very few options in terms of scaling back effort or reducing activity. He was between the proverbial rock and a hard place ... until the prime contractor unintentionally came to his rescue.

The Joint STARS prime contractor was in the midst of a corporate reorganization and consolidation of cost centers. One result of this initiative was to merge the Joint STARS plant and parent organization into a larger, regional organization. Because the business base supported by the plant had gradually diminished over time, the Joint STARS program had been bearing a larger and larger share of the indirect costs. G&A placed a particularly heavy burden on the program. The contractor also made a concerted effort to shift as much effort as possible from indirect to direct charges. The net effect on the program was dramatic. The reallocation of overhead charges to the larger, regional organization and the shift in many supervisory personnel from indirect to direct labor pools more than offset the \$13 million cut that Congress had imposed on the program. The only problem the PM was left to face was how to spend his excess funding.

Though these costs may not be directly traceable to a specific program, indirect charges typically constitute a significant percentage of the overall costs PMs bear on their contracts. According to a Defense Contract Management Agency (DCMA) report, more than 52 percent of costs associated with DoD contractor plants fall into the indirect realm. ¹² This suggests that indirect or overhead charges will, in many instances, exceed direct costs and more than double the overall cost of producing an end item (as compared to direct costs only). Unfortunately, controlling, regulating, or approving overhead rates falls largely outside the PM's area of responsibility; DCMA is largely responsible for negotiating and approving indirect rates. It is important to realize that these rates can change from a DCMA review during or well after the contract period of performance and thereby change the cost to your program. The best approach to avoid unwanted surprises is to establish communication with the responsible DCMA personnel associated with your contract.

Fee or profit makes up the final component of price (Figure 2) after accounting for all direct and indirect charges. Although fee or profit depends greatly on the contract type, we traditionally think of profit as a fixed percentage that a producer of supplies or services collects over and above the cost of producing those supplies or services. On cost-re-

¹² Ibid, p. 1-2.

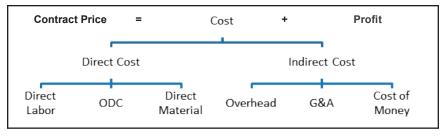


Figure 2. Contract Price Components

imbursable contracts, however, allowing fixed-fee rates would provide a perverse incentive to contractors: the higher their costs, the greater their (absolute) fee. Because of this, simple cost-plus-fee contracts are less common on large acquisitions (usually these are "cost plus fixed fee" or CPFF). More common are cost-plus-incentive-fee (CPIF) arrangements, which are structured to incentivize contractors to be as efficient and cost-effective as possible. A more detailed discussion of incentives is provided in the contract chapter.

Due to the incentivized nature of a CPIF contract, a PM likely will be unable to calculate the final price of a contract effort until the effort is completed, all of the direct and indirect costs are accounted for, and the appropriate fee adjustments are made. In some instances, a full accounting of costs can take months or even years, and many PMs never get an answer to the very basic question, "How much does it cost?"

Other Program Costs

Almost every DoD program incurs costs above and beyond those associated with contract supplies and services. Just the costs associated with running a large government program office sometime constitute a significant percentage of a program's overall budget. Most of these costs fall into a category referred to as program management administration (PMA). PMA includes the costs a program pays for advisory and assistance services (A&AS) personnel (contractors who work on behalf of the government), Federally Funded Research and Development Center (FFRDC) staff, travel costs, building leases, office supplies, information technology purchases and services, and other routine costs associated with running a large staff and office. Note that salaries for military and government personnel are *not* included in PMA and generally not accounted for in program costs. ¹⁴ These costs often go unnoticed; but left

¹³9 January 2012 SAF/AQX Memorandum, Subject: Reporting of FY12 Program Management Administration (PMA) FY12 Efficiencies.

 $^{^{\}rm 14}{\rm In}$ some cases such as the DoD laboratories, the cost of government civilian salaries may be included in PMA.

unchecked, PMA can consume a significant percentage of a program's total funding. With this in mind and as defense spending comes under closer scrutiny, the Office of the Secretary of Defense (OSD) and the military Services have levied strict limits on the percentage of total program budget that can be allocated to PMA. PMs and their financial officers should scrutinize PMA costs regularly to ensure they do not exceed OSD or Service limits and are defensible in terms of the total program funding they consume.

Government costs associated with testing weapons systems may also constitute a significant program cost. Large-scale test ranges such as those necessary to support aircraft, missile, and munitions programs are expensive to maintain and operate. As these ranges have transitioned to more of a "fee for service" model, programs have borne a greater share of these costs as direct charges to the program. Test assets can also add substantial costs to a program, especially if they are unlikely to survive the test event. Test missiles, targets, launch vehicles, and anything subjected to destructive "live fire" test and evaluation generally constitute significant "one time" costs. Consider the costs associated with missiledefense testing. Missile-defense programs must plan and pay for range access and support, target missiles, and interceptor boosters, and sometimes separate terminal kill vehicles. Test costs can easily run into the hundreds of millions of dollars for large-scale test events. Large programs often stand up and maintain dedicated responsible test organizations (RTOs), as well. The costs associated with maintaining a sizable staff of specialized test personnel at a dedicated facility over a number of years takes another significant bite out of the PM's budget.

Another cost PMs must account for is any government-furnished equipment (GFE) or government-furnished property. In some programs, the lowest-cost option may be to provide certain equipment or systems directly to the contractor to keep costs low or ensure interoperability with other systems. In these cases, procuring separate equipment or products will not be part of the overall *contract cost*, but it will be part of the overall *program cost*.

Finally, there is another class of costs that most programs incur over which the PM has little or no control. These are the taxes and assessments levied by authorities at all layers of the DoD acquisition system to pay for unanticipated or unfunded initiatives. Though these costs emanate outside the program and are entirely involuntary, they add yet another component to a program's total cost.

Adding It All Up—Acquisition Costs and Life-Cycle Costs

Thus far we've written generically about the different costs that programs bear. Not all costs are created equal, however. Program costs fall into very specific categories with very specific funding sources, and the PMs must be careful to ensure costs precisely map to budgets and funding sources.

Complex, large-scale programs (think aircraft, tanks, munitions, satellites, communication systems, etc.) typically proceed through three acquisition phases: technology development, engineering and manufacturing development (EMD), and production and deployment. This is significant because Congress authorizes and appropriates a different type of funding for the first two phases—research, development, test and evaluation (RDT&E) funds—than it does for the production phase, and PMs cannot apply RDT&E funding toward production activities. As the financial management chapter will describe, different rules also dictate how these different funding pools are budgeted and spent. The distinction between RDT&E and procurement is also significant because the ratio of RDT&E to production costs may substantially influence a program's acquisition strategy.

To use a very simplified example, consider a hypothetical program to procure a new Army mobile artillery system. The Army may discover that one concept costs substantially more to design and develop but ultimately results in a product that is much less costly per unit to manufacture or maintain. The decision to proceed with one concept or another will be determined not only by how many units the Service plans to procure and whether the realized production savings will offset the increased design and development costs but also by the funding—RDT&E versus procurement—that the Service has requested and Congress has authorized and appropriated.

Two more acquisition cost categories also figure into the calculation. If a weapon system requires dedicated facilities to operate or maintain—hangars, satellite operations sites, maintenance facilities, and the like—these must be paid for from "military construction" or MILCON funds. Programs must also ensure that weapon systems field with adequate initial spare parts. Though these costs are incorporated with the production costs, they are generally broken out and funded through a centralized spares budget, often managed at the Service level. ¹⁶

¹⁵This is a simplification that leaves out Concept Exploration/Pre-Milestone A activities and Operations and Sustainment/Post-Milestone D activities.

¹⁶ Air Force Instruction 63-101, Integrated Life Cycle Maintenance, March 7, 2013, paragraph 6.4, p. 68.

All of these costs—RDT&E, procurement, MILCON, and initial spares—together constitute what are termed "Acquisition Costs." These are the costs for which a program must plan, budget, and ultimately pay out of funds appropriated by Congress to deliver a weapon system to the user or warfighter. For large-scale acquisition programs, acquisition costs can easily run into the hundreds of millions or billions of dollars. As

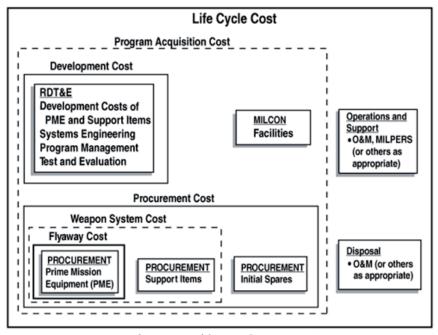


Figure 3. Life-Cycle Costs 17

impressive as these figures may be, acquisition costs typically constitute only a small percentage of the "total cost of ownership" that the weapon system user will bear over a weapon system's life cycle. 18

Operations and maintenance (O&M)¹⁹ and weapon system disposal costs make up the balance of weapon system "life-cycle costs," and they typically dwarf acquisition costs, on average accounting for more than 70 percent of total life-cycle costs (Figure 3).²⁰ O&M includes all

¹⁷From the PMs E-Toolkit, https://acc.dau.mil/CommunityBrowser.aspx?id=294481

¹⁸Space programs are the notable exception. Typically, the initial cost of the satellite system dominates the overall cost of the program.

¹⁹ Sometimes called Operations and Support (O&S).

²⁰ DoD Weapon System Acquisition Reform Product Support Assessment (Washington, DC: Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, November 2009), p. 54.

costs of operating, maintaining, and supporting a fielded system, including the costs of manpower, equipment, supplies, software, and services associated with operating, modifying, maintaining, supplying, training, and supporting a system in the DoD.²¹ Though PMs typically spend most of their time managing acquisition-related costs, life-cycle costs often play a more prominent role in shaping requirements and acquisition strategy. To use another simplified example, consider a hypothetical Navy acquisition program to replace the anti-submarine destroyer fleet. A more conventional design based on existing technology and concepts might cost substantially less to design and procure but significantly more to operate. Conversely, a newer design that used modern materials and advanced information technologies to reduce fuel consumption and crew size might cost the Navy substantially more to design and procure but cost significantly less to operate and maintain compared to the conventional design. Life-cycle cost considerations would typically steer the Navy toward the new and modern design, but constraints on RDT&E and procurement funds might also force the Navy to make a decision that would ultimately appear "penny-wise but pound-foolish." When the PM for this hypothetical program is confronted with the question of "how much does it cost," he or she might want to carefully consider just exactly which cost to cite in answering. For a DoD acquisition PM, "how much does it cost" is never a straightforward question.

A Note on "Should Cost"

Few concepts have created as much confusion at their outset as the "Should-Cost" initiative introduced by then Under Secretary of Defense (AT&L) Ashton Carter in September of 2010. Carter directed that he would "require the manager of each major program to conduct a Should-Cost analysis justifying each element of program cost and showing how it is improving year by year or meeting other relevant benchmarks for value." Skepticism ran rampant—to many members of the acquisition community it was not clear what Should Cost entailed or how it would be implemented. Should Cost has since demonstrated its worth.

The Joint Strike Fighter (JSF) program was one of the first major test cases of Should Cost, but it also exemplified the doubt and uncertainty that surrounded the policy. *Defense News* reported, "Acquisition experts are anxious to see how well the effort performs, but some are skeptical it will succeed at containing costs on large programs. 'It's an interesting way to try to impose discipline on what has become an undisciplined process. But I don't think it gets at the core problem here,' said Todd Harrison, senior fellow at the Center for Strategic and Budgetary Assessments."²⁴

 $^{^{2}l} Defense \ Acquisition \ Guidebook, p. 77.$ Available at https://acc.dau.mil/docs/dag_pdf/dag_complete.pdf

²²OSD/AT&L Memorandum, "Better Buying Power: Guidance for Obtaining Greater Efficiency and Productivity in Defense Spending," Sept. 14, 2010.

²³D. Mark Husband, "Applications of Should Cost to Achieve Cost Reductions," *Defense ARJ* 21, no. 2 (2014), p. 568.

²⁴ Defense News, "Pentagon Tests New Way Of Estimating Program Costs," June 23, 2012.

There were several reasons why Carter's initiative created confusion. First, "Should Cost" may have been a poor choice of terminology. At the outset at least, PMs were uncertain what the term "should cost" represented. As Harrison noted, "the Should Cost is more like a 'wish it would cost." There was also confusion regarding how or whether Should-Cost savings differed from cost-savings initiatives that PMs already implemented in their capacity as good fiscal stewards (short answer: generally, "no"). DoD bookkeeping and accounting systems also lacked the means to document Should-Cost initiatives. It would take several years before DoD and the Services implemented financial management tools to record and track Should-Cost savings. Finally, in a highly constrained budgetary environment, there was understandable suspicion that identifying how much a program "should cost" would put program funding at risk. ²⁶

Carter's original memo clearly outlined at least two important concepts associated with Should Cost. First, PMs need to perform a cost analysis to better understand their cost drivers: "They should be scrutinizing every element of program cost, assessing whether each element can be reduced relative to the year before, challenging learning curves, dissecting overheads and indirect costs, and targeting cost reduction with profit incentive." Second, official cost estimates would still serve as the basis for budget planning and programming: "The Department's decision makers and Congress use independent cost estimates (ICE)—forecasts of what a program will cost based upon reasonable extrapolations from historical experience—to support budgeting and programming … The forecast budget is expected, even required, to be fully obligated and expended."

Nonetheless, Carter himself acknowledged the uncertainty associated with Should Cost when he issued a follow-up memorandum less than a year later. He wrote that "some understandable confusion exists as to how to implement both "should cost" and "affordability as a requirement." Carter's memo clarified the Should-Cost concept, distinguishing Should Cost from "affordability as a requirement" and clearly stating, "The should-cost approach challenges us to do our best to find specific ways to beat the Independent Cost Estimates (ICE) or Program Estimate (which should already reflect the affordability requirements) and other cost projections funded in our budgets (i.e., "will cost"), when we find sensible opportunities to do so."²⁷

Carter's successor, Dr. Frank Kendall, made another important contribution to the Should-Cost policy when he clarified in an August 2013 memorandum that Should-Cost savings would remain with the program. Kendall wrote that "successful should cost initiatives should drive down future program budgets once the savings have been demonstrated and realized. Components have the latitude to apply savings to their most pressing unfunded requirements, or may reinvest this funding within the same programs to accelerate the acquisition, fund cost-reduction initiatives, or cover critical unfunded requirements" [emphasis added].

Senior leaders and a change in leadership culture played a significant role in turning the corner on Should-Cost implementation. Leadership from the program executive officer (PEO) level to the highest ranks of the DoD acquisition hierarchy established an expectation that PMs would make a rigorous effort to understand cost drivers and identify strategies to cut costs. Cost analysis and the Should-Cost

²⁵ Ibid

²⁶ "Applications of Should Cost," p. 569.

²⁷OSD/AT&L Memorandum, "Should-cost and Affordability," Aug. 24, 2011.

initiative became prominent topics in acquisition strategy reviews, execution reviews, configuration steering boards (CSBs), and other prominent programmatic forums. As the acquisition leadership "set the bar higher," PMs worked harder to find ways to beat the ICE or Program Office Estimate (POE). In much the same way that risk management compels PMs to think harder about risks that might undermine a program, DoD leadership's consistent emphasis on Should Cost forced PMs to think harder and more creatively about cost drivers and potential cost savings.

As the concept took hold, training and tools became available, and the DoD accounting systems caught up with policy, Should Cost began to yield meaningful benefits and savings. PMs took to heart the notion that the independent cost estimate (ICE) represented nothing more than a starting point for acquisition strategies, spend plans, and contracts, and that they were expected to drive program costs downward from there through systematic, documented cost-savings measures. One should probably view claimed Should-Cost savings with some skepticism—as we suggested at the outset, some of these savings would have likely been realized even in the absence of an explicit Should-Cost policy—but even with this caveat there are a number of documented and impressive success stories associated with the policy. The Apache helicopter program saved \$35 million over 2 years by "leveraging DT/OT events and utilizing combined contractor/government testing on events that were planned to be conducted independently."28 The Guided Multiple Launch Rocket System program slashed its schedule by 16 months (32 percent) through a "carefully considered decision to combine the MS C and FRP Decisions, based on their assessment that a mature production line would enable Initial Operational Test and Evaluation to precede MS C, obviating the need for an LRIP (LowRate Initial Production) phase."29 At a lower level, the Air Force PEO for Battle Management highlighted the example of a lieutenant in his directorate's Force Protection Division who shaved \$180,000 from a proposal by comparing the proposal pricing information to costs he solicited from the contractor's own supply chain office. Should Cost need not be rocket science!30

The change in culture and process that Should Cost has brought about is at least as important as the savings that have already been realized. It is simply no longer good enough for a program or PM to present a plan for meeting performance and schedule objectives without also demonstrating that they have made every effort to wring excess cost from the program. Sometimes the cost savings are realized, and sometimes they are not, but this almost misses the point. As Carter wrote in his first memo, "Should-cost targets are often stretch goals we expect our leaders to do their best to reach; we expect them to be based on real opportunities, but to be challenging to execute. Unlike affordability requirements, we do not expect them to always be achieved, but we do expect strong efforts to do so." 31

²⁸ "Applications of Should Cost," p. 578.

²⁹ Ibid, p. 585

³⁰ As relayed to the author during a Battle Management Directorate staff meeting. The PEO had noticed the action of the lieutenant while reviewing his Officer Performance Report and had him come in to explain exactly how he had come to realize the dramatic reduction. The PEO (Steve Wert) held this up to his divisions as an example of the sort of creative Should-Cost work he expected his program to implement at every level.

³¹OSD/AT&L Memorandum, "Should-cost and Affordability," Aug. 24, 2011.

SCHEDULE

Beware the time-driven project with an artificial deadline.

-M. Dobson

A project without a critical path is like a ship without a rudder.

-D. Meyer

As with cost, the term "schedule" is not nearly as straightforward as it might appear. The DoD "data item description" (DID) that provides contractor guidance on an integrated master schedule (IMS) defines the IMS as "an integrated schedule containing the networked, detailed tasks necessary to ensure successful program execution." Important terms from this definition include "integrated," "networked," and "detailed."

"Integrated" suggests that the schedule includes all activities necessary to complete the program, including management oversight, approval events or milestones, contractual activities, material ordering and handling, development, fabrication/manufacturing, test, and training. "Networked" means that the schedule depicts not just the list of tasks, but the interdependencies and sequencing of actions. In other words, it shows a specific sequence of events and which activities must be completed before others are begun. "Detailed" means that the schedule depicts activity to the level of discrete tasks (sometimes called "work packages") that typically span small periods of time (on the order of 2 weeks) and can be precisely tracked by level of completion.

This definition is also notable for what it leaves out.³³ The basic definition, for instance, makes no mention of "critical path," perhaps the most important concept to understand when discussing schedules. The critical path is the "long pole" in an integrated schedule: the sequence of linked activities that has the longest start-to-finish duration and ultimately determines when a program will be completed. You can almost say that the only activities that matter in tracking progress toward completion are critical path activities.³⁴

The definition also neglects to associate the IMS with Earned Value or Cost Performance Reporting (CPR) systems. On most "cost-

³²DI-MGMT-81650, Mar 30, 2005, Preparing Activity: OUSD(AT&L)ARA/AM(SO).

 $^{^{\}rm 33}\text{lt}$ is worth noting that the DID provides much more detail on many of the terms we go on to discuss here.

³⁴An important caveat to this admonition is that the critical path events can change quickly. As one sequence of linked events becomes delayed, those events can quickly supplant another chain of events on the critical path.

based"³⁵ contracts, these systems allocate the entire "budget" (primarily in terms of labor hours) for a program across all of the discrete tasks that make up the IMS. Programs can then track progress and identify variance according to how many tasks have been completed and how many hours have been expended. By comparing actual tasks completed and hours expended against a baseline plan, a PM can identify and quantify both cost and schedule variance. Earned Value or CPR schedule variances are sometimes poor predictors of overall program progress toward completion, however, because they place equal emphasis on tasks on and off the critical path. A program can report a positive (favorable) overall schedule variance but still be "late" by traditional measures if those activities on the critical path are delayed.

"Baseline" and "current" schedules are another important concept. Even in the absence of formal CPR systems, programs should maintain both of these schedules. The baseline schedule depicts the original plan. The current schedule depicts the actual execution and completion dates for scheduled activities. If a program fails to maintain a baseline schedule and regularly compare it to the current schedule, the PM will lack the means to identify whether the program is on schedule or to predict a realistic completion date.

A final thought that bears mention under "basics" is the idea of a contractually enforceable schedule. Many DoD contracts do not reward or punish contractors (directly) for success in performing to schedule unless specific and unusual schedule incentives are explicitly built into the contract. Cost-based incentives (discussed earlier) and progress payments associated with fixed-price contracts generally provide a strong incentive for contractors to stick to schedule as closely as possible, but individuals new to the DoD acquisition system are often surprised to discover that monetary penalties associated with schedule delays are rarely included in DoD contracts.

PERFORMANCE

A PM ham sandwich can't just deliver the bread.

-Joe Capobianco, Lieutenant Colonel, U.S. Army

Performance would seem to be a straightforward topic. When we purchase a car, there are traditional "performance metrics" with which we are all familiar: acceleration, miles per gallon, cargo capacity, etc.

 $^{^{\}rm 35}\mbox{We'II}$ discuss the difference between cost and fixed-price contracts in a subsequent chapter.

There are reasons why the measure of "performance" in the context of acquisition program management is more complex than performance in the context of buying a new car.

Capability-Based Requirements Process

A key complexity related to understanding "performance" comes from changes in the acquisition environment driven by "capabilities-based" assessment strategies. Capabilities-based assessments trace its roots to changes in warfighting strategies that took hold during the Persian Gulf War known as effects-based operations (EBO). Perhaps the best-known proponent of EBO was Colonel John Warden, and the philosophy he espoused discouraged focusing on traditional targets and metrics and instead encouraged warfighters to consider "end state goals" first; then focus on the means to achieve those goals.³⁶ This philosophy suggested that planners could avoid traditional strategies aimed at directly attacking and attritting enemy forces when there might be more effective and less costly means to achieve the desired end state. This philosophy found application in the Persian Gulf War in a strategy that, in the initial stages, dedicated at least as many resources toward decapitating the Iraqi leadership structure and eliminating its command and control capability as it did directly attacking Iraqi ground forces.³⁷ EBO influenced DoD acquisition thinking toward an approach that moved away from traditional performance "requirements" and in the direction of "capability-based" assessments. The movement toward capability-based assessments really took hold under the leadership of former Secretary of Defense Donald Rumsfeld, who initiated creation of the "Joint Capabilities Integration and Development System" (JCIDS) with a memo to then-Chairman of the Joint Chiefs of Staff, General Peter Pace, in which Mr. Rumsfeld wrote:

... please think through what we all need to do, individually or collectively, to get the requirements system fixed. It is pretty clear it is broken, and it is so powerful and inexorable that it invariably continues to require things that ought not to be required, and does not require things that need to be required.³⁸

The revised requirements process that resulted from the collaboration of Mr. Rumsfeld and his chairman nearly banished the word "requirement" from the acquisition lexicon and replaced it with the concept of capabilities. As with EBO, the idea was to focus less on traditional measures of performance and more on capabilities that allow warfighters to achieve their desired end effects. Rather than specify requirements for speed, ceiling, range, etc., capability-based assessments specify overall capabilities that a system needs to provide—for example, the ability to transport a ground maneuver unit, the ability to maintain constant surveillance over a given area of responsibility, or the ability to combat and defeat an Enemy Air Defense System.

³⁶Wikipedia, http://en.wikipedia.org/wiki/Effects-based_operations

³⁷Richard T. Reynolds, *Heart of the Storm: The Genesis of the Air Campaign Against Iraq* (Maxwell AFB, AL: Air University Press, 1995), p. 17.

³⁸Capabilities-Based Assessment (CBA)User's Guide, Version 3, Force Structure, Resources, and Assessments Directorate (JCS J-8), March 2009, p. 9.

³⁹Ibid, p. 5.

The significant benefit of a capability-based approach for the acquisition community is that a broad array of solutions can be examined and capability tradeoffs made between performance and cost. It also encouraged thinking toward "family of systems" solutions to satisfy capability needs. To return to the car analogy, rather than emphasizing specific size, fuel economy, acceleration, and cargo-space requirements, the required capabilities might be expressed in terms of the vehicle's ability to support certain "missions," such as commuting, family transport, golf outings, and trash hauling. A capabilities-based approach might end up pointing toward a solution that suggested a moped for dad to get to work, a smaller electric vehicle to get the kids to school and pick up groceries, and a leased vehicle when larger payloads or longer trips were required.

Capability-based assessments and the JCIDS process also resulted in a hierarchy of capability documents that replaced the previous system of requirements-based documentation that had guided weapon system design and development. These documents were just part of the larger JCIDS process that would, from that time forward, provide the basis for identifying weapon system needs and guide weapon system designs.

Figure 4 shows the primary interactions between the JCIDS process and the Defense Acquisition System.⁴⁰ As Figure 4 makes evident, PMs who enter a program post-Milestone B (MS-B) may never substantially interact with the first two documents that shape weapon system performance—the Initial Capabilities Document (ICD) and the Capability Development Document (CDD). Each of the documents describes, in greater detail, the capabilities gap that a material solution will seek to redress. The ICD recommends material initiatives to address

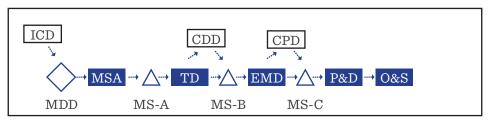


Figure 4. Simplified Diagram of the Defense Acquisition System

⁴⁰JCIDS background brief, key documents, and process overview, https://learn.dau.mil/CourseWare/802682_3/course/L03/pdfs/SYS202_L03_P015.pdf

gaps in joint warfighting capabilities and informs the first decision point, the Materiel Development Decision (MDD), as well as the subsequent Materiel Solution Analysis (MSA) that leads to the Milestone A (MS-A) decision to proceed with technology development. The CDD is an output of the Technology Development and Risk Reduction Phase and provides more specific direction on operational performance parameters required by the weapon system design.

Critically, the CDD also defines the weapon system Key Performance Parameters (KPPs). KPPs define *testable* attributes or characteristics of a system that are considered critical or essential to developing an effective military capability. APPs normally include both "threshold"—or minimally acceptable performance targets—and "objective" values. The KPP threshold and objective dimensions describe the "trade space" within which a program can work to achieve overall capability objectives. KPPs are the most prominent performance objectives and are documented in the APBs. Senior acquisition officials and Congress pay close attention to KPPs, and progress toward their attainment is reviewed at every major milestone review.

The Capability Production Document (CPD) translates broad CDD performance parameters into more specific "buildable" designs, in that it identifies production attributes for a single increment of a program (where an incremental acquisition approach is recommended) and reflects the results of trade studies conducted during the EMD phase. It also provides more refined and specific KPPs and performance attributes. ⁴² In other words, the CPD takes the broad capability trade space that a CDD provides, translates it into specific performance requirements for a production system, and serves as the "measuring stick" against which the contractor deliverable will be assessed.

The Critical Design Review (CDR) is, arguably, the single most prominent and important event in the EMD phase of this process, because passing CDR gives the contractor approval to start fabrication. During CDR, the government reviews the final contractor design as captured in product specifications for each Configuration Item in the system and ensures that each product specification has been captured in detailed design documentation. The resulting set of detailed drawings and specifications, when approved, establishes an initial product baseline, with

 $^{^{41}\}mbox{ACQuipedia}$, https://dap.dau.mil/acquipedia/Pages/ArticleDetails.aspx?aid=7de557a6-2408-4092-8171-23a82d2c16d6

 $^{^{42}\}mbox{ACQuipedia}, \mbox{https://dap.dau.mil/acquipedia/Pages/ArticleDetails.aspx?aid=1fbc732e-bb02-4383-a339-21274d166d57$

⁴³https://acc.dau.mil/CommunityBrowser.aspx?id=638320

a final baseline incorporating any design changes resulting from EMD testing of production representative articles and Initial Operational Test and Evaluation of Low-Rate Initial Production (LRIP) systems.⁴⁴

Proverbs for PMs

Make your system as robust as you can afford

- Someone else will trade off any extra "fat" in your program
- There are very few (like no) systems in the field that are still being used as they were originally designed
- If you design a capability or provisions for a capability, it will work better than something added later

As with cost and schedule, assessing weapon system performance is not nearly as straightforward as it would seem—somewhat by design. The warfighter will assess performance according to how well a system or family-of-systems addresses a gap in capabilities, typically stated in broad mission-area language. Senior acquisition officials and the test community will focus largely on KPPs to determine whether a PM is delivering a system with the requisite performance. The PM will focus on detailed product specifications to ensure the contractor is delivering the performance it is paid to design and produce. And then, even within the prime contracting team, multiple layers of even more detailed specifications will serve as the basis for determining whether subsystems satisfy their allocated performance requirements.

RISK

A simplified description of the PM's job might be encompassed in two words: planning and executing. *Planning* entails creating a program that brings cost, schedule, and performance into alignment, or describing a program that delivers the requisite performance within the associated cost and schedule bounds. *Executing* entails implementing that plan successfully. Perturbations to the plan—increased cost, increased schedule, or diminished performance—inevitably result from *risk*.

The DoD *Risk Management Guide*⁴⁵ defines risk as "a measure of future uncertainties in achieving program performance goals and objectives within defined cost, schedule, and performance constraints." The definition goes on to describe the "components of risk," including the

 $^{^{44}}$ ACQuipedia, https://dap.dau.mil/acquipedia/Pages/ArticleDetails.aspx?aid=dcc068fd-9994-44ed-9500-3a7ec7f81876

⁴⁵Risk Management Guide for DoD Acquisition, 6th ed. (Washington, DC: Department of Defense, 2006), p. 1.

probability and consequence of risk items manifesting on the program.

Consistent with the idea of "future uncertainties," risks are typically described as "if-then" statements: "If condition A comes about, then B outcome will result." Classic "risk matrices" illustrate probability and consequence calculations. As pictured in Figure 5, they provide a snapshot summary of the risks confronting a program and give a visual representation of the overall severity. The best risk matrices will depict risk "now" and risk "post mitigation." Rather than depicting risk as a static condition, these "before and after" diagrams illustrate how effective risk-mitigation strategies bring risk into acceptable bounds. Risk-mitigation strategies describe the specific steps the PM will take to reduce or monitor risk.

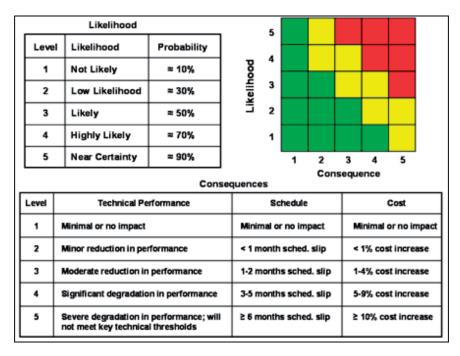


Figure 5. Risk Matrix

The DoD *Risk Management Guide* also lists a third risk component: root cause. This is the thing that "*if eliminated or corrected* [emphasis added] would prevent a potential consequence from occurring." We emphasize the phrase "if eliminated or corrected" because this activity is so central to the task of program management. In fact, the PM's job can almost be reduced to this one activity: eliminating or correcting root

causes that will otherwise result in perturbations to the cost, schedule, or performance. So why do program plans go awry if root cause identification and risk management are so central to the PM's job?

First, because some sources of risk may be completely outside the PM's control. Congress may eliminate funding. New security requirements may arise (and often do in the new cyber-centric world we live in). New threats may emerge. Technology may not work as advertised.

Second, some sources of risk may not be readily apparent. These are sometimes characterized as "unknown unknowns," and it could be argued that they are the most significant source of risk. Our own experience has been that "known risks" rarely have as great an impact on the program as unknown risks. Known risks are monitored and (one hopes) mitigated. Unknown risks lurk in the background, undetected, until they suddenly manifest themselves on the program, at which time they become "issues." The difference between risks and issues is subtle but important. Risks are probabilistic outcomes that have not yet adversely affected the program. Issues are *realized* risks. They are no longer probabilistic or theoretical. They have happened, and mitigation strategies now focus on minimizing the damage rather than heading it off.

The third reason PMs often fail to adequately deal with risk is perspective. The person whose job it is to build and execute a program management strategy is often blind to its potential shortcomings or failures. For this reason, we recommend, in a later chapter, that PMs create semiautonomous risk-management organizations to provide an objective perspective on risk.

As we will emphasize in that chapter, creating a risk-management organization within the program office should not equate to delegating risk-management responsibility or abdicating responsibility for program risk management. PMs have at their disposal a variety of risk-mitigation strategies and tools. Those tools all entail active engagement on the part of the PM and decisions to either *transfer*, *monitor*, *or accept* risks, or invest in activities that *control* risks.

Imagine this visual paradigm (Figure 6): Cost, schedule, and performance combine to form a well-shaped acquisition strategy (discussed in a following chapter) where all three come into balance. Within almost every plan lies risk, known or unknown. Successful execution of that strategy entails containing those risks. Poor execution leads to realized risks and a "poorly formed" outcome, in which cost and schedule grow while performance shrinks. Once the PM has created a "wellformed" strategy, his or her primary job is to contain the risks that will otherwise perturb the well-formed plan. It's a full-time job.

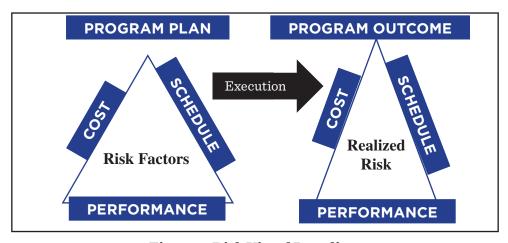


Figure 6. Risk Visual Paradigm

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SECTION I: TOOLS OF THE TRADE

Definition

Tool: anything used as a means of accomplishing a task or purpose.

Like a climber preparing to scale a mountain, a PM must have exquisite knowledge of the tools he or she will rely on to be successful. Although not all tools are used with the same frequency or carry the same priority, they all have a useful purpose.

PMs must have acumen in the broad range of tools. Although the complexity of program management often requires a team of experts in financial management, contracting, engineering, and logistics, the PM must seek to understand the details of these disciplines. It is the only true way we know to integrate the multidimensional and complex interrelationships of a program.

The following section contains four chapters on what we believe are the most important tools: financial management, contracting, systems engineering, and other tools and practices. This is not to imply that these are the only tools, and in fact some will argue for the importance of tools associated with testing, and tracking detailed contract progress, to name just a few. But we focus on these because success requires PMs to prioritize and focus the limited time and energy of self and the program management team.

In many cases, PMs may have access to a support staff of specialists from a variety of disciplines—financial analysts, contracting officers, chief engineers, security specialists. If you have access to such specialists, terrific: Tap into their expertise regularly. However, you should not allow yourself to rely solely on others' counsel. As PM, you are fundamentally responsible and must therefore develop familiarity and knowledge of these other disciplines and the associated tools. Without a basic understanding, you may be unable to recognize early signs of a problem and ask the type of questions that will reveal real issues. To put it another way, without developing a firm understanding of these specialty areas, a PM will be ineffective.

FINANCIAL MANAGEMENT

The Golden Rule: He who has the gold, makes the rules.

-Unknown

It's all about the money—if you control it, you control the program.

Brig. Gen. Pete Hoene,USAF (retired)

Most programs fail on the management and money, not technical issues.

—Blaise Durante, Deputy Assistant Secretary for Acquisition Integration, SAF/AQ Acquisition PMs face a dual mandate that is sometimes difficult to reconcile. 46 They are compelled to be good stewards of taxpayer money and find the most cost-effective means for acquiring weapon systems or services. At the same time, they face enormous pressure to expend their budget as quickly as possible. OSD publishes explicit guidelines and targets that describe how quickly investment funding needs to be "obligated" and "expended." Failure to keep pace with these targets places a programs funding at risk. This inherent tension is part of what makes the PM's job so challenging.

The mandate to spend money wisely but quickly is not necessarily inconsistent in the way it might appear. During a program's *planning* stage, PMs are expected to build an acquisition strategy that delivers the greatest operational "return on investment" and makes the best use of precious taxpayer dollars. Investment decisions are ultimately based not only on operational imperatives and requirements, but on how much capability a given dollar of investment returns to the warfighter. This competition for funding drives programs toward efficient and cost-effective acquisition strategies.

During the program's *execution* phase, PMs must implement their programs in ways that are consistent with their plans and schedules. The guidelines that drive programs to spend their funding quickly are, in truth, simply mechanisms to enforce integrity and honesty in the acquisition process. If programs must compete for funding based in part upon their return on investment, they must be held accountable for the plans that served as the basis for funding allocation decisions.

Creating a financial plan that supports an acquisition program and then executing to that plan is more challenging than it may first appear. Even if it were not for the inherent risk and technical complexity associated with a "typical" DoD acquisition program, the unique requirements and duration of the federal budgeting process (discussed later in this chapter) significantly limit a PM's flexibility through the execution phase. To make matters worse, the planning and execution phases are both highly iterative and parallelized processes, so much so that it is somewhat misleading to describe them as sequential. Every program's financial plan and budget requests are subject to review on an annual basis. Next year's (or even this year's) funding can be decremented if a program shows signs of falling behind its spend plan. This means programs must execute and plan in parallel—year in and year out. Finally, person-

⁴⁶Frank Kendall's Better Buying Power (BBP) 2.0 initiative issued by the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics (OUSD[AT&L]) in 2013 is an attempt to address this issue.

nel turnover at all levels of a typical DoD acquisition program quite often dictates that PMs execute plans written by predecessors and author plans to be implemented by their successors. All these considerations help explain why PMs spend more time creating, refining, reviewing, and defending their programs' finances than they do on any other aspect of their programs.

PLANNING—COST ESTIMATING

Financial planning begins in the earliest stages of concept exploration and analysis of alternative solutions. Though the plan that emerges from these early planning sessions will be revisited on at least a biannual basis, it fundamentally defines the parameters and expectations within which all subsequent PMs will have to work. So it is critically important, especially in terms of cost requirements and the phasing of funds, that the early planners get it right.

DoD Cost-Estimating Track Record

Since 1997, at least 74 breaches of Nunn-McCurdy guidelines have occurred where programs have exceeded either initial baselined cost estimates by 30 percent or current (updated) estimates by 15 percent.⁴⁷

It is at this point, early in a program, where PMs first substantially interact with one of their most important resources: the cost-estimating team. Cost estimators do precisely what their title implies: They estimate all the costs associated with the program—development, fielding, operating, sustaining, and decommissioning. This is known as the lifecycle cost estimate (LCCE). The LCCE describes how much and what type of funds are required to take an acquisition program "from cradle to grave." There is an unfortunate tendency to relegate cost estimators, and the rest of their financial management brethren of whom we will speak shortly, to the category of "bean counters," and to interact with them only when absolutely necessary. The importance and complexity of producing a quality life-cycle cost estimate should suggest what a mistake this would be. Your cost-estimating team needs to be intimately well versed in the subtleties of the acquisition strategy and its associated technology in order to produce a useful cost estimate. They need to understand not only the scope and duration of the project, but also its inherent risks. In short, they need to be joined to the hip of the PM to produce quality estimates. Failure on the part of PMs to properly integrate and inform their

⁴⁷"DoD Cost Overruns: Trends in Nunn-McCurdy Breaches and Tools to Manage Weapon Systems Acquisition Costs," Statement of Michael J. Sullivan, Director of Acquisition and Sourcing Management, Government Accountability Office (GAO-11-499T, released March 29, 2011), p. 2.

cost-estimating team goes some way toward explaining DoD's poor record in predicting and executing initial cost estimates. The Government Accountability Office (GAO) highlighted this problem in a 2011 report, noting that "cost and schedule estimates are often based on overly optimistic assumptions. Our previous work shows that without the ability to generate reliable cost estimates, programs are at risk of experiencing cost overruns, missed deadlines, and performance shortfalls."

A separate GAO guide counseled that "program assessments have too often revealed that not integrating cost estimation, system development oversight, and risk management—three key disciplines, interrelated and essential to effective acquisition management—has resulted in programs costing more than planned and delivering less than promised."

Cost-Estimating Basics 50

The following four cost-estimating techniques are the most common:

- 1. *Analogy*—based on historical data for an analogous system or subsystem.
- 2. Engineering Build-up—system is broken into lower-level components (such as parts or assemblies), each of which is costed separately for direct labor, direct material, and other costs.
- 3. *Parametric*—uses regression or other statistical methods to develop cost-estimating relationship between historical cost of a system and a key parameter. A good example of this is the relationship between the cost of a satellite and its expected weight.
- 4. Actual Cost—actual cost experience or trends from prototypes, engineering development models, and/or early production items used to project estimates of future costs for the same system.

Two other elements of cost estimating are important to be aware of:

- A. Confidence level—an indication of the likelihood that actual costs will fall below estimated costs. Necessarily, the greater the confidence level, the higher the estimated cost.
- B. Independent cost estimate—one that isn't part of the organization trying to sell a program (which usually means force fitting it to meet the existing budget) is always good—and mandatory for major defense acquisition programs.

⁴⁸"DoD Cost Overruns," p. 7.

⁴⁹GAO Cost Estimating and Assessment Guide, GAO-09-3SP (Washington, DC: GAO, March 2009), p. 2.

⁵⁰Based on information found at http://www.acqnotes.com

It is easy to think of a program cost estimate as an artifact frozen in time. However, as requirements change, technologies evolve, schedules slide, and other events transpire, the cost of almost any large program will change. As much as any PM wants to bring his or her program in "on schedule and under budget," it is important to document changes in initial assumptions and conditions that formed the basis for an initial cost estimate and to update cost estimates as these assumptions and conditions change. Cost estimating is also an important tool for decision makers who are considering alternative courses of action. PMs should resist the temptation to keep their cost-estimating teams sequestered, only to be called upon when the inevitable requests come in for updated cost estimates "before close of business today." Your cost-estimating team needs to be an integral part of your overall program management team, fully apprised of changes in program strategy, requirements, schedule, technology, or any other factors that will influence the predicted cost.

PLANNING—THE COLOR OF MONEY

Producing an estimate for the total cost to complete a program is necessary but not sufficient for describing a program's initial cost baseline. The complex manner in which Congress authorizes and appropriates federal monies makes it essential that PMs predict with great precision not only how much but also what type of money they will require in any given year. Though there are at least six different types of DoD appropriations, we will focus on the three appropriations that acquisition PMs most often encounter: RDT&E, Procurement, and O&M. Whole sections of the Defense Federal Acquisition Regulations Supplement and Financial Management Regulation describe the purposes of these different "colors" of money. But, generally speaking, RDT&E supports all efforts-including concept development, technology development and maturation, and EMD-through Operational Test of a DoD weapon system. Procurement funds support manufacturing, production, and fielding activities. O&M supports, as the name would imply, operations and sustainment.51

The fact that programs can spend only RDT&E, procurement, and O&M funds toward specific activities explains why programs must build and revise their cost-estimating baseline in a very specific manner. Programs need to ensure that the correct type and amount of money is in place to support each phase of the acquisition life cycle. At one lev-

⁵¹DoD Financial Management Regulation 7000.14-R contains details on the "colors of money."

el, this means the phasing of the funds must account for milestone decisions, design reviews, and test events that serve as prerequisites for the program to move from one acquisition phase to another. At another level, however, phasing must also account for more subtle triggers or chokepoints, like contract award timelines, staffing or manufacturing "ramps," and subcontractor lead times. These activities all influence how quickly funds can be "obligated" or "expended" and generally drive programs toward funding profiles with overlapping types of money that gradually increase and then decrease as the program progresses. Of course, there are exceptions to these rules. Acquisition of "long lead" production items, incentive payments, or large lot buys of commercially available items may justify or require irregular funding spikes, for example. The point to take away from this discussion is that funding profiles that programs generate in the planning stages for each type of money need to accurately reflect macro- and micro-level influences on funding requirements.

Key Financial Terms⁵²

- *Commitment*: An administrative reservation of funds based on firm procurement requests, unaccepted customer orders, directives, and equivalent instruments.
- Obligation: Amount representing orders placed, contracts awarded, services received, and similar transactions during an accounting period that will require payment during the same, or a future, period.
- Expenditure: An actual disbursement of funds in return for supplies or services. Frequently used interchangeably with the term "outlay."
- Contingent Liability: Funds not considered "obligated," including (1) outstanding fixed-price contracts containing escalation, price redetermination, or incentive clauses, (2) contracts authorizing variations in quantities to be delivered, and (3) contracts where allowable interest may become payable by the U.S. government on contractor claims.

There are several important distinctions between the different types of money that all PMs need to be cognizant of: (1) how long they last, (2) how they are tracked, and (3) full-funding and incremental-funding rules. When we speak of how long funds "last," we typically mean how

⁵²DoD Financial Management Regulation, Glossary of Terms (Dec. 2008). Details should always be reviewed with financial professionals. Available at http://comptroller.defense.gov/fmr/glossary.pdf

long a program has to spend, or more precisely "obligate," the funds before the funds "expire." In the most straightforward sense, obligating funds means creating a legally binding financial obligation for the government—this generally means awarding a contract with an associated financial obligation. Once the DoD has a contract with a service or supplies provider, the funds typically cannot be canceled or withdrawn from the program for other purposes. In some instances, transferring funds from one government entity to another via Military Interdepartmental Transfer Request (MIPR) or Military Obligation Reimbursement Document (MORD) also creates an obligation. ⁵⁴

O&M funds have the shortest lifespan; they must be obligated in the fiscal year in which they are appropriated. RDT&E funds last for 2 years, and procurement funds last for 3 years. However, as we alluded to at the outset of this section, OSD guidelines suggest much shorter timelines to obligate most RDT&E and procurement funds. According to the latest guidelines, OSD expects that 90 percent of a program's fiscal year RDT&E funds will be obligated in the first year, and 80 percent of its procurement funds. Table 1 reflects these guidelines. It also highlights the second important distinction between fund types: how they are tracked.

⁵³ When we use the term "expire" here, we mean funds are no longer available to put on contract or use for any purpose. As we discuss in more detail, Congress appropriates funds for only a limited duration. If the funds are not used within this window, they are no longer available to the executive branch to spend and, in that sense, offset any federal budget deficit. By law, 31 U.S.C. 1551–1557, appropriations are available for limited periods. An agency must incur a legal obligation to pay money within an appropriation's period of availability. If an agency fails to obligate funds before they expire, they are no longer available for new obligations (e.g., issuance of a new/basic funding document, awarding a new contract). Appropriations acts specify the time period for availability for new obligations. Differences in time periods reflect congressional understanding of various timeframes to accomplish work. Expired funds retain their "fiscal year identity" for 5 years after the end of the period of availability for new obligations. During this time, the funds are available to adjust existing obligations or to liquidate prior valid obligations. Closed appropriations are no longer available for any purpose. An appropriation becomes "closed" 5 years after the end of its period of availability as defined by the applicable appropriations act.

⁵⁴DoD Financial Management Regulation 7000.14-R.

⁵⁵Shipbuilding and Conversion, Navy appropriation funds are good for 5 years; reference DoD Financial Management Regulation 7000.14-R, volume 3, chapter 13.

⁵⁶ James Krott, *Business, Cost Estimating and Financial Management Department Teaching Note, Obligation and Expenditure Plans* (Fort Belvoir, VA: DAU, Feb. 2011), C-136.

Table 1. OSD Benchmarks for Obligations and Expenditures
During Execution (as of Dec. 15, 2010)

Appropriation Category	First Yea	r Available	0 01111011	ative for nd Year	Cumulative for Third Year		
	Obligation	Expenditure	Obligation	Expenditure	Obligation	Expenditure	
O&M	100%	75%	100%	100%	100%	100%	
RDT&E	90%	55%	100%	90%	100%	100%	
Procurement	80%	N/A	90%	N/A	100%	N/A	
Initial Spares	92%	N/A	96%	N/A	100%	N/A	
Adv Proc	100%	N/A	100%	N/A	100%	N/A	

Note that both O&M and RDT&E funds must meet not only obligation guidelines, but "expenditure" guidelines. Whereas obligations are tied to contracts or other activities that create a financial commitment for the federal government, expenditures trace to actual payment of bills, vouchers, or invoices. Obligations occur once and typically in big chunks. Expenditures occur over time as invoices are levied, bills are paid, or funds associated with those obligation events stream out of the government bank account. From a financial accountability perspective, this means PMs managing RDT&E or O&M efforts need not only to get funds obligated on schedule but to ensure that the recipient spends those funds in a manner consistent with the original funding profile. This again reinforces the idea that the original estimate and derived funding profile must account for activities that might influence how quickly the recipient can actually spend the funds considering the time it takes to hire personnel, stand up a facility, order and invoice for long lead items, or bill for subcontractor activities. We still haven't gone beyond the planning phase of financial management, but this begins to get at the complications and effort associated with execution.

Full Funding

Procurement funds are accountable only to obligation guidelines, while RDT&E and O&M funds are also accountable to expenditure guidelines. This gets at the third distinction between fund types: fullfunding versus incremental-funding rules. "Full funding" is a *policy* requirement that mandates "funding the total cost of major procurement and construction projects in the fiscal year (FY) in which they will be initiated."⁵⁷ Though whole treatises have been written on the topic, it's

⁵⁷Gary Hagan, *Glossary of Defense Acquisition Acronyms and Terms* (Fort Belvoir, VA: DAU Press, 13th ed., 2009), B-72.

actually pretty easy to understand why Congress insists on full funding for major procurement activities. At one level, it ensures that Congress, as the keeper of the purse strings, is cognizant of the full cost of major procurement activities when they occur. It also ensures that neither Congress nor the DoD can create an encumbrance or financial obligation that the next congressional session must pay. Full funding reflects that Congress only appropriates funds one year at a time. A program can never be absolutely certain that next year's funding will be provided until the Congress authorizes and appropriates that the major procurement activities always deliver "fully funded end items." That is, it ensures that we don't get half of a Navy destroyer, two-thirds of a tank, or even an unsupportable transport aircraft (because we purchased the plane but none of the spare parts or support equipment).

Incremental Funding

Incremental funding means the program is provided dollars every year based on need. The funding standard for efforts entailing RDT&E or O&M funds is substantially lower. For these efforts, "incremental funding"—the phasing of program funds for a single effort over 2 or more fiscal years⁶⁰—is permitted as long as the program has adequate "assurance of funding." In most instances, this requires that the funds needed to support future year obligations are reflected in the President's Budget (PB). This is because RDT&E funds are considered expenditure appropriations and are based on procuring a "period of performance" rather than a usable end item. The thinking seems to be that O&M and RDT&E funds typically provide services associated with developing or operating and maintaining a weapon system and that the government derives value from the services, regardless of what happens in remaining years. If next year's funding fails to materialize (always a possibility), the government has already derived value from the services it acquired. As a PM, you should work to make sure this is true for your program

Another aspect requiring PMs' attention for all types of funds is the alignment of fiscal year dollars with the year of "bona fide need." Because RDT&E dollars can be obligated across 2 years (FY01 funds can be obligated in either FY01 or FY02), last year's funding can still be avail-

⁵⁸ Authorization is not required, only appropriation. This has been long settled by the comptroller general, as authorization is an internal procedure of Congress. Also note that only DoD and now the Department of Homeland Security have authorizations.

⁵⁹Note exceptions to this rule for long lead items and large capital items like ships.

⁶⁰ Hagan, Glossary, B-83.

able during the current year. The "bona fide need" stipulation says that, for example, FY01 funds can be used only for a purpose that existed in FY01—so you can't use FY01 funds for a purpose that you only discovered in FY02.

PLANNING—POM SUBMISSIONS AND CONGRESSIONAL BUDGET EXHIBITS

It's tough to manage an event-driven program in a schedule-driven budget.

-Cooley

So far, we've discussed financial planning and the importance of cost estimating, phasing of funds, and the different colors of money. Now we will touch upon how budget requests and financial plans are documented. Program offices typically produce a "Program Office Estimate" (POE) that is revisited at each milestone or major decision review. The POE is an integral component of acquisition strategy documents, acquisition program baselines, and various other program plans and documents. By and large, however, these documents circulate within the acquisition and user communities. They are important in terms of documenting your financial plan and securing program approval within the acquisition hierarchy, but they are not the mechanism by which a program actually secures funding. Funding for DoD acquisition programs, as with all other federal programs, ultimately derives from congressional authorization and appropriation, and there are two principal documents that codify their financial requirements and submit requests for funding: the Program Objective Memorandum (POM), which eventually results in the President's Budget Request (PBR); and congressional budget exhibits (sometimes called the "J-Book"), which include the "R-docs" and "P-docs" (discussed below).

Program Objective Memorandum

The first thing to understand about the POM is its audience. POM requests are the mechanism by which a program "makes its case" for funding, first to the operating command or materiel command that serves as the program sponsor or proponent, ⁶¹ then to the Services Headquarters (Army, Air Force, Navy), and ultimately to the OSD. At each level, an acquisition program has to compete for limited funding available within

⁶¹For the Air Force, this would be Air Combat Command, Air Force Space Command; for the Army it is typically the Army Materiel Command; and for the Navy it is Deputy Chief of Naval Operations (DCNO) for Resources, Requirements and Assessments (N8).

the PB that Congress will review and, in some modified form, approve as the basis for the DoD budget. Program office involvement in the preparation of the POM inputs can vary significantly. In some instances, the major command will prepare the budget inputs and POM requests with little input from the program office. In many instances, however, the complexity and detail required for an accurate budget request compels the major command to work hand-in-glove with the program to fashion its budget request. The "POM brochure" is a document some programs produce to describe the underlying rationale and cost-estimating techniques that support a program's budget request.

The first lesson of economics is scarcity: there is never enough of anything to fully satisfy all those who want it. The first lesson of politics is to disregard the first lesson of economics.

-Thomas Sowell

Again, not every program produces a POM brochure, and the level of involvement in the POM submission varies from program to program. But there are at least two reasons you, as PM, should be engaged with your program advocate or operating command and understand the budget requests they make on your behalf. First, resources are limited and your program is competing for very limited acquisition funding at every level of the POM process. Your program advocates likely have a portfolio of programs for which they are responsible. In many instances, therefore, it falls upon the program office and the PM to make the best possible case for program funding. If the PM is not engaged in the POM process, it increases the likelihood that the program will not be funded sufficiently. The second reason to be engaged in the POM process is execution responsibility. The operating command may advocate for the program, but the program office will ultimately need to execute based on the POM request that goes forward. Failure to be directly engaged with the POM process may make a PM's life very uncomfortable when you are tasked to execute a funding baseline you had no role in shaping.

CONGRESS

On the Hill, there are Democrats, Republicans, and Appropriators.

—Ellen Maldonado, Professional Staffer, Senate Appropriations-Defense Subcommittee (SAC-D) Congressional budget exhibits accompany and support the PB to Congress. Since the PB is the "end product" of the budgeting process, a program's budget request may differ substantially from the original request submitted by the program at the outset of the POM process. The audience for the congressional budget exhibits, which communicate the PB to Congress, is composed primarily of members of Congress and their staffs. For acquisition programs, these budget exhibits are primarily "R-docs" and "P-docs." The R-docs describe RDT&E funding requirements ("R" is for RDT&E), and P-docs describe procurement funding requirements ("P" is for Procurement). These documents serve as one of the primary mechanisms by which Congress reviews the PB and evaluates whether a program is deserving of funding. They act as a "contract with Congress."

Consistency, completeness, and accuracy characterize good budget exhibits. Congressional authorizers will look for inconsistencies within a set of fiscal year budget exhibits and with prior year budget exhibits. Within a given year, for example, it is critical that R-docs and P-docs tell a consistent story in terms of development and production activities and that all events reflect careful thought to milestone reviews, contract award timelines, and other events that influence budget execution. The P-docs themselves actually encompass a dozen or more separate documents that describe the underlying program and its rationale, cost analysis, contract history and strategy, production schedule, and other aspects. These individual submissions must tell a clear and consistent story. Congress will be reluctant to approve significant obligation events in either the first or fourth quarter of a given fiscal year. First-quarter obligations are often put at risk when the DoD budget, as is often the case, is not approved on time, and the resulting Continuing Resolution Authority generally prohibits "New Start" programs and constrains the funding available for other programs until the full DoD budget is approved.

Fourth-quarter awards come under scrutiny because of the like-lihood of delays and because it is difficult to argue that the obligation cannot be delayed one quarter to the following fiscal year. ⁶² If the exhibits reflect substantial cost growth or schedule delay from the prior year, the exhibits must be forthright and logical in describing changes from prior years. If Congress discerns a smokescreen or any other sign that program documents are not honest about a condition or progress, both the program's credibility and funding prospects will suffer. Finally, exhibits must be consistent with established acquisition policy. Congressional staffers who have been reviewing these documents for years will immediately note any discrepancies with respect to "full funding" mandates

⁶²Acquipedia, Program Management Office (PMO) Budget Estimate.

and the "12-month rule."63

Completeness and accuracy are critical to budget exhibits because congressional budget decisions will primarily be based on the content of these documents, regardless of the accuracy of the data they contain. Failure to request or to document required funding for spare parts, test support, program overhead costs, long lead items, or any other less obvious aspect of a program's total cost will not receive a sympathetic hearing once Congress approves a program's funding. Similarly, while increased budget requests year to year will likely lead to some back and forth with congressional staffers, failure to document changes attributable to new acquisition strategies, program delays, or increased costs may go unnoticed in the short term, but eventually will catch up to the program and ultimately will damage service acquisition credibility.

The next important thing to understand about these documents is their schedule for preparations and submission. POM inputs are the initial mechanism by which programs document their funding requirements. Program funding requests will compete at the level of the Service operating-command headquarters, the Service, and the OSD before finding their way into the PB (where they will compete again at the congressional level). Because of this multi-tiered review, programs typically provide their POM inputs to the operating command nearly 2 years in advance of the fiscal year.

The operating command staff reviews and adjudicates budget estimates and forwards the major command POM position to the Service staff. Service staffs, through a complex and lengthy review process, will do the same thing before forwarding the Service-level POM input to OSD. 64 OSD then produces the final inputs, which represent the DoD portion of the PB.

The White House forwards the final PB to Congress for consideration in February of the fiscal year prior to its enactment—this is referred to as the PBR or just PB. The POM process formerly occurred biannually (on even fiscal years), but it has recently evolved into an annual process.

 $^{^{63}}$ DoD Financial Management Regulation Volume 2A, June 2000, Chapter 1, pp. 1-36 (Glossary of Terms – Procurement).

⁶⁴This sentence greatly simplifies a tremendously complex and tedious process that takes place over months and involves multiple levels of board review at the Service level alone.

Timeline for the Budget Process-Example

If we were to consider inputs for FY17 (from October 1, 2016, through September 30, 2017), a program would be expected to provide budget estimates and supporting information to its operating command headquarters in the fall of 2014. The major command will combine and distill the various budget requests that compete for funding within its portfolio and provide the command's consolidated budget estimate to the Service the following spring (in this example, the spring of calendar 2015). The Services then conduct lengthy summer budget reviews before submitting their final Service-level POM inputs to OSD in August 2015. Programs would not know the final disposition of their requests until the 2017 PB is released in February 2016.

Development of the Fiscal Year 2017 (FY17) Budget Timeline

- 2014 Fall → Program office provides POM input to major command
- 2015 Spring → major command provides POM input to Service HQ (Pentagon staff)
- 2015 August → Service delivers POM to OSD for "Program Review" & OSD input
- 2015 Fall → OSD reviews/refines budget via "issue papers"
- 2015 Dec → PB finalized by late December or early January
- 2016 Feb → PB delivered to Congress
- 2016 Spring → Congressional staffs review budget documents & receive briefings from Service acquisition staff officer/resource managers
- 2016 Summer → Congressional committees adjust budgets via "Marks" to the PB
- 2016 September → Congressional committees reconcile differences in conference
- 2016 September → Authorizers and appropriations bills completed and sent to the White House for approval of FY17 Defense Budget.

An important point is that, until the PB is officially released, all budget requests and their underlying strategies and assumptions are considered "predecisional" and very sensitive to release. Programs are not permitted to release or discuss budget requests or estimates with congressional staffs before release of the PB in February. Between that time and congressional approval of the final DoD budget, however, PMs of large, troubled, controversial, or "special interest" programs in particular should be prepared to interact regularly with congressional members concerning their budgetary requirements and requests. Well-prepared budget exhibits will be the constant reference point for a program over this period and until the program's funding is approved as an element of the larger DoD program. Your Service headquarters acquisition staff officer⁶⁵ will be your constant companion during this interchange.

⁶⁵From now on referred to as "acquisition staff officers," discussed in greater detail below.

Proverbs for PMs

Pay close attention to which budget you are working on and who knows what ...

- This year's budget in "execution"
 - Next year's PB in discussion on the Hill
 - The following year's POM budget in development in Service headquarters and is considered "predecisional" and not releaseable
- Always pay attention to which budget numbers you are discussing!
 PB numbers are different from actual executable dollars
- Even veteran PMs can get this confused!

Smartbook

Working on money issues is about information and detail; if you don't have it at your fingertips, you can't do your job. Unless you have a photographic memory, a best practice is to create a "Smartbook" that contains the critical information you will need. ⁶⁶

Financial Management "Smartbook"

- R-docs & P-docs (recent PB submission and one prior)
- Future Year Defense Program funding profile by appropriation and budget line (constrained and unconstrained budgets)
- Track of funding cuts (both out-year budget and appropriated)
- Budget execution data on appropriated dollars (including budget history)
- Current appropriation—commitments, obligations, and expenditures as compared to Service and OSD goals
- Expired appropriations—obligations and expenditures
- Current appropriations—comparison of forecast to actual obligations and expenditures
- Program cost data
- Staffer Brief
- Baseline history—original baseline and each subsequent approved baseline

⁶⁶Roberta Tomasini created this list for the Executive PM's course (PMT 402) at DAU.

Key Program Representative in the Pentagon

Many program offices are geographically far removed from the hub of DoD financial planning and decisionmaking: Washington, D.C. This fact underscores the important role played by the Service staff officer responsible to represent your program within the Pentagon. Each Service has a different name for this critical Service staff officer position, which represents major programs within the DoD and on Capitol Hill:

- The Air Force calls them "Program Element Monitors" or PEMs.
- The Army calls them Department of the Army Staff Coordinators (DASCs).
- The Navy calls them Requirements Officers.

In each case, this staff officer serves as the program's primary spokesperson within the Service headquarters and represents the program in most routine interactions with Service and OSD staff as well as with members of Congress and their staffs.

While it's tempting to say that the acquisition staff officers are the programs' advocates, this characterization can be somewhat misleading because it suggests that they work primarily on behalf of the programs. In reality, acquisition staff officers work on behalf of their Service staffs. They will advocate for the program, but only to the extent that program objectives are consistent with larger Service objectives. What's more, because of where they sit and because they usually have a robust acquisition background, the acquisition staff officers quite often can provide perspective, advice, and counsel to the programs. They will often provide this same perspective to customers and operating command sponsors, and in this sense they play the role of the "honest broker" at the heart of an acquisition program.

Therefore, PMs' communications with their acquisition staff officers must be open, two-way conversations—and PMs are ill advised to ignore the staff officers' counsel. An acquisition staff officer can be a program's best friend, and a competent and energetic one can be a potent weapon on behalf of a program. PMs should, as a matter of routine, keep the acquisition staff officers involved in significant program reviews or decisions and include them on important correspondence. What is even more important, PMs must be completely transparent and honest with their acquisition staff officers. The information that acquisition staff officers provide to congressional members—often pertaining to funding requirements or financial execution performance—typically originates in the program office. If that information is incorrect or misleading, it un-

dermines the staff officer's credibility with your most important constituency—Congress. Once trust breaks down between the acquisition staff officer and the program office, it may be hard to restore—not to mention the difficulty you may have restoring trust with Congress and key staffers. If there is a lack of trust, your key headquarters advocate will be reluctant to accept your recommendations, advocate on your behalf, or share critical information from "inside the Beltway."

Acquisition staff officers are involved in both regular, cyclical activities and multiple ad hoc taskings. One of their primary tasks is to assist in the review and production of the R-docs and P-docs. At the same time, they are typically building their "staffer day" presentations that they will present to congressional staff members shortly after the rollout of the PB. Then, in the time between release of the PB and approval of the defense authorization and appropriations bills, they may be called on to answer questions and provide additional information supporting congressional budget deliberations. Throughout the execution process, acquisition staff officers constantly monitor execution status and, should the need arise, may be asked to defend the program funds against reprogramming.

Proverbs for Acquisition Staff Officers

Never pass up an opportunity to keep your mouth shut.

- Never answer a question that has not yet been asked.
- Do not elaborate just to show how much you know.
- When you're standing in a hole, stop digging.

Acquisition staff officers also play a significant role outside the budgetary planning and execution process. Because they represent the program within their Service staffs, the acquisition staff officers typically serve as "point men" on any number of other staff actions and interactions with other organizations. They prepare senior Service leaders for congressional testimony pertaining to the program, they represent the acquisition community on behalf of the program in meetings with the other functional Service staff entities, and they respond to audit requests that originate in either the executive or legislative branch. It's worth adding that on occasion a congressional staffer, a member of Congress, a Cabinet or Service Secretary, or other VIPs will ask a program-related question and need an answer immediately. On a major program, this will happen many times a year. To meet this deadline, the only person who can answer this question is your acquisition staff officer—there is no time

to vet an answer through the PM. Therefore, it is important to make sure they have excellent knowledge of your program and the most up-to-date charts at all times.

Though it's impossible to describe the full range of activity in which they are involved, suffice it to say that acquisition staff officers are typically among the hardest-working and most important members of their Service staffs. PMs should keep this in mind and do everything they can to earn their trust, keep them informed, and help make them potent advocates for the program.

EXECUTION PHASE ... YOU'RE ALREADY LATE

"Execution"—in the context of acquisition financial management—means obligating and, in the case of RDT&E or O&M funds, expending funds. If you've read this far, some of the challenges to successful execution deriving from the planning process should already be apparent:

- Programs must execute plans originally formulated at least 2 years in advance of receipt of funds. In the intervening period, events may have occurred that affect the underlying assumptions upon which the original plan and budget request were based.
- The original plan was based on cost *estimates* that may or may not prove to be accurate.
- It's likely that the program's original budget request was adjusted during the multiple levels of service, OSD, and congressional review.
- Finally, it's almost certain that full funding—and the associated authority to start any new efforts—will not be provided until well after the start of the fiscal year. The last time Congress passed all appropriation bills on time was 1997, and it has only accomplished this feat three times since 1954. 67

With all this in mind, laying the groundwork for successful execution must begin well in advance of actual receipt of funds. The first step is to assemble a fiscal year spend plan—a revised version of the original budget request that allocates a program's appropriated funds across the typically multiple line items of an acquisition program that depicts a time-phased strategy for obligating and expending funding. The spend plan serves two purposes: (1) it gives the PM early insight to his ability to meet OSD obligation and expenditure guidelines, and (2) as the fiscal year progresses, it provides a tracking tool to ensure a program is tracking to its plan to meet obligation and expenditure targets.

⁶⁷Sandy Streeter, Continuing Resolutions: FY2008 Action and Brief Overview of Recent Practices (Congressional Research Service, CRS Report for Congress, RL30343, Jan. 9, 2008), p. 6.

The initial version of the spend plan will typically be based upon the PB submission and then adjusted as necessary as Congress acts on the request. To be truly useful, the spend plan must be comprehensive and account for *every* item toward which funds will be allocated. On a typical program, the largest single portion of the funds will go toward prime contractor payments, but the spend plan must also account for travel and temporary duty (TDY) costs, program office support contractors, federally funded research and development center (FFRDC) support, facility costs, test-range support, Service-level "taxes" and withholds, GFE purchases, transfers to other programs, and the multiplicity of other line-item costs that programs typically face. Spend plans might easily encompass hundreds of line items and should predict specific obligation and expenditure events (for RDT&E funds) over each month of the fiscal year.

Although a program's financial management and program/project management staffs will typically take the lead in building a program spend plan, everyone involved in the process needs to review the final product to ensure the profile is realistic and achievable. The contracting team in particular should be involved, as contracting events and associated lead times often drive obligation and resulting expenditure profiles.

The purpose of the spend plan is to ensure the program meets OSD targets for obligations and expenditures. A plan itself will never attain these targets unless other activities have been underway well in advance of the fiscal year. Programs often need to start preparing for major contract awards a year or more in advance, especially if the awards entail complex Requests for Proposals (RFPs), source selections, or negotiations. Even in advance of this, PMs might need to lay the groundwork for contracting activities that lead to early fiscal year obligations. As an example, if a program is completing Developmental and Operational Testing (DT&OT) at the end of one fiscal year in anticipation of a production contract award in the next fiscal year, the PM will typically need some special permission to release a production RFP in advance of DT and OT results. Programs also need to account for the fact that it is unlikely that all of their funds will be released on October 1.

If the government is working under Continuing Resolution Authority (CRA), which could last well into the next calendar year (or even the whole year), contracting strategies need to account for the limitations that CRA imposes: no "New Start" programs, 68 and total obligation authority limited to either 80 percent of the prior year funding or 80

 $^{^{68}}$ According to the DoD Financial Management Regulation 7000.14-R, Volume 3, Chapter 6, Paragraph 060401E, a "new start" is defined as any program, subprogram, modification, project, or subproject not previously justified by DoD and funded by Congress through the normal budget process.

percent of the smallest budget under consideration in the congressional authorizing and appropriating committees. Failure to account for CRA limitations or to lay the groundwork necessary to get money obligated and expended early can set a program back months in terms of meeting OSD execution goals. With the first serious Service-level execution reviews typically scheduled for early in the spring of each calendar year, a program can lose funding before it even had a chance to spend it if the PM didn't plan sufficiently far in advance or consider the obstacles to spending money.

The point is that while "execution" is defined as obligating and expending funds to support program needs, execution actually starts well in advance of the receipt of funds. Good PMs will position their programs to award contracts and obligate funds as early as possible—ideally in the first month of the fiscal year.

Financial Roller Coaster

Christmas came early for Colonel Bill Cooley... December 19, 2011, to be precise. That's when he learned that the Air Force Research Laboratory's (AFRL) Space Vehicles Directorate would get the full PBR of \$193 million. He and the entire staff had spent the last 6 months trying to figure out how they would get through FY 2012 if the 42 percent mark (reduction) from the House Appropriations Committee on Defense (HAC-D) held in conference. In the summer of 2011, the HAC-D had reduced the PBR of AFRL Space Vehicles by about \$80 million or 42 percent, resulting in a scurry of activity to decide which programs to keep and which to kill. Then, because of delays in congressional appropriations, the DoD was under CRA for nearly 3 months, which meant the funds were limited to 80 percent of the lowest mark. Colonel Cooley and the staff focused on slowing down contracted efforts and delaying awards of new contracts because of the very real likelihood that their FY12 funding would be dramatically reduced.

But the money came ... all of it! This was great news for the entire directorate and for Space Science and Technology. Now get those contracts moving and prepare for the spring execution review in 2 months!

David Harder, the directorate chief financial officer (CFO) was a master at obligating funds in civilian payroll and every other known valid annual cost. Unfortunately, the positioning for a 42 percent cut meant that contract expenditure rates (sometime referred to as burn rates) were reduced to a minimum and FY11 funds had been loaded on some of the key contracts, which would result in even slower execution of FY12 funds on those same incrementally funded contracts. The directorate had a serious expenditure challenge in addition to a building obligation challenge unless a few large contracts were awarded soon.

The Spring Execution Review passed without incident as the obligation and expenditure rates were not significantly under the OSD goals. However, as the months ticked by and two large contract awards were delayed due to processing complications and a protest submitted to GAO by a disappointed competitor—the obligation and expenditure rates fell further behind the OSD goals.

By mid-June 2012, the Air Force was running well behind in its O&M accounts and needed to identify funds that were not meeting execution goals

elsewhere in the Air Force. These funds could be "reprogramed" into O&M by including them in an omnibus above threshold reprograming (ATR). Although it would take months for Congress to work through the proposed funding sources and recipients, the Air Force had no choice but to cover the O&M shortfall.

Colonel Cooley got the news in mid-June 2012. Despite the strong advocacy within the Air Force and OSD to protect Science and Technology investments, as it is the "seed corn" for future DoD systems, the poor execution rates in the Space Vehicles directorate were indefensible—Air Staff targeted \$24 million within the directorate as "excess to need."

Was it a "perfect storm" given the positioning required to plan for the 42 percent reduction? How could all of the diligent work and planning for an \$80 million cut by the HAC-D turn into a "year of execution cut" of \$24 million? Did the directorate fail to plan sufficiently for success by getting contracts in place that would enable it to increase its obligations and expenditures in January and February 2012?

I can't believe we lost \$24 million in the omnibus!

Execute, Review, Reallocate-Repeat as Necessary

Financial reviews are perhaps the least entertaining, most mundane, and yet most important part of a PM's job. They also are an opportunity to excel and receive funds from poor executors. One measure of a PM's seriousness and commitment to his job is the time he invests in financial execution reviews. The keys to making this as effective and painless as possible is to do it on a periodic basis, involve all of the key players, use a standardized template for review, and maintain a timely process for reallocating funds.

The Services typically conduct their execution reviews in the spring of each calendar year, no later than halfway through the fiscal year. If a program conducts its first serious execution review only in the weeks leading up to the Service-level review, it is probably too late to address adverse performance, and the data upon which decisions will be based are likely already "in the books." Execution reviews should start in the first month of the fiscal year and take place monthly or (at the very least) bimonthly. Because these reviews also typically assess performance against prior year funds (2-year RDT&E funds and 3-year procurement funds), the review process is continuous and unending.

Involving "all of the key players" starts at the top: A PM's lack of involvement in the review indicates he or she doesn't take the execution and review process seriously and signals project managers and functional representatives that they also need not take it seriously. In addition to the PM, at least three other groups should participate in every execution review.

The first of these is the financial management (FM) team, including the CFO or equivalent and the financial analysts and planners associated with each subordinate program or project. The FM team will typically consolidate the data and prepare the charts necessary for an execution review, and its expertise in budgeting, execution, and reprogramming is essential.

The second team that needs to be represented is the lead contracting officer (CO, or KO to avoid confusion with the "commanding officer") and subordinates (other KOs and nonwarranted buyers). The contracting team plays a critical role because contracting actions often represent the "long pole" in the obligation and expenditure process. The KO and the KO's team must be there to speak to the likelihood that the program will be able to hit the contracting marks necessary to support an execution plan.

The third team essential to an execution review is program management-the group of subordinate program and project managers responsible to support the lead PM on almost every defense acquisition program. These subordinate PMs will have their own budget allocation necessary to implement subsystem or support system programs, often associated with independent contracts. Though contract awards typically represent the last event before funds obligate, countless activities under the purview of the program management team precede most contract awards, including the generation of requirements documents, authoring of requests for proposal, building of contract data requirements lists, and completion of technical evaluation. What is more, a large part of any program budget may have nothing to do with contract activities. GFE, test support, airlift support, and any number of other expense categories typically require the program management team to execute and initiate. At the end of the day, it is the PM (and the subordinate PMs) who are primarily responsible for successful execution.

The template for an execution review is typically based on the format that will be submitted to support Service-level reviews. It comprises three main elements: current execution status for each year and color of money, obligation and expenditure forecasts, and detailed timetables (based on the program spend plan) that show specific obligations and expenditure events and typically highlight activities that will push a program above expected guidelines. Current execution "stoplight charts" use red, yellow, and green color codes as well as specific obligation and expenditure measures to depict execution performance at a specific time as measured against OSD guidelines. Forecasting "snake charts" (see Figure 7) depict predicted obligation and expenditure performance and

identify when the program will meet or exceed OSD guidelines. Detailed obligation and expenditure timelines typically are provided only when funds execution status does not meet OSD guidelines ("red"). These timelines provide a project-by-project, month-by-month description of the entire program element spend plan and might incorporate dozens or even hundreds of line items.

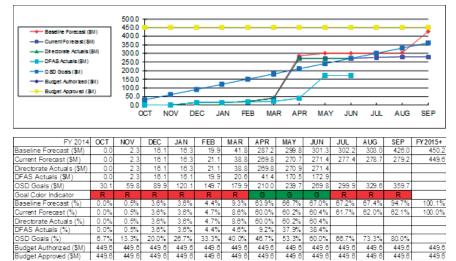


Figure 7. Example "Snake Chart"

Though poring over this level of financial detail is time consuming, PMs cannot be confident of their ability to meet OSD guidelines or defend their funds until they have subjected their spend plan to this level of scrutiny. As PMs review the detailed execution plans and encounter significant obligation and expenditure events, they should turn to the functional teams to validate that the predicted activities will occur on schedule. KOs, for example, should know at least several months in advance whether they are on a glide slope to achieve significant contract awards. Similarly, financial managers should be able to speak to major funds transfers, and financial analysts should be able to vouch for predicted expenditure rates.

All three components of the execution review that we have discussed—current status "stoplight charts," forecasting "snake charts," and obligation and expenditure timetables—are government products generated by the CFOs and their staffs. In order to validate expenditure forecasts in particular, the PMs also need to review the contractor-generated funding and execution plans versus actual performance

Contracts above certain dollar thresholds⁶⁹ are required to provide a Contract Funds Status Report (CFSR) as a data deliverable specified in all cost-plus type contracts. A CFSR provides historical data based on actual invoicing, while the contractor's predicted data are based on a program baseline. If there are substantial differences between what the CFO-produced expenditure timetable shows—either historically or looking forward—and what the contractor-generated CFSR shows, this is a sign that something is amiss. A delta between the two reports typically indicates one of two things: Either government financial analysts are not tracking and adjusting their timetables and expenditure forecasts based on contractor performance or the contractor is not updating its CFSR as it deviates from the original baseline. In either case, PMs cannot be confident about their predictions until they resolve discrepancies between the government- and contractor-generated products.

Understanding Versus Fixing

It's not enough that we do our best; sometimes we have to do what's required.

-Winston Churchill

Although an effective execution review process is essential to understanding whether a program is performing to standards, the review process itself cannot fix a program that is not obligating or expending to OSD standards. To use a metaphor, the execution review is like a map—it simply tells the PMs where they are. Once PMs recognize their situation, they need to take corrective action or someone else will.

If a program is not keeping up with obligation or expenditure guidelines, the PM essentially has two choices: reallocate funds or relinquish funds. By reallocation, we mean moving funds from one program or project within a Program Element⁷⁰ (PE) to another. As we have already mentioned, most programs typically include smaller programs or budgets funded from a common PE. The spend plan depicts how funds are distributed among these projects and how each project will execute over the course of the year. If it becomes evident during an execution review that programs or projects within a PE are not meeting their execution forecasts, the first thing a PM should do is look for opportunities to real-

⁶⁹Typically above a certain cost threshold of no less than \$1 million.

⁷⁰The PE is the primary data element in the FYDP and is the foundation of the PPBE process. Each program and entity within the defense portfolio has its own PE and is the specific allocation of resources for those entities from the Secretary of Defense. For more information, see http://www.acqnotes.com/

locate those funds to other programs or projects that can use the funds more effectively. $^{\!71}$

The best reallocation processes are the simplest, and if all the key decision makers—the PM, the CFO, the KO, and the subordinate PMs—participate in the execution review, reallocation can occur in real time. When it becomes evident that a program is lagging (particularly in terms of obligations), all the PM needs to do is turn to the other subordinate PMs and ask who can use the money and what the "payback" mechanism and timeline will be. If the two affected program or project managers can agree on the swap, and the other key participants agree that the reallocation plan is realistic, executable, and will improve performance, all that's left is for the CFO and staff to document the agreement and reallocate the funds through their funds management and tracking system.

An alternative approach is for the PM to "sweep" funds determined to be either excess or under-executing, and to maintain a list of unfunded or underfunded programs or projects. Periodically, based on his or her judgment or with advisors at hand, the PM can review available funds and reallocate them against "unfunded requirements." Though this is a common approach, there are a couple of reasons we recommend the "real time" strategy. The first reason has to do with the underlying problem: poor execution. If a program is lagging on obligations or expenditures, time is of the essence in correcting the problem. Especially given the contracting lead times that often precede obligation and expenditure events, a good solution today is generally better than a great solution a month from now. Beyond this, our experience has been that the highly deliberative, unfunded-requirements process often tends to break down in the complex dynamics that pervade many program offices. Requirements change over time, cost estimates grow stale, and opportunities that may have been great ideas 6 months earlier no longer seem so appealing. Maintaining a list of projects that can quickly absorb and execute funds can be difficult, time consuming, and ultimately fruitless. For all these reasons, combining the funds execution review and reallocation process in a single, real-time event is often the most effective and efficient way to identify and quickly move to remedy execution shortfalls.

⁷¹If the "losing" program is likely to need those funds at some point in the future, it should go without saying that the PM and subordinates need to make sure that there is some sort of "payback" opportunity. Keep in mind, however, you will be in a weak negotiating position.

Management Reserve

When you're going through hell, keep on moving—you might get out before the devil even knows you're there.

Rodney AdkinsCountry and Western Singer,Songwriter

Another financial management tool essential for a PM's success is "management reserve" (MR). These funds are a part of the overall program that is best thought of as a savings account for unknown costs or unanticipated bills. Having an MR is a best practice in acquisition programs, but it requires a clear understanding of how and when it is used, as well as an understanding of what constitutes an appropriate amount of MR for a given program. First, an MR is applicable for cost-reimbursement contracts (e.g., CPIF, cost plus award fee [CPAF]) and not fixed-price contracts. In a fixed-price contract, the contractor should have accounted for the program risk.

There are two types of MR: program MR and contract MR. Program MR is at the program level (i.e., in the government program office) while contract MR is money obligated on the contract and tracked by the contractor as part of its Earned Value Management (EVM). The key difference is that program MR is risky to maintain and not recommended. We say this for two reasons: (1) funds held in the program office are neither obligated nor expended and will count against the overall financial execution goals, and (2) the MR becomes an "easy take" from staff comptrollers when discovered. On the other hand, contract MR is a necessary and encouraged practice. Contractor MR funds are obligated and provide resources to fix problems quickly in the year of execution. We recommend that the contractor report to you every month their MR balance and options for using it to improve schedule, risk, or cost baselines.

The amount of the MR depends on the risk in a program. Although there is no accepted standard amount of MR, the rule of thumb below provides an approximate amount of MR as a function of program risk.

Rule of Thumb							
Low-risk program	< 5% MR	(production)					
Medium-risk program	~ 5–10% MR	(LRIP)					
High-risk program	~ 10−15% MR	(development)					

Breaking Glass

The idea of a reallocation process assumes that within a PE, another program or project is available to absorb funds. When that's not the case, the PM may need to consider relinquishing funds. This is a dangerous prospect that should be pursued only when all other options have been exhausted. The danger derives from the fact that total program funding requirements do not change just because a program falls behind its original spend plan. If anything, as the execution schedule lengthens, total program costs will grow due to inflation and the costs associated with maintaining a "standing army" of program personnel and contractors. With this in mind, a program that is relinquishing funds in a given fiscal year needs to make every effort to secure future "payback" to offset the lost funds. This is an especially difficult prospect when a program has already demonstrated an inability to execute current-year funds.

There also is a limit to the funding that a program can relinquish and that the Services and DoD can reapply to another PE without congressional authorization. This limit is known as the below threshold reprogramming (BTR) limit. BTR limits are put in place by Congress. They provide DoD with some flexibility to reallocate funds across acquisition programs, but they preserve Congress' DoD spending oversight role. For RDT&E funds, programs are allowed to reprogram only the lesser of \$10 million or 20 percent of a given year's funding. For procurement funds, programs can only relinquish the lesser of \$20 million or 20 percent of funds. The same constraints apply to programs transferring funds into their PE. Within these limits, the Services and the DoD can transfer funds between PEs without prior notification of and approval from Congress.

The acquisition staff officer and the Services' secretariat-level acquisition offices typically play a central role in the BTR process. Quite often the formal decision to proceed with reprogramming occurs during annual Service-level execution review. This is an ideal forum for BTR requests for several reasons: (1) Service-level reviews are typically chaired by someone with the authority to arrange for future paybacks, (2) the forum lends itself to quick decisionmaking and allows the program to avoid what can otherwise be a lengthy staff process, and (3) when a program is under-executing, an offer to relinquish and trade for future funds is likely to be received better than trying to defend current-year funds.

If a program decides to relinquish or absorb funds exceeding BTR limits, DoD must formally notify and receive approval from Congress. This is referred to as above threshold reprogramming (ATR) and is typi-

cally accomplished through the annual DoD omnibus⁷² reprogramming bill. This is an even more dangerous prospect, however, because it entails providing Congress with explicit notice that a program is either relinquishing funds (and hence under-executing and probably behind schedule) or in need of additional funds (likely because of cost overruns). If a PM is compelled to take these measures, there are probably no good alternatives, but the PM should realize that requesting congressional assistance through the ATR process invites additional scrutiny and, in all likelihood, loss of autonomy and control. PMs who have been there know that their life becomes substantially more complex when Congress starts playing an active role in financial management.

DRIVING THE FINANCIAL BUS

It should be self-evident by this point that managing the finances for a major acquisition program is tremendously complex and will occupy a significant percentage of any PM's time. Financial management is also highly collaborative, and the PM will necessarily rely on a number of subject matter experts (SMEs) and functional support teams to successfully navigate the process. The cost-estimating team must create the detailed estimates that will ultimately lay the groundwork for the program execution plan. KOs must write solicitations, support contractor source selections, and negotiate and award contracts that will typically lead to a preponderance of a program's obligations and expenditures. The acquisition staff officer will play a central role in preparing and defending the budget and in negotiations with congressional or Service staff representatives. The CFO leads a team whose sole purpose is to plan, manage, and execute program funds. With all this assistance, it is easy to forget who, at the end of the day, ultimately controls and is responsible for financial management decisions: simply, the PM.

Each of the functional entities we described above is there to help PMs manage and execute their funds, but they will each come to the process with a unique perspective and agenda. As the famous adage says, "What you see depends on where you sit," and the PM is the only member of the program management team who sits at the center of the financial management process. At the end of the day, the PM is also the only member of the program management team who will be held accountable for successful or unsuccessful execution.

With these thoughts in mind, it's critical first that PMs under-

⁷²An omnibus is a vehicle carrying many passengers. In the case of congressional bills, it simply means it is an action providing for many things at once; "an omnibus law."

stand the unique perspectives of their individual team members. There's more than a little stereotyping in the following characterizations, but cost-estimating teams are, by nature, conservative, KOs almost always want more time to negotiate the best possible deal, and CFOs will tend to worry about execution first and cost/schedule/requirements a distant second. If PMs don't understand the perspectives each team member brings to the process, they will be ill equipped to offset the undue influence they might bring to bear.

Second, it's important that PMs take the time to truly understand the financial landscape. Peruse the cost estimates so you understand underlying assumptions and numbers. Know and continue to monitor your spend plan sufficiently well to ensure it is realistic and executable. Challenge the contracts team on its ability to meet its critical contracting milestones.

Finally, with the support of the entire acquisition team, the PM gets to make the final call on financial management decisions. Lots of advisors and help are available, but you must make the decisions. This is perhaps one of the best parts of the job—you get to make key and impacting decisions, spend significant amounts of money, and feel great pride in accomplishment when you succeed.

THE CONTRACT

 $The \ contractor \ is \ coin-operated.$

-Anonymous

Rule No. 1 ... know your contract.

-Anonymous

Most definitions of the word "contract" describe agreements between a buyer and a seller that dictate the conditions of an exchange—typically of goods or services for payment. The DAU *Glossary*, for instance, defines a contract as "a mutually binding legal relationship obligating the seller to furnish supplies or services (including construction) and the buyer to pay for them." While these definitions are accurate, they are also unfortunate in that they emphasize the static nature of a contract as a transactional agreement.

From a PM's perspective, the contract should be seen as another tool that can to be used to influence contactor behavior and improve

⁷³ Hagan, *Glossary*, B-41. Similarly, Wikipedia describes "an agreement having a lawful object entered into voluntarily by two or more parties, each of whom intends to create one or more legal obligations between them."

the likelihood of program success. An effective and well-written contract aligns government and contractor objectives and incentivizes a contractor to work first toward the most important government objectives. A poorly conceived or structured contract, on the other hand, can create incentives that cause the contractor and government to work at cross-purposes.

Whether a contract is well written or not, the "legal" and "mutually binding" nature of the document dictates that in most instances it will guide and govern contractor behavior, regardless of a PM's efforts to persuade, cajole, or threaten the contractor to work toward objectives not defined in the contract. With this in mind, PMs must be directly involved in RFPs and contract drafting to engage their contracting staffs and think hard about the contract type, contract incentives, and contract language. We encourage PMs who inherit a contract—a more frequent occurrence—to carefully read their contracts to understand the scope of work they define, the performance objectives they demand, and the contractor incentives they create.

This second piece of advice in particular may seem like fundamental guidance, but many PMs never read the details of their contracts, in part because a typical contract can appear overwhelming. It needn't be. The sections of the contract that the PM needs to be familiar with are typically a small subset of the total contract and include, in approximate order of importance, (1) the Statement of Work (SOW), (2) performance specifications and incentives, (3) the Contract Data Requirements List (CDRL), and in some instances, (4) special contract requirements, which are terms and conditions specific to that contract.

What Makes the Contractor Tick? The Contract!

Government letters and emails to DoD contractors often end with disclaimers along the lines of "nothing contained in this correspondence is to be construed as contractual direction." It is unfortunate that DoD contractor correspondence does not include a similar disclaimer, though theirs would read a little differently, something along the lines of "Regardless of what we say, nothing contained in this correspondence is to be construed as any indication of what this company intends to accomplish. At the end of the day, we will execute to the letter of the contract."

Both new and seasoned PMs often make a similar mistake when providing guidance to the contactor outside the bounds of the formal, written contract. Their mistake is to believe that unwritten guidance or informal agreements substantially influence contractor behavior. More often than not, they don't—or at least they don't when (1) those informal agreements actually run counter to what the contract directs the contractor to do or counter to the contract's financial incentives, or (2) things go to "hell in a hand basket" and the contractor is struggling to deliver minimum, documented contractual obligations.

This is not to say PMs should not collaborate with their industry counterparts. As we have stressed, open and clear communication with all members of your acquisition team—government and industry—is a prerequisite for program success. Every PM needs to understand, however, that (1) the contractor is paid according to how he performs against documented contract requirements, (2) any good contractor will be well versed in what the contract says, and (3) because of these two considerations, contractor performance at the end of the day will be driven primarily by what the contract directs them to do, and not by informal agreements arrived at outside the bounds of the contract.

The SOW describes "what" the contractor is required to accomplish, and is usually organized according to tasks the contractor is expected to complete. One good way to evaluate the adequacy and completeness of SOW language is to ask yourself: "What if the contractor does exactly what we tell them to do (and nothing else)? Will we be satisfied? And how will we evaluate whether they have met our objectives?" We'll take an example from a recent Air Force acquisition program to illustrate what we mean here.

When Money Gets Tight ... It's the Contract That Matters

The SOW paragraph for the program's training program reads as follows:

The contractor shall provide operations and maintenance training. Operations and maintenance training shall be based on the "Train the Trainer" approach. The contractor shall develop a training plan, which outlines learning objectives, methods, module-level skills, schedules and identifies any prerequisite training (i.e., operating systems, COTS/GOTS applications, etc.) required. The contractor shall develop a formal operator training course and course materials. The operator training shall encompass the needs of mission management, mission planning, imagery analysis, MASINT analysis, and all source analysis functional areas.

The contractor in this case did exactly as it was told. The contractor built operations and maintenance courses based to "train the trainer" for mission management, mission planning, imagery analysis, and the other functions described. It developed a training plan with learning objectives and the other components. And it developed a formal operator training course with course materials. By the time the contractor started undertaking this task, however, the program (an Air Force intelligence, reconnaissance, and surveillance system) was already late and well over budget. The contractor was looking for every opportunity to cut costs. With that in mind, it did almost precisely what the SOW directed it to do. The contractor provided 1 week of operator and maintenance training that covered the components of the system the contractor had developed, but it ignored training on any of the commercially provided or government-furnished components ("COTS/GOTS applications"), which in this case constituted a significant percentage of the system's overall functionality. Training focused almost entirely on user interface familiarization or "buttonology," and provided no scenario-based exercises that

enabled operators to understand how to use the system operationally. Predictably, the customer was completely dissatisfied with the training course, but the PM had little recourse in terms of penalizing the contractor or forcing it to redesign or redo the task. The SOW did not direct the contractor to provide training on commercial or government-provided components, and made no mention of scenario-based training. Additionally, there were very few criteria that helped the PM determine whether the contractor had met the objectives of the training program. The contractor had done exactly as the SOW instructed ... and nothing more.

The lesson to take from this nonfiction story is that the SOW must be as explicit as possible in terms of describing what you expect the contractor to do and how you will evaluate (and financially reward or penalize) the adequacy of the contractor's performance. This guidance might make some PMs uncomfortable. Acquisition policy over the past decade has consistently emphasized strategies that give industry wider latitude to offer creative solutions to government requirements. With this in mind, some programs have abandoned authoring SOWs altogether, typically supplanting them in their RFPs with a much higher-level "Statement of Objectives" that allows contractors to author the Statement of Work.

Ensuring that contracts provide explicit guidance and giving the contractor latitude to propose innovative solutions are not mutually exclusive concepts. Whether the government or the contractor authors the SOW, both sides must collaborate to ensure the document provides clear and comprehensive guidance regarding government expectations. The Department of Defense Handbook for Preparation of Statement of SOW is an outstanding reference book for SOW authors. It describes the standard format for a DoD SOW and provides detailed guidance on crafting requirements specific to the program type and phase.

Early in the introduction, the DoD SOW handbook provides sage guidance on another important issue—avoiding redundancy among contract sections. The disparate contract elements—the SOW, performance specifications, and the CDRL—can cause confusion if the documents overlap or attempt to restate information from other sections of the contract. The guide states:

The tendency of SOW writers is to include requirements which belong in other parts of a government contract. Contract requirements should be specified in Sections A-M and should not be restated in other parts of the contract. Quantitative technical requirements should be specified in

⁷⁴Department of Defense, *Handbook for Preparation of Statement of Work (SOW)*, MIL-HDBK-245D, April 3, 1996, available at https://acc.dau.mil/CommunityBrowser. aspx?id=46583&lang=en-US.

the specification and not be restated in other parts of the contract. Work requirements should be specified in the SOW, and all data requirements for delivery, format, and content should be in the Contract Data Requirements List (CDRL) in conjunction with the appropriate Data Item Description (DID) respectively, with none of the requirements restated in other parts of the contract. Redundancy invites conflict [emphasis added].⁷⁵

As the guide makes clear, the SOW describes specific work requirements, performance specifications describe the standards against which the work will be evaluated, and the CDRL describes deliverable "data items" within which some of the work will be captured.

Performance specifications may be authored as part of the contract, in which case they define specific performance targets the contractor is expected to achieve. Alternatively, performance specifications may be incorporated by reference, in which case they point to established defense or industry performance specifications. In either case, they make clear to the contractor precisely what performance will be deemed acceptable and provide the government with objective criteria by which to accept or reject contractor goods or services.

The CDRL (see Figure 8) and its accompanying DIDs provide similar guidance for written reports, tech orders, manuals, design documents, drawings, and other data submissions (including software) that a contractor provides as part of a contract, specifying delivery schedules, format, and content requirements. The CDRL is used to order data or reports, while the DIDs describe format and content requirements for specific data items (though whenever possible, the CDRL should make clear that contractor formats are acceptable). As with performance specifications, the CDRL and DIDs provide clear guidance to the contractor on how it is expected to perform a task or provide a deliverable.

⁷⁵ Ibid, p. ii.

⁷⁶Ibid, p. 14.

How Well Is the Software Development Going? No Idea

An example from a major Air Force battle-management system illustrates the importance of making sure that the SOW, specifications, and CDRL all support one another. In this example, the effort under contract consisted primarily of software development, integration, and test on a large battle-management platform. The Air Force required a means to track software development progress. To accomplish this, they inserted language in the SOW that directed the contractor to provide "software metrics" detailing software size, productivity, quality/maturity, and status of progress. Unfortunately, the contract did not include any requirement for a data deliverable to report on these metrics. Additionally, the contract left unstated or undefined specific measures for software productivity, quality, or progress. The contractor thus reported on metrics according to whatever schedule it found convenient (typically during periodic, formal reviews) and chose only those metrics it already had collected as part of the software development process. Because the contract provided no way to assess acceptable performance, no definition of the specific "metrics" the Air Force desired, and no data deliverable within which the contractor was required to report on metrics, the SOW language was essentially unenforceable—the contractor provided what it wanted, when it wanted to do so. The result was a program management team with little insight.

CONCERNING CONTRACT TYPES

Providing clear direction to the contractor and objective criteria against which the government can assess the adequacy of its performance is not always sufficient if the criteria are not tied to appropriate financial incentives. On some CPIF contracts, for example, contractors may be late in realizing key milestones or providing critical deliverables, but their fees will be unaffected if they eventually meet the contract requirements and do not exceed cost targets. This is because fee structures are based primarily on cost containment rather than schedule or performance objectives. In fact, an emphasis on cost containment may work at cross-purposes with a PM's desire to accelerate schedule or deliver improved system performance if the contractor's fee is determined by how well the contractor does against cost targets not necessarily related to schedule or performance objectives. Designing and structuring contracts so they motivate the contractor to perform in alignment with government priorities is an art form that requires a close working relationship between the PM and the contracting officer.⁷⁷

Most PMs inherit their contracts from predecessors. Even when that's not the case, PMs too often abdicate decisions about contract types

⁷⁷The Federal Acquisition Regulation (FAR, part 16.104) lists 10 considerations that influence contracting type, including price competition, price analysis, cost analysis, type and complexity of the requirement, urgency of the requirement, period of performance, contractor's technical capability and financial responsibility, adequacy of the contractor's accounting system, concurrent contracts, and extent and nature of subcontracting.

and structures to their contracting officers. This is regrettable. The type of contract a PM applies to a particular effort should be tailored to the risk and complexity of the task, the goals the government wants to achieve, the management resources at the PM's disposal, and the incentives that best motivate the contractor. The contract type can dramati-

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Figure 8. Sample Contract Data Requirements List (CDRL)

cally influence how the PM manages the program and how the contactor responds. There are countless variations on the basic contract types, but for the purposes of this discussion we will focus on the most common: firm fixed price (FFP), cost plus incentive fees (CPIF), fixed price incentive (firm target), and cost plus award fees (CPAF).

Proverbs for PMs

Contracting officers and lawyers are on your staff, you are not on theirs.

- If you frequently hear "you can't do that ...," find a new one.
- Teach them to figure out how to do it.
- If the problem is beyond their experience, have them seek outside help.
 Broaden their horizons.

FFP Contracts-Zero Sum

Firm Fixed Price (FFP) contracts are likely to succeed when two conditions exist: we know our requirements and they will not change; and the contractor understands his processes sufficiently well to be able to bid a fixed price.⁷⁸

Dr. Ashton Carter
 Former Under Secretary of Defense for
 Acquisition, Technology, and Logistics

According to Carter, if both of these conditions exist, the risk associated with producing the end item or service typically is low, making it feasible for contractors to bid and work to a fixed price. At least one thing bears repeating about the conditions Carter described: The government understands its requirements, and they will not change. This bears revisiting because these conditions dramatically constrain a PM engaged in an FFP contract. Terms and conditions are typically well understood at the outset of the contract, and the PM typically has little recourse to modify the terms once the effort is underway, unless he or she is willing to pay a substantial penalty. In fact, the role of the PM in an FFP contract typically is limited to that of an enforcer; the most the PM can do is hold the contractor to the letter of the contract and ensure that the contractor provides services or delivers goods to the minimum standards described in the contract. Another useful way to think about an FFP—and a critical distinction between FFP and cost-plus contracts—is to frame it in

⁷⁸Patty Welsh, "Pentagon acquisition chief talks 'Better Buying Power' at Hanscom," June 3, 2011. Available at http://www.hanscom.af.mil/news/story.asp?id=123258581. From Carter presentation to the Air Force Electronic Systems Center (ESC) audience in May 2011.

terms of a "zero-sum game." With a fixed price already agreed to by both parties, the contractor will be extremely reluctant to consider any suggestions from the government that might add effort, complexity, or risk to the task. This is because, with the overall price fixed, any added costs resulting from government requests for changes come directly out of the contractor's bottom line. This is why requests for changes to FFP contracts often come with a substantial price tag.

Cost-Plus Contracts—Incentives Matter

Where Carter described FFP conditions in which both requirements and processes are well understood, cost-plus contracts typically find application where one or both of these conditions do not exist, and as a result a certain amount of risk exists in predicting the cost associated with meeting government objectives. Cost-plus contracts reimburse contractors for allowable costs they incur (sometimes with limits), then determine a fee based on criteria we will elaborate on shortly.

As described in the Federal Acquisition Regulation, the CPIF contract "is a cost-reimbursement contract that provides for the initially negotiated fee to be adjusted later by a formula based on the relationship of total allowable costs to total target costs." The government and contractor agree on a target cost, target fee, minimum and maximum fees, and a fee adjustment formula or "share ratio." The target cost represents what both sides deem the most likely reasonable cost for the effort, while the target fee defines the fee associated with the target cost. In most instances, the target cost and target fee only form the starting point for actual fee calculations. The total reimbursement to the contractor varies depending on whether the contractor underruns or exceeds target cost. The fee increases if the contractor completes the effort for less than target cost, and it decreases if the contractor's costs exceed the target.

The fee is calculated based on a "share ratio," which effectively determines how much of a cost underrun the contractor is allowed to retain, or how much of an overrun it is required to bear. So Share ratio always must equal 100 percent. That is, every dollar of cost below or above the target cost must be divided between the government and the contractor. A "70-30" cost share would indicate that the government would retain 70 percent of every dollar if the contract were to underrun, and pay

⁷⁹FAR part 16.405-1.

⁸⁰ Technically, contractors on CPIF contracts are reimbursed for all costs and only their fee is adjusted according to underrun or overrun conditions. The practical impact of this approach, however, is as described here: Contractors absorb a portion of the overrun costs (through decreased fees) and retain a portion of their underrun costs (through increased fees)

70 percent of every dollar if the contract cost were to overrun. Though a contractor's total reimbursement (and the contract's total price) will increase in an overrun situation, the contractor fee declines in proportion to the share ratio. In this case, the government effectively pays the contractor only 70 cents for each dollar of cost it incurs until the minimum fee is reached. Once the contractor's allowable costs reach the minimum fee condition (an overrun of target cost), the contractor is paid total allowable costs plus the minimum fee. Similarly, if the contractor's underrun reaches the maximum fee condition, it is paid total allowable costs plus the maximum fee.

A simple example helps to illustrate these ideas. Assume as a starting point that the target cost for an effort is \$100 (wishful thinking in the DoD domain), target fee is \$20, target cost plus fee is \$120, and the share ratio is 60:40. If the contractor completes the effort for \$90, the fee calculation starts with the target fee of \$20. In addition, the contractor gets to keep 40 percent of the \$10 underrun, or an additional \$4. The total fee is thus \$24 and the final price to the government is \$90 + \$24 = \$114.

Now take the case where all the same preconditions exist, but the contractor overruns the effort and accumulates \$110 in costs. Again, the fee calculation starts with the \$20 target cost, but in this case the contractor also bears responsibility for 40 percent of the \$10 overrun, thus the fee is reduced by \$4 to \$16. The total price to the government is \$110 + \$16 = \$126. See Figure 9.

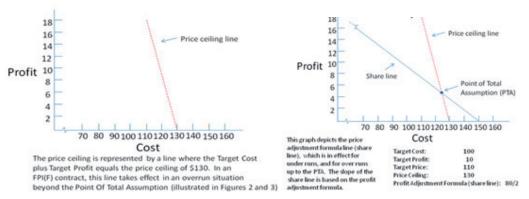


Figure 9. Example of Incentive Structures (Profit-Cost Share Line)

There are several variations on the share ratio theme. The contract might include multiple share ratios that describe the allocation of cost (and fee) at different points on the cost axis. The contract might also include a "price ceiling," which defines the maximum amount that might

be paid to the contractor.⁸¹ The cost associated with the price ceiling is sometimes referred to as the "Point of Total Assumption," because it is the cost point above which the contractor assumes responsibility for all additional costs and will no longer be reimbursed for costs (or additional fee) by the government. Put differently, this is where the share ratio becomes "0:100" and the contract converts to essentially a fixed-price effort. Contracts that impose a price ceiling are generally referred to as "fixed price incentive (firm target)," or FPIF, because they combine characteristics of both fixed-price contracts (limited government liability) and contractor cost incentives.

Isn't There a Better Way? Delivery and Performance Incentives

If cost containment is the primary government objective, but the risks associated with requirements or processes are inconsistent with an FFP contract, CPIF or FPIF often represent the best contracting options. But, as we have already mentioned, cost-based incentive contracts can constrain a contractor's willingness to cooperate on objectives that are *not* cost related, because there typically is no direct financial incentive for the contractor to perform above the minimum standards described in cost-based contracts.⁸²

Tips for PMs

Wargame your planned incentive strategy from the perspective of someone trying to rip you off.

The shortcomings of CPIF contracts suggest another contract strategy that schedule-driven programs often pursue: incentive payments tied to the accomplishment of tasks or delivery of items by target dates. Schedule incentives work well if schedule compliance is a concern, but there are multiple issues to be aware of here as well.

First, contractors will often be tempted to pad schedules to reduce the risk associated with meeting the target dates. If the criteria that describe what constitutes successful accomplishment of the task are not explicitly defined, contractors who are otherwise at risk of missing deadlines may also be tempted to conduct meaningless or incomplete activities simply to collect the schedule fee. For example, a contract might tie schedule incentive payments to the accomplishment of a "demonstration

⁸¹FAR, part 16.403-1 Fixed-price incentive (firm target) contracts.

⁸²This does not account for Contractor Performance Assessment Ratings (CPARs). CPARs account for and reward performance above contract requirements, but they do not confer any direct financial rewards. Contractors value higher CPARs because of the potential benefit they yield on other competitively awarded contracts.

flight test." If this contract does not also clearly describe what constitutes a successful "demonstration flight," the event may take place on time but fall far short of what the government imagined it would entail. Another risk associated with incentivizing specific events is that the contractor might "drop everything else" in order to collect payment in a manner ultimately detrimental to the larger program.

Related Contracts, Unrelated Incentive

A recent Air Force aircraft modernization program was undergoing both an engine upgrade and a separate overhaul of its computer systems. Both efforts were with the same contractor, but on two separate contracts with different incentives for performance. The computer system upgrade included an incentive clause for the accomplishment of a flight test. The engine program had no similar incentive. Both programs ran behind, and the contractor asked for relief on the incentive schedule for the computer system. The Air Force was in a disadvantaged position to negotiate or resist because the contractor threatened essentially to shut down the engine flight test program in order to meet the target date on the computer system flight test unless the Air Force complied with the contractor's request (which it did).

Contracts can also invoke "performance incentives" when "quality of performance is critical and incentives are likely to motivate the contractor." Performance incentives can either be associated with product characteristics (range, velocity, radar cross-section, etc.) or, on service contracts, quality of task performance. Many of the same warnings apply here in terms of unintended consequences, however, and the FAR warns that "the incentives on individual technical characteristics must be balanced so that no one of them is exaggerated to the detriment of the overall performance of the end item."

"Holistic" but Painful—Cost Plus Award Fee

Each of the cost, schedule, or incentive contracts described above rely on measureable, *objective cost*, schedule, or performance objectives to determine how much fee the government awards a contractor. In contrast to this approach, "award fee" contracts find application "when it is not feasible to devise predetermined objective incentive targets based on cost, technical performance, or schedule, with the focus instead being on subjective criteria, such as project management." The idea of "subjective criteria" might seem anathema to DoD program management and government contracting (award-fee contracts are less prevalent today than in the past partly because of this), but award-fee contracts of

⁸³ FAR. 16.402-1 Cost Incentives.

⁸⁴ Ibio

⁸⁵ Federal Contracting: Guidance on Award Fees Has Led to Better Practices but Is Not Consistently Applied (GAO Report to Congressional Requesters, GAO-09-630GAO, May 2009).

fer some important advantages over the other cost-plus constructs. Most notably, they afford the opportunity to evaluate contractor performance from a more holistic perspective, reward overall contractor performance, and avoid some pitfalls associated with narrowly focused cost, schedule, or performance incentives.

The FAR describes three preconditions that support a CPAF contract:

- (i) The work to be performed is such that it is neither feasible nor effective to devise predetermined objective incentive targets applicable to cost, schedule, and technical performance.
- (ii) The likelihood of meeting acquisition objectives will be enhanced by using a contract that effectively motivates the contractor toward exceptional performance and provides the government with the flexibility to evaluate both actual performance and the conditions under which it was achieved.
- (iii) Any additional administrative effort and cost required to monitor and evaluate performance are justified by the expected benefits.⁸⁶

Award-fee contracts require that the government program office generate and the "Fee Determining Official" approve an "award-fee plan" that (1) identifies award-fee evaluation criteria and how they are linked to acquisition objectives, (2) describes how contractor performance will be measured against award-fee criteria, (3) establishes the schedule for award-fee assessments and contractor feedback, and (4) defines the total award-fee pool amount and how this is allocated across each evaluation period.⁸⁷

A well-crafted award-fee plan will outline a process and structure that rewards contractor performance and incentivizes the contractor to be responsive to government priorities. Unfortunately, even with a well-crafted plan, CPAF contracts can be unwieldy and time consuming to administer. Both sides need to agree to the award-fee plan, and contractors will be loath to agree to either vague or challenging criteria in advance, knowing that their profits will be determined by the govern-

⁸⁶ FAR. Subpart 16.4—Incentive Contracts.

⁸⁷ Ibid

⁸⁸The award-fee plan is part and parcel of the contract with the contractor, and the contractor can refuse to sign the contract if it is dissatisfied with the plan. On sole-source contracts in particular, this generally leads to a collaborative authoring process. On competitive contracts, the award-fee plan is included with the solicitation.

ment's subjective assessment of how well they have performed against these standards. Once a contract is awarded, administering the annual or even biannual assessment can be extremely time consuming. Contractor performance must be continuously monitored and documented—and determining and awarding fees typically entails extensive contract, financial, and legal reviews to ensure the government assessment is accurate, fair, and defensible.

Partly because of the challenges associated with administering award-fee plans and defending awards that penalize poor contractor performance, there is a tendency not to hold contractors closely accountable for their performance. As the GAO noted in one of its reports, many DoD contracts "did not hold contractors accountable for achieving desired outcomes," and DoD representatives "frequently paid most of available award fees regardless of whether acquisition outcomes fell far short of, met, or exceeded expectations." This explains at least in part why CPAF contracting strategies have largely fallen out of favor within the DoD, despite the flexibility they provide to a PM.

Understand what drives the contractor to make the decisions they make.

-Blaise Durante, Retired Deputy Assistant Secretary for Acquisition Integration, Office of the Assistant Secretary of the Air Force

The lesson to take away from this is *not* that "all contracts are flawed." The point we are trying to make is that a good PM must understand his or her contract, play an active role when possible in selecting a contract type and crafting its contents, and then administer and execute the contract to enforce its requirements and satisfy the program objectives. The personal relationships a PM establishes with industry counterparts are critical, and open dialogue and good communications are essential, but in the end the contract determines what the contractor will accomplish and how closely its interests align to those of the government PM.

Rule of Thumb

Incentivize the contractor with your APB to the maximum extent possible ... then your goals are aligned. You'll either both be rewarded for your success ... or fail together.

SYSTEMS ENGINEERING

UNDERSTANDING SYSTEMS ENGINEERING

Even this book's authors follow different schools of thought on the utility derived from the different systems-engineering disciplines, including risk management, configuration management, requirements management, test management, data management, and decision analysis. One author maintains that a robust and independent systems-engineering organization is an essential component of almost any successful program office. The other posits that systems-engineering organizations have a tendency to become bloated and self-serving, resulting in modest return on investment, and that this not only occupies vital manpower slots but actually impedes progress on many programs. The manner in which a PM organizes and employs systems-engineering resources largely determines which outcome is realized.

The first thing any new PM needs to understand is that systems engineering is a completely unique engineering discipline that in many respects bears a closer semblance to disciplined management than engineering. Various definitions are available, but they all emphasize common themes: (1) it is an interdisciplinary approach, (2) it is typically applied to complex systems, (3) it translates an operational requirement into a functional, usable system, and (4) it takes into account the full life cycle of a system. The DAU description⁸⁹ articulates two characteristics that help to explain how systems engineering should work within a typical program office: It is an "integrating mechanism across the technical efforts" and "system engineering develops technical information to support the program management decision-making process." Written differently, systems engineering serves the PM by ensuring that the disparate engineering and technical efforts proceed in an integrated, coordinated, and consistent manner. All these descriptions reinforce the view that systems engineering is as much about management as it is about engineering.

⁸⁹ https://acc.dau.mil/se

The defense acquisition community traditionally refers to "technical processes" for system design and product realization and "technical management processes" used to manage system development. In this text, we'll only go so far as to describe the most prominent systems-engineering disciplines and the roles they play in effective program management. These systems-engineering disciplines include:

- Risk management
- Data management
- Information assurance
- Test management
- Decision analysis (cost benefit, trade studies, etc.)
- Interface management
- Configuration management
- Requirements management

Characteristics of Good Systems Engineering

- Integrated but autonomous—report directly to PM to enable smart, informed decisions with raw, blunt opinions, and recommendations.
- Well-defined, disciplined, respected processes.
- Stable core of subject matter experts, with well-defined areas of responsibility for government systems engineers and FFRDCs.
- Dedicated functional personnel—nothing better than a good configuration manager and data manager.

EFFECTIVE SYSTEMS-ENGINEERING PROCESSES

Our experience suggests several factors that distinguish effective and efficient systems-engineering organization from poor systems-engineering teams. First, the systems-engineering office must be both autonomous and integrated. That is, it must have sufficient independence to be able to exercise its functional authority (especially in the risk management, configuration management, and test domains) but sufficiently embedded in the program to understand the technical and programmatic issues. Practically speaking, this means the lead or chief systems engineer reports directly to the senior PM and is at least on par within the management hierarchy with subordinate PMs and other functional leads. On any large program, it also means that the senior engineer leads a staff that includes dedicated personnel for each of the disciplines described above. Finally, the requirement to be autonomous but integrated suggests that the systems engineers must participate in most program

activities and reviews and in many instances embed themselves within the individual program and projects.

The potential pitfalls associated with creating a robust systems-engineering organization should already be apparent. A systems-engineering organization with dedicated personnel for each of the systems-engineering functions, embedded within each of the projects and required to attend all program or project events, can very quickly become bloated, costly to maintain, and self-serving. To counter this, the PM must demand accountability from the lead system engineer to ensure that the systems-engineering organization continuously provides value to the PM and subordinate project managers.

Risk Averse? Do a Study...

Most systems engineering and technical assistance (SETA) contractors supporting government program offices are competent and influential. SETA contractors provide a valuable service because of their technical depth and, in many cases, because of their continuity on a program. Therefore, they provide the best technical recommendations they can, which generally drives them to make conservative recommendations—whether it's for more testing, to avoid using a different part, or for an in-depth study. A reality that PMs need to keep in mind is that SETAs are incentivized to make conservative technical recommendations—or said another way, to be risk averse, because, if something goes poorly, they can always say "we did all we could" or "you should have followed my advice." Additionally, depending on the precise arrangement with the SETA contractor, indirect financial incentives may exist that further motivate risk-averse behavior.

As a result, a PM may wonder whether a SETA recommendation for further study is based on its incentive to be conservative or on legitimate, meaningful risk. As a PM, you are concerned with the balance across cost, schedule, risk, and performance—cost overruns and schedule delays are the fault of the government PM, not the SETA contractor.

One way to constrain bloat and ensure effectiveness is to build effective processes that reduce oversight requirements and ensure consistent outcomes. Early in any program, putting in place well-defined and executable systems-engineering processes—think management review processes—should be one of the lead systems engineer's primary focus areas, especially in risk management, configuration management, and data management. Risk-management processes are typically schedule driven and involve periodic reviews of program risks and risk-mitigation strategies, though they may also occur in concert with milestone activities or other program reviews. Configuration and data-management processes typically are event driven. In the former case, configuration management boards typically review and validate requirements when a contracting action is about to take place (such as an RFP or contract award), or when an activity that affects the weapon-system configura-

tion, such as a software release or fielding activity, is about to go forward. The rate of activity sometimes merits monthly or even weekly configuration-management boards, especially on large, complex programs that are already fielded and undergoing modernization or capability upgrades.

Data management processes kick in whenever new data products become available for review. Data management ensures that data products receive thorough and timely reviews and that quality data items (such as drawings, users manuals, or tech orders) ultimately are available to support key program activities.

Because systems engineering is so pervasive in an effective program management office, it's easy to recognize a program that has effective systems-engineering processes in place. There is a near-constant "hum" of activity associated with the systems-engineering processes. Configuration management boards may occur every week. Data products flow from desk to desk through the office for review. Test planning and test readiness review boards are ongoing. Trade studies and other decision-support activities provide constant feedback to the PM. Community-wide requirements reviews take place at regular intervals. In other words, effective systems-engineering processes often constitute or support a significant percentage of the overall activity within a systems program office.

Another way to identify effective systems-engineering processes is to read about them. The plans that describe a program's configuration management, data management, risk management, and other systemsengineering processes should be readily accessible, reasonably short, up to date, and easily understood-200 pages of systems engineering "blather" are not helpful. When a new PM walks into the office, the systemsengineering team should be able to hand him or her a set of instructions and, in short order, the PM should understand the processes, inputs, and desired outputs for each systems-engineering process. Program office personnel should interact with the systems-engineering processes with confidence, ease, and predictability. They should understand how the processes work, the required inputs, the desired outcomes, and the typical timelines associated with generating a product. These production timelines include an approved data item or test plan; or a decision, such as approval to change the weapon-system configuration or an accreditation decision on an information-assurance issue. In short, well-defined systems-engineering processes keep a program office running in a predictable and well-understood manner.

The last characteristics of an effective systems-engineering or-

ganization are well-defined roles and responsibilities. One aspect of this has already been described—clear delegation, responsibility, and accountability for the key systems-engineering functions. It should be readily apparent who is in charge and ultimately responsible for risk management, configuration management, data management, test, and the other systems-engineering disciplines. Another aspect of well-defined roles and responsibilities is related to the different pools from which systems-engineering personnel are drawn. These include government personnel (military and civilian in the DoD), advisory and assistance services (A&AS) contractors (which include SETA contractors), FFRDCs, and the industry team with which a program office contracts for products or services. Each pool typically provides different systems-engineering services, and it's important that a PM understands who is responsible for what.

Typical Systems-Engineering Roles

Government and A&AS contractors within a program office typically design and execute the systems-engineering processes. In this sense, as we indicated at the outset, their role is primarily one of systems-engineering management. FFRDC personnel, on the other hand, typically provide in-depth subject-matter expertise to a program office. As Carter wrote in a May 2011 memorandum, "They exist to perform the mission of providing the Department with unique capabilities in many areas where the government cannot attract or retain personnel in sufficient depth or numbers. Our FFRDCs maintain long-term capability in core competencies in domains that continue to be of great importance to the Department." Thus FFRDC personnel often act as technical advisors and more often than not lead technical studies, trade studies, and other systems-engineering decision-support activities. They also inform many of the other systems-engineering processes, particularly risk management and information assurance.

Systems design is typically a collaborative effort that involves both government and prime contractor systems-engineering teams. Government systems engineers typically lead the requirements and requirements-analysis process, though they may interact or contract with industry on a formal basis to support this process during the early stages of a large program. Once the requirements are better understood, government and/or FFRDC engineers produce requirements documents, performance specifications, and the DoD architectural products that illustrate the overarching design, systems of systems, key interfaces, interface standards, and the allocation of performance requirements.

Detailed system design, however, typically falls squarely in the realm of the industry team with which the government contracts to ultimately design, fabricate, test, and field a weapon system. All members of the government team—government engineers, A&AS support personnel, and FFRDC engineers—will be intimately involved in the design process, most notably by participating in design reviews and test-and-evaluation activities. But responsibility for detailed design must necessarily be delegated to the industry team, since this is the primary activity for which they will be paid and against which they will be evaluated. Excessive government involvement in the detailed design process can expose the government to claims of interference if the program ultimately underperforms, overruns, or is delayed. We'll provide a critical caveat to this statement, however, as well as provide some illustrative case studies in our detailed discussion of risk management.

Test and evaluation also constitute a highly collaborative effort. The contractor will perform all sorts of subsystem- and system-level testing completely apart from government oversight as part of its standard systems-engineering processes. The contractor may or may not invite the government to witness these events, and a program that is especially forward-thinking will require it to post even contractor-executed test results on the standard Data Accession List. 90

Government involvement in test activities typically begins with the formal "sell-off" of requirements. For these events, the industry team will typically author and execute test plans. Government test engineers will review and approve the test plans. Government involvement in test activities varies widely from program to program. But, at a minimum, government test personnel will need to monitor any tests where the contractor is demonstrating its compliance or satisfaction of performance requirements.

The weight of responsibility for test planning, execution, and participation swings substantially more toward the government team as formal DT&OT gets underway, which ultimately determines whether the program office has delivered a weapon system that satisfies its performance requirements and is operationally effective and suitable.

⁹⁰The purpose of the Data Accession List (DAL) is to provide a medium for identifying contractor internal data that has been generated by the contractor in compliance with the work effort described in the SOW. The DAL is an index of the generated data that is made available on request. From DAU Ask a Professor, https://dap.dau.mil/aap/pages/qdetails.aspx?cg|SubjectArealD=0&cg|QuestionID=103821

RISK MANAGEMENT

The first step in the risk management process is to acknowledge the reality of risk. Denial is a common tactic that substitutes deliberate ignorance for thoughtful planning.

-Charles Temper Risk Management Author

Risk: an uncertain future event that may cause an execution failure in the program.⁹¹

Risk Management: the overarching process that encompasses identification, analysis, mitigation planning, mitigation plan implementation, and tracking. 92

Risk management might be thought of as the "Rodney Dangerfield" of the systems-engineering disciplines—it doesn't get any respect. There are two good reasons for this. First, nothing "happens" when a risk management strategy succeeds. Risk management is designed to head off perturbations to program performance, cost, or schedule expectations. So it is not generally apparent when a risk management strategy succeeds, because nothing happens.

Unfortunately, risk management's reputation also suffers when risk management strategies fail, and something *does* happen—either an increase in program cost, an extension to program schedule, or a short-coming in program technical performance. Failures of this sort, especially on large DoD acquisition programs, typically stimulate publicity. The spotlight shines on risk management failures, but success is overlooked.

Earned Value Management (EVM) is a manual "fire alarm" but Risk Management is a "smoke detector."

> -Ed Armstrong, Col., USAF (ret.) PM NRO Programs

Despite its reputation, risk management is arguably the most important of the systems-engineering disciplines. Effective risk-management organizations reflect the same characteristics we spoke of earlier: They are well integrated into the program office and understand the program from both a technical and programmatic perspective, but they are sufficiently autonomous to be objective and avoid the dangers of successoriented planning. This combination of insight and objectivity makes an effective risk-management organization not only useful but essential to a PM. The argument could otherwise be made (and often is) that risk

⁹¹DAU Quicklinks definition: https://acc.dau.mil/CommunityBrowser.aspx?id=19182

⁹²DoD *Risk Management Guide*, p. 1.

management should be integral to basic program management and that there's no need for a separate systems-engineering-based risk-management function. The problem with this thinking is that PMs are, by training, and typically by nature, predisposed to plan for success. The question they often pose to themselves is "How can I execute this program successfully?" Risk managers, on the other hand, ask themselves "What can go wrong with this plan?" What is even more important, they also ask, "What can I do to manage (or mitigate) that risk?" Successful PMs understand the value of an active risk-management team.

There are hazards associated with assigning risk management to a separate systems-engineering entity. The first is that by delegating responsibility for risk management, the PM essentially abdicates responsibility for managing risk. As one old Army colonel once relayed to me (sarcastically), "We don't need to worry about that any more ... we created an office to deal with it." The danger here is twofold: At one level, risk management can become a "token" activity that the PMs believe (mistakenly) they are addressing by having risk-management teams and risk-management charts. At another level though, there's a danger that the PM will fail to *invest* in risk-management activities. To clarify what we mean by this, we first need to quickly review the different types of risk-mitigation strategies.

Risk-Management Strategies

Risk-management strategies include avoiding risk, transferring risk, assuming risk, and controlling risk. 94

Avoiding risk involves pursuing a strategy or technology that does not expose a program to the identified risk and typically derives from fundamental decisions about design, technology, or strategy made early in the acquisition process. Risk avoidance may entail pursuing a lower-risk, higher-cost solution, or accepting reduced performance with proven technology.

Transferring risk can take several forms. In everyday life, the most common way to transfer risk is to take out an insurance policy on our car, our home, and our life. We pay a fee for this transaction, but in so doing we transfer from ourselves to the insurer the risk (usually financial) associated with an accident, reckless behavior, a natural disaster, or

⁹³Colonel John Dolan, USA, OSC-A, August 2005 timeframe, though in this instance Dolan was actually talking about troop morale.

⁹⁴ DoD Risk Management Guidebook.

some other calamitous event. We transfer risk in a similar manner whenever a program engages in a fixed-price contract. If there is any substantial risk associated with a project and we impose a fixed-price contract on the contractor, we are transferring the risk from the government to the contractor. In much the same way that an insurer charges the customer insurance premiums, a DoD contractor will insist on increased fees or higher prices to assume programmatic risk from the government. Another way to transfer risk is to allocate demanding or technically challenging requirements from one subsystem or program to another. If a demanding end-to-end timeline is associated with a satellite system providing data to an end user, the satellite system may transfer risk to the ground system by requesting more time for the satellite processing and communication and less time for the ground system.

Accepting risk is exactly what it sounds like. Sometimes it is simply impossible or not cost-effective to avoid or transfer risk. In these instances, the best a PM can do is monitor the risk and deal with any repercussions that occur. Note that accepting risk should be a deliberate decision, and it is not necessarily the same as monitoring but *failing* to mitigate risk. Too often risk-management plans highlight a risk, but simply fail to articulate an effective risk-mitigation strategy. This is not an example of risk acceptance; it's an example of failed risk mitigation, and there's a difference.

Controlling risk is the strategy that comes most readily to mind when people think of risk mitigation. It involves actions or measures that reduce the likelihood of an adverse outcome. Example risk-control strategies include pursuing multiple- or dual-path technical solutions, implementing iterative test-and-build programs, or developing sophisticated modeling and simulation capabilities.

The key point here is that PMs need to make explicit risk-management decisions, and these decisions often entail investing in risk-avoidance or risk-control strategies. Each of these strategies requires conscious decisions on the part of the PM to invest resources (spend program funds or trade off performance) to "buy down" risk. The PM who delegates risk management to his systems-engineering team without adequately interacting in the process may not be positioned to understand the risk-reducing benefits derived from these investments or the full costs associated with realized risks.

Another delegation issue arises when the government assigns responsibility for risk management to a contractor. This is a common practice, and almost every DoD systems-acquisition contract tasks the con-

tractor with executing some level of risk management. One problem that arises from this tasking is that the contractor may not be in a position to see or understand many of the most serious risks to a program. As an example, a contractor may be unaware that a multiyear program is underfunded across the DoD budget Similarly, if there is a dependency on another program or project, the contractor may not be cognizant of the dependency or be able to obtain information on another program's status. Another problem is that the contractor's perception of what constitutes risk may differ substantially from the government's perception. For example—taken from an actual program—the contractor may consider not receiving its incentive fee a risk factor. Indeed this may pose a risk for the careers of the contractor leadership, but it is not a risk factor from the government's perspective.

The authors' opinion is that the government is typically not well served by tasking only contractors to perform risk management, because (1) they will almost inevitably perform this function on their own as part of their internal systems-engineering processes, and (2) many of the most prominent risks to a program emanate from sources that the prime contractor is often not in a position to observe or understand. This only reinforces the importance of the PM and the program office maintaining a robust risk-management entity that can survey both the internal and external landscape for technical, financial, and programmatic risks. That is not to say that contractors should be excluded from the riskmanagement process. Our experience has been that the most successful risk-management organizations are government-led (or jointly led by the government and contractor chairs), and include not only contractor representatives but representatives from each of the engineering and functional domains: hardware, software, integration, production, test, information assurance, program management, financial management, scheduling, logistics support, etc. Membership should be tailored to the needs and scope of the individual program, but the risk-management process is best served when it captures concerns and incorporates input on mitigation strategies from diverse personnel directly supporting the program.

To return to a recurring theme, the PM must also be actively involved in the risk-management process. The schedule and organization for risk-management processes will differ from program to program, but if the senior PM is not actively involved in the process—participating in risk-management reviews and investing in risk-mitigation strategies—at least two adverse outcomes are likely. First, the program's risk-management processes will become isolated, possibly bloated, and non-value

added, because the PM is not sufficiently involved to hold the systems-engineering team accountable or assess whether risk management is adding value to the program. Second, the program will likely encounter an adverse outcome associated with realized risk because the PM did not invest in adequate risk-mitigation (transfer, control, or avoidance) strategies. In either case, the risk-management process will not have served the program well, not because of inherent systems-engineering shortcomings or failures, but because the PM failed to integrate risk management in the overall program-management strategy.

A Risk-Management Horror and Success Story All in One

The Air Force Distributed Common Ground Station (AF DCGS) Block 10.2 system was intended to transform the way the Air Force performed its airborne intelligence mission, controlled its airborne ISR platforms, and provided intelligence information to the warfighter. The existing AF DCGS consisted of isolated ground stations that required point-to-point communication with individual intelligence customers to solicit ISR requests and disseminate exploited intelligence products. Customers had little insight to platform/sensor status or preexisting products. Finished ISR exploitation products were often emailed to end users as PowerPoint charts. The Block 10.2 system would be a Web-based enterprise integrating five "core" sites as well and numerous Air National Guard support sites into a single, integrated capability. Customers would access the system via classified Web portals to survey airborne ISR platforms, send requests for airborne intelligence support, and query the worldwide AF DCGS database for existing intelligence products.

However, as the Air Force program office approached the deployment of the first AF DCGS ground station to Beale Air Force Base (AFB), it realized that although the system had been designed to operate under the increased workload anticipated with Web-based operations, it had never been adequately tested. Such testing needs to be done in an enterprise configuration, with internal operators performing their routine collections-exploitation-dissemination functions, distributed AF DCGS sites sharing data and distributed workflows, and external customers querying the system and monitoring missions via Web portals at both the secret and top-secret levels. To allay concerns that the system might not perform the mission once deployed in an enterprise environment, the program office invested more than \$1 million to have the prime contractor build a simulated AF DCGS enterprise in its factory and conduct a test to determine how the Block 10.2 system would perform under these stressed conditions.

The test was a success ... and a failure. The Block 10.2 system ground to a halt less than an hour into the test, its central computer completely unable to keep up with the demands of internal and external customers while processing incoming, large-bandwidth files from various ISR platforms. The test eventually led the Air Force to invest more than \$10 million in a nearly total redesign of the Block 10.2 system, but it also prevented the Service from deploying a system that would have failed the warfighters when they needed it most. Today the AF DCGS Block 10.2 system is installed at Air Force and Air National Guard sites worldwide, supporting U-2, Global Hawk, Predator, and various other airborne intelligence platforms and providing intelligence products to the warfighters in near real time via classified Web portals that any user with a computer connection, clearance, and user account can access.

CONFIGURATION MANAGEMENT—"DO NO HARM"

The configuration-management-and-control process is intended to protect the integrity and functionality of a system. It is a deliberate, multilayered, recursive system intended to serve the same function as the physician's "Hippocratic oath"—ensure that changes to the system first and foremost "do no harm." To extend the medical analogy, the configuration-management process ensures that, before we perform "surgery" on the program, we've validated the symptoms and diagnosis, obtained a second opinion, made certain the procedures we follow are right, and guaranteed that the actions we take will not result in an outcome less desirable than the current condition. Configuration management is especially important for fielded weapon systems undergoing modernization, block upgrades, or component replacements, but it also plays a role in development or design with an evolving configuration baseline.

Configuration management is necessarily thorough and deliberate. Almost all programs are composed of complex "systems of systems." To use a simple example, any aircraft platform includes (at a minimum) avionics, propulsion, airframe, communications, and maintenance-support subsystems. In many cases, aircraft may also include munitions, self-defense, and sensor subsystems. An aircraft relies on all of its subsystems to perform its intended mission—be it transport, attack, or intelligence/surveillance/reconnaissance. Changes that affect any of the subsystems can undermine the aircraft's ability to perform its mission if the changes are not properly designed and implemented.

But even this description fails to capture the complex, interdependent nature of most modern programs, because it suggests that the subsystems are modular "boxes" performing isolated functions (communication, navigation, propulsion) in support of the overall system but independent of other subsystems. More realistically, subsystems not only support the overall system but interact with one another in ways that are sometimes difficult to anticipate. Guidance is one example. A guidance system may be upgraded as part of an avionics-system-improvement program, but it's conceivable that that same guidance component also interacts with weapons or sensor subsystems. Thus, modification to the avionics system may have unintended consequences on the weapons and sensor subsystems. To further complicate matters, the avionics upgrade may create new sources of heat or electromagnetic interference or may require additional power. Any of these issues could flow over to affect other subsystems in ways that are not readily apparent.

At yet another level, changes to a weapon-system design may profoundly affect weapon-system maintenance or sustainment. Anticipating and resolving these issues is one of the critical challenges of systems engineering. Configuration management and control are, together, the disciplined, systems-engineering process put in place to make sure these potential issues are fully considered before a change is implemented.

Changes in DoD acquisition have made configuration management both easier and harder. The emphasis on common standards, open systems, nonproprietary interfaces, and modular design has *generally* made it easier to manage systems configurations to isolate and understand the impact of changes to specific subsystems or components. These same measures, when combined with increased emphasis on competition, multisourcing, and better buying practices, however, create a situation in which multiple contractors collaborate or contribute to weaponsystem design. This is a positive trend in terms of cost effectiveness and innovation, but it also means that the days of a single prime contractor internally enforcing rigid configuration control are largely a thing of the past. More and more, it is incumbent on the government to ensure changes to weapon-system configuration do not adversely affect performance of the system.

Configuration Management Nut and Bolts

Almost every program office produces its own configuration-management plan and executes its own configuration-management process according to unique system requirements and program office structure. But most plans and processes share common features.

First, configuration management is typically at least a two-tiered process. Either integrated product teams (IPTs) or configuration management "review boards" assess and approve proposed changes at the action-officer level before changes are reviewed by a higher-level configuration-control board (CCB). The lower-level reviews allow for more detailed SME review and interchange. More importantly, they provide an opportunity for functional SMEs to resolve disagreements or issues before the proposal is presented for senior review.

The mere fact the initial review occurs at the "worker bee" level doesn't mean program leaders can divorce themselves from the process. When configuration management fails, either in adequacy or timeliness, it is often because lower-level IPT members failed to adequately support the process. Their review may be cursory or incomplete, they may fail to report issues to their supervisors or to the PM sponsoring the change, or

they may fail to interact with the other IPT members toward a constructive resolution of issues associated with a proposed change.

All these "failure modes" reflect a misunderstanding on the part of IPT members about their role in the configuration-management process. Configuration-management-and-control processes are not put in place simply to provide an opportunity to accept or reject proposed changes. They are intended, especially at the IPT level, to create a forum to resolve differences and work toward solutions. Program leadership must emphatically support this concept and emphasize the importance of participating, *cooperatively*, in configuration-management processes. They must also hold members accountable for unsuccessful outcomes. Configuration management breaks down when people fail to participate adequately. This occurs because leadership fails to emphasize the importance of participation or to incentivize participation, or conversely encourages confrontational or adversarial (as opposed to collaborative) approaches to configuration control.

If lower-level configuration-management or IPT processes work correctly, second-level reviews—which often take the form of CCBs chaired by the PM or chief engineer—should be pro forma events. Significant issues should have been resolved at lower-level reviews, functional representatives should come to the table already briefed by their teams on the configuration change and any associated issues, and the only person with substantive questions should be the CCB chair. The purpose of the configuration-management process, and the CCB in particular, now bears repeating: to protect the integrity and functionality of a weapon system. We reinforce this because we've observed instances where CCB chairs or board members use the configuration-management process as a venue to debate acquisition strategy, contract type, or some other issue fundamentally unrelated to configuration management.

Routinely using the configuration-management forum to delve into other issues dilutes its primary purpose. It also leaves PMs speculating and ultimately wasting time wondering what issue will confront them during a configuration board. CCB deliverables, process, and exit criteria should be well defined and well understood, by both the lower-level workers and the board members and chairman. Configuration-management plans are typically not long documents. The responsibility of all members of the CCB is to be familiar with the plan and to abide by the process, deliverables, and objectives it describes.

CCBs occur at as many as four points over a project's implementation: requirements review, RFP release, contract award, and produc-

tion or fielding. The requirements review ensures that the project is addressing a legitimate requirement and is ultimately traceable to either a CDD or some other valid requirements source. This review ensures the configuration change is mandated by a documented, unmet requirement and that the priority or urgency associated with the requirement merits the expenditure of funds and resources. Once a project passes through this review, the issue of requirements validity should not resurface. The next review takes place at solicitation and might be considered a "verification" process. It ensures that the program has evaluated all material and nonmaterial solutions, that the material solution or service for which they are releasing a solicitation is the right one, and that the requirements have been *translated* into accurate and comprehensive requirements direction. It also ensures that the solicitation addresses all performance and task requirements and that there are adequate provisions for sustainment and life-cycle considerations.

It should go without saying that every review considers the potential impact on weapon-system and subsystem suitability and effectiveness, but this assessment should be especially focused and purposeful during solicitation and subsequent contract-award CCBs. The RFPs and contract-award CCBs are the first reviews where details of the design and sustainment strategy become apparent, but they take place before the government commits funds to the project.

The contract award CCB extends the verification process started during the RFP CCB and provides the government with a final opportunity to review requirement documents (SOW, performance specification or technical requirements documents, etc.) and contractual direction—again with an eye on impacts to weapon-system performance—before committing government funds to the effort. The fielding CCB—the final hurdle to fielding or actual modification to a weapon system—should be the most cursory. Fielding CCBs follow on the heels of the requirements, RFP, and contract-award reviews and, in an ideal world, would reveal little new information. In reality, however, fielding CCBs are often highly contentious, primarily because they are the final opportunity for project members to voice concerns before contractors are authorized to actually "bend metal" or implement real changes to the weapon-system configuration. The imminence and significance of this action spurs a more intense and focused assessment of the change.

Additional data (such as test results) or changes resulting from the contractor's detailed design or manufacturing processes may create legitimate concern. Finally, CCB members may view the fielding CCB as their final opportunity to raise preexisting objections regarding the underlying requirement, the cost to implement, or its impact on operations. In any event, CCB chairs shouldn't be surprised if fielding reviews become emotionally charged events.

There is no better time to point out another feature most configuration-management plans share. Though the CCB typically includes all the senior functional personnel, as well as representatives from the using command and even the end-user community, the CCB is typically a nonvoting entity. This means that the CCB chair has final as well as full authority to disregard the protests or objections raised by other CCB members. CCB chairs exercise this authority at their own risk and discretion, but it is a risk they sometimes have to take.

Configuration management doesn't end with the CCB. Before accepting contract deliverables, the government needs to confirm that items delivered by the contractor correspond to both the physical and functional baselines. The program office satisfies this requirement through the Physical Configuration Audit (PCA) and the Functional Configuration Audit (FCA). The PCA is a "formal examination of the 'as-built' configuration of a configuration item against its technical documentation to establish or verify the configuration item's product baseline."95 PCAs often entail an actual walk-through or comparison of the delivered system with detailed system drawings or design documents. As surprising as this may be, it is not uncommon to discover significant discrepancies between the two during the PCA, at which point the government and contractor need to determine whether the fault lies with the documents or the delivered item. In either case, it is critical to ensure the "as built" system fully corresponds to all design drawings and documents. Discrepancies between the actual system and the documented system complicate weapon-system maintenance, modification, and future configuration control.

As with the PCA, the FCA compares observed system performance to documented system requirements and performance specifications. FCAs generally focus on thorough reviews of test results, though, in instances where inspection or analysis play a prominent role in system-performance verification, the inspection and analysis results and methodologies will also come under review. On complex systems, the functional audit may be accomplished in increments, with incremental FCAs confirming performance for separate configuration items in ad-

⁹⁵ Military Handbook: Configuration Management Guidance, MIL-HDBK 61A (Washington, DC: Department of Defense, 2001).

vance of a summary FCA at the weapon-system level. 96 This incremental approach simplifies what might otherwise be an overwhelming closeout to the configuration-control process.

DATA MANAGEMENT—A VERY SHORT NOTE

In the introductory section on systems engineering, we noted that one feature that effective program offices share is a "near-constant 'hum' of activity associated with the systems-engineering processes." Much of the "hum" we spoke of emanates from the constant flow and review of "data items"—design documents, drawings, technical orders, test plans and procedures, and similar items. This is the business of data management, and, while there's no denying its importance, the reader would be entirely justified in asking why data management is considered a systems-engineering function.

We recently posed this question to a data-management chief, who also happens to organize and oversee configuration-management processes (a common practice among program offices). His answer was short and precise: Data deliverables largely document the weapon-system configuration. This simple observation highlights the importance of effective data-management processes. The quality of a program's final documentation will reflect the effectiveness of the underlying data-management processes. Well-designed, well-supervised, and well-executed data-management processes produce thorough and *on-time* reviews of contractor progress. Poorly designed and executed processes subject to lax or nonexistent PM oversight and tracking are likely to produce low-quality data products that will ultimately make it harder for the government to operate, maintain, upgrade, or even understand the weapon systems it procured.

Already this description is getting ahead of itself. The data-management process actually begins at program inception, and the success of a program's data strategy depends on data managers' willingness to interact with other systems-engineering and sustainment processes, including the requirements process, trade studies, and integrated logistics-support planning. Each of these processes influences a program's data requirements. Data specialists need to engage to make sure that requirement authors, systems engineers, and logisticians understand the data implications of their data-management construct. Subsequently, they need to make sure that the Data Requirements Review Board cap-

⁹⁶ ACQipedia, https://dap.dau.mil/acquipedia/Pages/ArticleDetails.aspx?aid=555d837d-067b-4f9b-b14e-bd336d8f1095

tures and documents program data requirements and makes well-informed data-requirement decisions. Again, this interplay between requirements, design, and data reinforces the idea that data management falls legitimately within the systems-engineering domain.

REQUIREMENTS MANAGEMENT

No other term in the systems-engineering nomenclature is as ill-defined and misunderstood as "requirements management." As a program management corollary to Supreme Court Justice Potter Stewart's definition of pornography ("I know it when I see it"), the best program management definition of requirements management might be stated in terms of its absence: PMs will recognize requirements management when they *don't* have it.

PMs will recognize it in its absence when they are unable to trace a program-specific capability (technical requirement) to an operational requirement. 97 They will recognize it in its absence:

- When they cannot precisely state the meaning or intent to achieve an overarching capability or requirement.
- When they cannot accurately describe the priorities assigned to competing requirements by the different members of the requirements community.
- When they have no idea what process led to a requirement making its way to their desk with a demand for urgent implementation.

These problems highlight the function of an effective requirements-management program. First and foremost, requirements management provides clear traceability between supporting projects that a program undertakes and the underlying capability documents or operational-requirements documents. Put differently, the documents provide the PM with the response he needs when the GAO, the PEO, or a congressional staffer questions the need for a supporting project.

Second, effective requirements-management processes translate and decompose overarching requirements or capabilities into spe-

⁹⁷Note the difference between a "technical requirement" and an "operational requirement." There is a difference, and it does matter. For example, the Air Force testified before Congress that the tanker program had more than "800" requirements. These were technical requirements, some of which were derived from operational requirements. The tanker program had fewer than a dozen KPPs at the time, which constituted the "operational requirements."

cific weapon-systems initiatives or projects. This decomposition of requirements and pairing with specific capabilities is arguably at the heart of systems engineering and essential in order to "simplify" complex programs by breaking them down into understandable parts.

Requirements-Management Example: Joint STARS (E-8C)

A "real world" example is the Air Force E-8C Joint STARS program. Among the multitude of program-level requirements, the system sponsored separate initiatives to incorporate signals intelligence payloads and Net-Centric Collaborative Targeting. These two systems provided separate data sources but were also needed to complement its ground moving-target indicator sensor into a fused data source that could be understood in an operational context. Additionally, the multiple sensors needed to collaborate in a way that met an underlying Combat Identification requirement. Only through a detailed parsing of the individual requirements and technical capability—leveraging a highly effective requirements management—can the system-of-systems deliver this remarkable capability.

Third, a program's requirements-management team interacts with the requirements community to help generate and maintain prioritized requirements. This teaming and interaction with the requirements community is vital to assess the interrelationship on cost/schedule/performance trades and "what if" drills. The requirements community in many instances relies almost entirely on the program management office to inform their understanding of technology, performance trades, costs, and risks associated with requirements. The requirements team maintains the requirements process and documents this dialogue between the program office and the external requirements community. PMs in most instances won't understand the value that the requirements team provides until they are on the receiving end of a requirement that is severely disconnected in technical maturity, cost, risk, or return on investment.

Considerations for Systems Engineering

- Can be value added or a waste of resources.
- Autonomy is a critical characteristic of the systems-engineering organization, but it must strike a fine balance between autonomy and lack of knowledge.
- Configuration management is critical to complex weapon systems and systems-of-systems.
- The importance of process—both in terms of ensuring effectiveness and efficiency (timeliness/responsiveness).
- Risk management should be an integral component of program management—the value of autonomous risk-management function is that they see risks that might be lost or not visible to someone working the program on a daily basis.
- If all the risk-management team does is to document risks—with no value added—the team needs to be empowered to dedicate resources toward mitigation efforts.
- Contractors should be made aware that risk management has revenue potential.
- Systems engineering is a discrete engineering discipline, quite distinct from traditional engineering.

OTHER TOOLS AND PRACTICES

The previous three chapters covered three vital tools for program management—financial management, contracting, and systems engineering. Although these are arguably the three most important tools for the PM, they are not the only useful tools. The following chapter provides a short summary of three additional disciplines that, based on our experience, have proved their utility—maintaining a battle rhythm, EVM, and external independent reviews.

BATTLE RHYTHM

Most people spend their time on the "urgent" rather than on the "important."

-Robert Hutchins

One of the most important disciplines a PM (or any leader) can implement is a regular recurring meeting and review process—also known in military circles as a "battle rhythm" (Table 2). The basic idea is to establish a frequency of communications and reviews that internal and external program stakeholders can rely on, providing an opportunity to raise issues, solve problems, and maintain awareness.

Table 2. Example of "Battle Rhythm"

Frequency	Event
Weekly or Daily	- Staff meetings—Personnel inbound and outbound/training
	- Status key events
	- Telecon/synch with Headquarters Representative Team
	- High-risk track status (any identified)
	$\hbox{-}\operatorname{IPT}\operatorname{status}\operatorname{check-report}\operatorname{out}\operatorname{of}\operatorname{IPT}\operatorname{leadership}$
Biweekly	- Email/point paper summarizing key events to stakeholders
	- Telecon/synch with Requirements Team
	- Telecon/synch with contractor leadership
Monthly	- Publish stakeholder newsletter
	- Review EVM data
	- Review funding obligation and execution
Quarterly	- Strategic planning offsite
	o Reflect on major issues "Are we doing the right thing?"
	- Program review with PMO and contractor
	- Commander's (or Director's) call/All-Hands
	- Report to senior leadership

This discipline accomplishes several important program objectives. First, it prevents the "urgent" issues from absorbing so much attention that "important" issues get overshadowed or overlooked. For example, when a "crisis" in engineering dominates your and your key leadership's attention, do not cancel your established financial review—you may find that a crisis with far greater impact involves your inability to obligate funds. By maintaining a regular review and communication process, these less "urgent" issues could be identified and potentially solved earlier, when there is less of a time crunch and likely more options. Although maintaining a battle rhythm of meetings and reviews will not guarantee that the right issues are identified, the likelihood of finding problems early is much increased, and the recurring forum may also provide for open discussion and vetting of proposed solutions among the key stakeholders.

Battle Rhythm at Apple 98

Tim Cook became the chief executive officer (CEO) of Apple in August 2011 and runs one of the most creative and dynamic companies in the world with a disciplined routine. The "Battle Rhythm" starts Monday morning with an executive team meeting that lasts four hours with the entire leadership team—mandatory attendance. The purpose is to review everything that is important for the company's success from shipping to personnel, to development of the next big thing, to current product performance. The constant interaction of the leadership team enables quick resolution and identifies points of disagreement that can be addressed. Occasionally an issue is deferred to an off-site meeting if it requires more time and thought, but the consistent Monday meetings with the company leaders keeps things running and synchronized.

The same scheduled meeting discipline takes place at subordinate units within the company. Every product division meets with the key leadership at Apple to review all the important issues that particular team is dealing with—iPhone, Mac, iPad, Operating System software. Every key element of the business gets several hours on a recurring basis. Tim Cook sets aside a number of hours each week for detailed reviews to keep him aware of every product and issue and to keep the company running smoothly.

As the PM establishing a battle rhythm, you must balance the frequency of meetings with a very real manpower-resource decision. Every minute in a meeting is 1 minute less that you and your team can devote to other productive activities. Time is a zero-sum game, and meetings have a multiplication factor defined by the number of attendees. It is also important to consider who should not be in the meeting. If the attendance is too large, productive discussion becomes impossible and it is just an information exchange that could more efficiently be handled with newsletter. Meetings also become longer when more people attend. The point is: Think hard about recurring meetings—they can serve a very useful purpose, but there is a clear cost in man-hours for every meeting you establish.

A second objective is related primarily to stakeholders outside the program office. By establishing regular engagement and communication opportunities with the broader community of interest, you may avoid the "out of sight, out of mind" phenomenon as well as its cousin, "not invented here." Regular engagement with external stakeholders will lead them naturally to take ownership of the program and become "stakeholders" not just because of their organizational positions but, one hopes, because they have personally engaged in program office discussion and decision-making. A disciplined battle rhythm that includes external stakeholder engagement builds ownership, and when problems arise it may help you avoid assertions such as "you never told me that."

⁹⁸ "Tim Cook's Freshman Year," *Bloomberg BusinessWeek* (Dec. 10–16, 2012), p. 62 (from an interview with Apple Chief Executive Officer Tim Cook).

Proverbs for PMs

How many meetings does it take to equal 1 man-hour of productive work?

- Meetings should be used sparingly (like garlic).
- Use them for creating solutions for sticky problems.
- Use them to validate or modify strategy (ideas).
- Do not use them to "get the word out" (publish a newsletter instead).

Address this with a proactive communication plan. This could be something as simple as an "End-of-Week" email to all your stakeholders, updating them on the key events or progress from the week before. The key to making this succeed is to keep it short enough so people actually read it (they can always follow up later with questions) and to be consistent in delivering it so people can count on receiving the communication. If you set the expectation that your stakeholders will get a weekly update, don't skip weeks. Skipping will erode the confidence not only in your ability to deliver on an effective communication plan but in your ability to deliver on a program.

Using font colors or a boldface font is another highly effective method of highlighting text when providing a running update on the status of programs. This way the detailed information and history are captured in the document, but most folks can quickly scan and absorb the most recent "updates" by, for example, reading only the blue-font text. Whatever method and frequency you select for your communication plan, the key is to communicate consistently to the program stakeholders.

A third objective of a disciplined battle rhythm is to help avoid "program management by email," and your attendance helps demonstrate the importance of the meeting and its participants. In the current information-technology age, it is fairly common for us to send and receive direction electronically. In some sense, this may be good, as it forces written, documented guidance and decisionmaking. In another sense, it deprives us of an important human interaction within the team. This human interaction also sends an important message to those attending a meeting or review with you, that "this is important to the PM." So when you choose to hold regular meetings or reviews, make the most of the opportunity. Your team needs direct interaction with you and with one another to communicate effectively and to build a unified team working toward a common cause. Take the opportunity to articulate how important the team's functional area is to the overall program success.

Do the Math

For a large prime contractor, meeting costs can go through the roof. During a recent review with Northrup Grumman (NG), the excellent contract PM started every meeting by going around the room to NG employees he didn't recognize and asking, "Who are you, and why are you here?" If they had a poor answer, he booted them out of the meeting. The program was on a tight budget, and the PM was deadserious about delivering within cost. It was amazing how many contractor personnel would come to meetings "just to learn about your program" and then charge their hours to your program. Do the math on major meetings. If you fill a room with 200 people, that costs about \$200,000 per day. (An SME makes \$100,000 to \$150,000 yearly. Benefits and overhead can bring the cost to about \$300,000 per year, or about \$150 per hour, or around \$1,000 easily for each SME. That's \$200,000 daily for 200 people, not including travel and preparation time.)

But avoid becoming too stingy. Some large meetings are needed. Don't fall into the trap of thinking you can do away with them completely, because it has been tried many times and never works. Also consider whether other government programs at the contractor plant can "cross-fertilize" ideas that can help your program. Even if it costs you some extra money, it may be cheaper in the long run.

Are you sure the money wouldn't have been better used retiring a high-risk issue? The answer is probably "it depends." If the program is on a tight budget, the government PM should think about turning to the contractor counterpart to limit attendance on the contractor's side.

A final note regarding battle rhythm: Apply common sense. If there is no point in having a meeting, don't be afraid to cancel it. If an area needs additional attention and your regularly scheduled review would be insufficient, add time or content to an existing meeting or establish a separate review process. If events outside the control of the program office occur in a way that allows you to adjust, then do so. A good example is given in the next proverb: Avoid scheduling in December.

Proverbs for PMs

Never intentionally schedule anything in December.

- The comptroller reviews for the PB are in full swing.
- Your key people are on leave (if not, they should be).
- There is no time to slip the schedule if things don't go according to plan.
- This year's budget is still under continuing resolution.
- Whatever you accomplish will fall under "hurry up, catch up, mess up"

EVM

In the minds of many federal acquisition professionals, EVM suffers from the unfortunate reputation as a system that requires excessive number-crunching and produces esoteric results that sometimes seem irrelevant to managing a program. Gold-card-carrying EVM practitioners are often relegated to isolated corners of financial management shops where they can recite obscure passages from ANSI/EIA-748B while entering data into large, complex spreadsheets. 99

Boston's "Big Dig" was the most expensive and complex highway project ever approved by Congress. The project replaced a six-lane elevated highway that cut through the heart of Boston with an 8- to 10-lane underground expressway, extended the Massachusetts Turnpike (Interstate 90) beneath Boston Harbor, and created a 14-lane bridge crossing the Charles River just north of downtown Boston. Its original budget was \$2.8 billion and it was slated to be completed by 1998, or 7 years after construction began. In the end, the project cost more than \$22 billion and was not completed until 2007, nearly 10 years later than planned.

A number of reasons typically are cited to explain why the Big Dig ran so far over budget and took so much longer to complete than anticipated:

- It was one of the most complex highway projects ever undertaken.
- The environmental approval process was delayed.
- It encountered unanticipated subsurface obstacles.
- The state agency created to oversee the project had little experience managing projects of this scope.¹⁰⁰

But there may be more to the story. An associate who worked for the systems-integrating contractor told us that another contributing factor played a large role in the cost and schedule growth: EVM was never fully or effectively implemented on the project. The significance of this oversight may not be obvious to those unfamiliar EVM, but it's almost inconceivable that a project of this magnitude or complexity would be undertaken without a robust EVM process and well-defined baseline in place. EVM shortfalls go a long way toward explaining why the Big Dig

⁹⁹Pat Barker and Roy Wood, "The EVM Hoax: A Program Leader's Bedtime Story," *Defense AT&L* 40, no. 6 (2011), p. 33.

¹⁰⁰Virginia Greiman, "The Big Dig: Learning from a Mega Project," *ASK Magazine* (NASA, online edition), July 15, 2010, http://appel.nasa.gov/2010/07/15/the-big-dig-learning-from-a-mega-project/

missed its cost and schedule targets so badly and why the project's managers seemed to have such a poor grasp of the magnitude of the cost and schedule overruns.

This statement may seem a stretch, but EVM provides PMs with a powerful tool and straightforward metrics to keep track of progress and compliance to cost and to schedule targets on highly complex projects. More to the point, PMs who lack robust and accurate EVM systems have few means to track cost or schedule status on a program as complex and interdependent as the Big Dig. Without EVM, PMs may know how much cost they've incurred on a project, but on highly complex projects they will have little idea where the costs have been incurred, how the costs compare to their original estimates, or what their final costs will be. Similarly, PMs may have some idea how they are progressing on the most prominent schedule items, but they'll have little insight to the overall schedule status and will leave themselves vulnerable to unwelcome surprises from critical interdependencies that may not be readily apparent.

That EVM was overlooked or underutilized during the Big Dig is not much of a surprise. As the quote that introduces this section suggests, EVM is often misunderstood and underutilized. Too many PMs think of it as a subcategory of financial management, relegate it to specialists, and fail to integrate it into their basic program-management tool kit. Properly understood and implemented, EVM and its associated artifacts, tools, and metrics should play a central role in most large programmanagement processes.

EVM can be complex to implement, but the basic concept is easily understood. First, the work for a project is translated into dollars and material costs, which are allocated to various major activities or work breakdown structure (WBS) elements (such as design, software development, material procurement, integration, testing, manufacturing, program management, etc.). These major activities are subdivided into discrete "work packages," which have the following characteristics: 101

- They represent units of work at levels where work is performed.
- They are clearly distinguished from all other work packages.
- They are assigned to a single organizational element.
- Have scheduled start and completion dates and, as applicable, interim milestones, all of which represent physical accomplishment.
- Have budget or assigned value expressed in terms of dollars, manhours, or other measurable units.

¹⁰¹Earned Value Management (EVM) Performance Assessments and Root Cause Analyses (PARCA), in the Office of the Assistant Secretary of Defense for Acquisition, "Glossary of Earned Value Management Terms," available at http://www.acq.osd.mil/evm/glossary.shtml

- Their duration is limited to a relatively short time or subdivided by discrete value milestones to facilitate the objective measurement of work performed.
- They are integrated with detailed engineering, manufacturing, or other schedules.

Work packages and material costs are integrated into a master schedule that depicts when each activity is to begin and end. This IMS is a critical and essential element in any EVM system. With work packages and the associated costs integrated into a time-phased schedule, PMs can render a curve that depicts how work and associated costs accumulate over time. They can then compare this "baseline plan" with the actual execution to get a realistic indication of both cost and schedule status. As the project progresses, EVM systems compare the actual costs of the work completed to the planned or "budgeted" costs for this same work. They also compare tasks (work) actually completed to the tasks planned to be completed. This basic comparison—actual costs to planned costs, and work completed to work planned—forms the foundation for EVM.

The budgeted costs for each work package are known in advance and built into the baseline. Individuals known as control account managers record and track the actual costs associated with completing specific work packages. Similarly, the start and end dates of work packages are built into the baseline plan. There are different methods for tracking actual work progress. The most accurate method tracks "percentage completion" for each work package, but this requires precise measurement of work-package progress. Less precise methods either track work-package completion in increments (0 percent, 50 percent, or 100 percent complete, as examples) or, in the most conservative approach, only claim credit for packages that are 100 percent complete.

An important point to keep in mind relates to the concept of "done." Work is not "done" because the scheduled completion date has passed, nor is work "done" because the dollars budgeted toward a task have been fully expended. Work is done when a task is completed in the manner intended and the products or services associated with that task have been produced, verified, and made available (where appropriate) for subsequent tasks to integrate, test, or otherwise apply toward the larger project.

The "Gold Card"—Critical EVM Metrics

The brilliance of EVM is how it "normalizes" cost and schedule metrics in a way that enables an "apples to apples" comparison of the base-

line cost and schedule to actual cost and schedule. In traditional EVM terminology, the measure of budgeted costs to actual costs is termed "Cost Variance" (CV), and it compares the *Budgeted (or planned)* Cost of Work Performed (BCWP) to the Actual Cost of Work Performed (ACWP). Schedule Variance (SV), on the other hand, compares the Budgeted Cost of Work Performed to the Budgeted Cost of Work Scheduled. Note the difference: CV subtracts Actual Costs from Budgeted Costs, both normalized on *Work Performed*. SV subtracts Work Scheduled from Work Performed, both normalized on *Budgeted Costs*.

The formulas for CV and SV look like this:

CV = BCWP-ACWP

SV = BCWP - BCWS

In either case, negative variance is bad. Negative CV indicates the actual cost of work performed exceeds budgeted costs, and the project is over budget. Negative SV suggests that actual work accomplished is less than scheduled, and the project is behind schedule. These two simple formulas provide PMs with the most fundamental measures of their cost and schedule status.

Other common and useful measures include the Cost Performance Index (CPI) and Schedule Performance Index (SPI), which use the foregoing measures to create a ratio that quantifies cost and schedule efficiency. Again, the formulas for these measures follow (note that CPI and SPI ratios less than one are unfavorable):

CPI = BCWP ÷ ACWP

SPI = BCWP ÷ BCWS

An EVM Glossary

Budgeted Cost of Work Scheduled (BCWS) = "Planned Value," a forward looking translation of "work scope" into dollars.

Budged Cost of Work Performed (BCWP) = "Earned Value," or an assessment of the value of accomplished work.

Actual Costs are just that—these come straight from the contractors' accounting system. They are real dollars.

¹⁰²As we discussed in the schedule section, this is not always true. The better indication of overall program schedule status is performance against the critical path. It's possible that a program can have negative SV and still complete on time. It's also possible that a program can have net positive SV and complete late. In terms of predicting overall schedule performance and status, the PM must track performance and slack along the critical path.

The final EVM measure we'll speak to is the "To Complete Performance Index" (TCPI). TCPI is worth mentioning because it depicts the level of efficiency a project will need to attain to complete within a financial target. Fundamentally, the formula looks at the ratio of work remaining to budget remaining. Work remaining is measured according to the original baseline, subtracting the budgeted cost of work completed from the total budget. Cost remaining subtracts the actual cost of work completed (ACWP) from the target budget (usual Budget at Complete, or BAC). In terms of formulas, it looks like this:

TCPI = Work Remaining ÷ Cost Remaining = (BAC - BCWP) ÷ (Cost Target - ACWP)

In any instance where the contractor is over current budget, the ratio of work remaining to cost remaining is greater than 1. TCPI can be compared to the Cumulative Cost Performance Index (CPIcum) to get an indication of whether the contractor's TCPI projections are reasonable. As a "rule of thumb" for TCPI, one should be highly dubious if the TCPI exceeds the CPIcum by more than 10 percent. Unless the contractor makes a persuasive case that it will achieve its TCPI and overcome an existing cost variance, government PMs are wise to start calculating and budgeting toward a more realistic Estimate at Completion (EAC) figure.

It's easy to get lost in these formulas, and more than one PM has turned his back on EVM in frustration over his inability to understand what the formulas all mean. Resist that temptation. EVM is not foolproof, and it's not always easily understood, but it still provides the PM the most concise measure of compliance with the program baseline. CV and SV give quick indications of whether a program is over budget or behind schedule at any time, while CPI and SPI give a good indication of how efficiently the program is operating compared to the baseline plan. These measures also factor into a more complex algorithm that predicts the EAC, or what the project will likely end up costing. Comparing EAC to the original budget (BAC) gives the PM an indication of how much additional funding a program will require if performance efficiency continues at its current level and the total work scope remains unchanged.

A valuable EVM reference for the PM is the "DAU Gold Card." The Gold Card provides a summary and definition of all EVM metrics and formulas, along with the most important policy guidelines and ref-

¹⁰³Patrick Barker, DAU, Earned Value Management (EVM) Reference for PMs, draft.

erences. The most basic of these policy guidelines has to do with EVM mandates. DoD policy states that earned value reporting is required on all cost-incentive contracts valued at more than \$20 million. 104

The Gold Card also summarizes many of the most important earned value concepts in one diagram we include here (Figure 10).

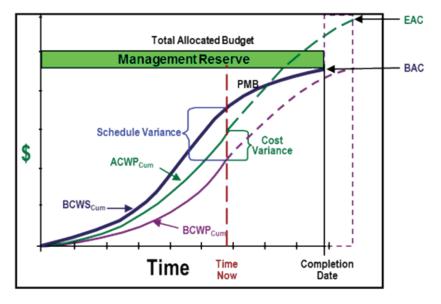


Figure 10. EVM "Gold Card"

The diagram illustrates two important concepts. First, the program budget is typically *not* fully allocated in the initial baseline. Management Reserve (MR) represents a percentage of the total program budget that the contractor keeps in reserve. MR serves several functions. First, it provides a budget for the contractor to deal with unforeseen issues or delays. The contractor will typically allocate MR over the course of the program to deal with issues that, as they arise, increase costs, ideally allowing a program to deal with issues without overrunning total budget. On incentive-fee contracts, MR also provides the contractor with a tool to improve its overall financial performance. A contractor completing a project with unallocated MR guarantees that the program will complete at less than target cost and realize an incentive-fee bonus.

The second, more subtle, point the diagram illustrates is the difficulty in reversing trends. Contractors will often describe the measures they are taking to improve performance and recover cost overruns or schedule delays. However, once a program starts trending toward budget

¹⁰⁴ DoDI 5000.02. Encl. 4. Table 5.

overruns in particular, the overrun is often nearly impossible to recover because it's not good enough to get "back on plan." Once a program is over budget, the program has to actually outperform its original plan to recover overruns already realized. Once the lines depicting ACWP and BCWP diverge toward negative CV, they almost never join again.

Snapping the Chalk Line—Performance Measurement Baselines and the Integrated Baseline Review

Perhaps the most important stage of EVM implementation is the first: defining the performance measurement baseline (PMB). The PMB, sometimes simply referred to as the "baseline," represents the budgets for all work packages overlaid on the IMS. It depicts the time-phased accomplishment of all program tasks and the associated accumulation of costs. The PMB provides the basis for measuring contractor performance by comparing actual costs to budgeted costs and actual work to scheduled work. 105

The contractor first presents the PMB to the government for review during the Integrated Baseline Review (IBR), and scheduling for the IBR is one of the first issues a government PM must confront. Generally speaking, sooner is better, though both the contractor and government need adequate time to prepare. Policy requires that the IBR be scheduled no later than 180 calendar days after contract award or the incorporation of major contract modifications. On short-duration contracts where 6 months represents a significant percentage of the overall performance schedule, the PM should consider the "10 percent rule," which suggests the IBR be scheduled within the first 10 percent of the overall schedule.

Practically speaking, it's impossible to review the entire PMB for most large programs, which may include thousands of work packages. With this in mind, it's important that the government team enter the IBR with a strategy. First and foremost, the program management team should ensure that the IMS generally corresponds to the contractor's original proposal and precisely corresponds to government schedule objectives regarding major milestones and deliveries. Of course, there's little value in an IMS that complies with government schedule objectives but is unexecutable. So the government needs to ensure that the overall

¹⁰⁵ This description of the PMB is somewhat simplified for this discussion. For an excellent and more detailed description of the PMB elements, see AQUipedia, which distinguishes between work packages, undistributed budget, and summary-level planning packages and also describes the PMB as a component of the Total Allocated Budget (TAB).

¹⁰⁶ ACQuipedia

¹⁰⁷Based on conversation with Pat Barker, DAU, May, 15, 2013.

sequence and durations for major tasks depicted in the IMS are realistic and that the IMS accounts for all internal and external dependencies. The government should be especially concerned that timelines for receipt of GFE or government-furnished information (GFI) are consistent with government plans. While it's unnecessary and unreasonable to evaluate every task on the IMS, the IBR should provide adequate time to carefully vet critical-path events. ¹⁰⁸

Note on Leverage

As discussed in the schedule section, cost-plus contracts often leave the PM with limited leverage to enforce contractor schedule compliance. The baseline, however, provides the basis for EVM metrics that are reported in Contractor Performance and Assessment Reports (CPARs). CPARs in turn often figure prominently in future competitive acquisition source selections as an indicator of contractor past performance. Because of this, the PMB provides a powerful mechanism to ensure the government and contractor work toward common schedule objectives. The government needs to carefully vet and validate the baseline and schedule during the IBR to ensure the program can exert this leverage via EVM metrics and CPAR reporting.

The program management team should also assess the PMB to ensure that "level of effort" (LOE) tasks and techniques have been pared to the bare minimum. Legitimate LOE tasks are generally management or administrative, tend to bill at a consistent rate over time, and are generally not tied to specific deliverables or discrete tasks. Contractor program management and financial management are examples of tasks that can be legitimately captured and measured as LOE.

The problem arises when LOE techniques are applied to efforts—such as software development or material handling—that should be associated with specific deliverables and broken into discrete, short-term tasks. It is important to make this distinction and minimize the number of tasks measured as LOE because LOE tasks, almost by definition, realize zero CV or SV. If LOE tasks constitute a significant percentage of the PMB, they can dilute the most important earned value metrics (CV and SV) and mask problems at the project level that PMs may not see unless they dig carefully into specific cost accounts. Therefore, the government should encourage the contractor to partition LOE tasks and assign them

¹⁰⁸The Integrated Baseline Review (IBR) Guide (Arlington, VA: National Defense Industrial Association [NDIA], September 1, 2010) provides an excellent and concise overview and recommendations for IBRs. For the IMS review, the NDIA guide also recommends, "A Schedule Risk Assessment (SRA) should be conducted prior to the IBR to ensure adequate schedule health and provide a basis of discussion for schedule risk and adequacy of schedule reserve" (p. 11). We strongly recommend this short but informative guide to PMs preparing for an IBR.

to discrete work packages to the maximum extent possible. The GAO considers 15 percent as the "upper bound" for acceptable LOE as a percentage of overall work. 109

"Sampling" of work packages is a method for determining the scope of work and level of detail the packages report. While it's impossible to assess every work package, a subsection of the government review team composed of EVM SMEs can "splinter" from the larger review to look carefully at a selection of the work packages, focusing on particular tasks on or near the critical path and tasks that are sources of significant cost or schedule risk. Their review should determine that the work package scope is well defined and consistent with the statement of work; that durations are reasonable; that task interdependencies are understood and properly captured; that specific and appropriate resource assignments have been made; and that methods for assessing progress will use objective measures of accomplishment wherever possible. As an example, the completion criterion for a test activity should be successful completion of the test, not just test execution.

Though the PMB will be updated, adjusted, and reviewed regularly over the course of most programs, the IBR is an especially critical event because it is the "last best chance" to establish an accurate and useful PMB. All changes thereafter emanate from the PMB that emerges from the IBR. In the early months of a contract, when the IBR typically occurs, there is often a great deal of activity underway and there is a great temptation to short-shrift the IBR or delegate responsibility to EVM analysts who may not fully understand the program. PMs should avoid this mistake. Plan for the IBR, resource the IBR, participate in the IBR, and use the event to ensure you have a meaningful baseline in place to track and report contractor performance.

Once Underway ...

The PMB that a program has spent so much time creating, reviewing, and putting in place is useful only to the extent that the PM uses it to monitor performance and progress. The Integrated Program Management Report (IPMR)¹¹¹ is the deliverable within which the contractor reports its performance against the PMB. Though the DoD *IPMR Implementation Guide* recommends that "the IPMR should always be

¹⁰⁹Patrick Barker, DAU, *Earned Value Management (EVM) Reference for PMs*, draft.

¹¹⁰ Integrated Baseline Review (IBR) Guide, pp. 10-11.

 $^{^{111}}$ Data Item Description (DID) DI-MGMT-81861. This is a very recent data item update to the legacy CPR with which many PMs are familiar. It combines much of the content formerly included in the CPR and IMS data items.

carefully tailored to meet the needs of each individual program,"¹¹² the basic format and content will not vary substantially. The most significant tailoring decision a program makes regarding IPMRs concerns reporting levels. Standard IPMR reporting typically occurs at WBS Level 3 or 4. ¹¹³ Requirements for reporting at lower levels may be justified in especially high-cost or high-risk areas, but the program must be mindful not to generate excessive CPRs that drive costs and may generate only marginally useful information. Different portions of the WBS may merit different levels of reporting, and this is a good tailoring option for many programs. Contracts typically require delivery of IPMR data monthly and within 17 days of the contractor's accounting period, ¹¹⁴ but the data can lag by a month or more because of delays associated with the contractor collecting, collating, analyzing, and reporting contract cost data.

Integrated Program Management Report (IPMR)

The IPMR data item description (DID) focuses on seven different formats associated with the IMPR, their applicability, and their tailoring options. Formats 2, 3, and 4 are required only for contracts exceeding \$50 million, while the rest are required for all contracts over \$20 million in value. Several are recommended even for small contracts (of less than \$20 million).

Format 1 (WBS) includes the most basic and essential IPMR reporting information: EVM performance data (BCWS, BCWP, and ACWP) by reporting WBS elements for the current reporting period as well as cumulative to date; CV and SV; BAC, EAC, and VAC; MR and undistributed budget (UB). Format 1 enables PMs to identify and quantify CV and SV according to the contract WBS.

Format 2 (Organizational WBS) provides similar information, but it presents the performance data (again, BAC, EAC, VAC, etc) by organizational elements, allowing a PM to discern in part whether performance issues are related to organizational issues or isolated to specific organizational components.

Format 3 (Baseline) depicts the budgeted, time-phased PMB through program completion. Format 3 information provides the "S-curves" we typically associate with a PMB. When you compare these curves month-to-month or quarter-to-quarter, you can readily see baseline movement.

¹¹² IPMR Implementation Guide (Washington, DC: OUSD(AT&L), Jan. 24, 2013), p. 2.

¹¹³Department of Defense Standard Practice: Work Breakdown Structures for Defense Materiel Items, MIL-STD-881C, Oct. 3, 2011, p 2.Available at https://acc.dau.mil/adl/en-US/482538/file/61223/MIL-STD%20881C%203%20Oct%2011.pdf

¹¹⁴ DoD Earned Value Management Implementation Guide (EVMIG; Defense Contract Management Agency, 2006), p. 31.

¹¹⁵ IPMR Implementation Guide, p. 7.

Format 4 (Staffing) gives staffing forecasts for organizational elements through program completion. Because staffing levels are one of the resources contractors can most easily rectify to address SV (especially in labor-intensive tasks such as software development and test), this is information and content that government PMs often home in on when a program encounters adverse SV.

Format 5 (Explanation and Problem Analysis) provides the contractor with an opportunity to explain the source of variance and the steps they will take to address or correct the problems. The Format 5 content gives a good indication of whether the contractor is using EMV to manage the program. It is also where "and then a miracle occurs" explanations sometimes manifest by way of explaining how a contractor will overcome significant CV or SV.

Format 6 (IMS) depicts the schedule for completing the contract and includes both the baseline and forecast schedules. It predicts the contract completion date and all interim milestones. It is interesting that this is the only format from within the IMPR that a government PM can elect to apply to FFP contracts without waiver, and the *IMPR Implementation Guide* explicitly states that "Format 6 is applicable to fixed-price contracts with deliverables." ¹¹⁶

Format 7 (Electronic History and Forecast File) is new and provides time-phased historical and forecasting data.

Even when contractors report at WBS Levels 3 or 4, it's easy to imagine how overwhelming the CPR can be for a major program. There are several things a PM can do to minimize this problem:

First, rely on your staff. Most large program offices have dedicated earned value analysts within their financial management office. These trained SMEs can highlight problem areas that merit more indepth review.

Second, learn to use and rely on the in-plant (DCMA) earned value experts. DCMA brings specialized earned value expertise and training, and it can interact directly with the contractor and solicit more upto-date and frequent earned-value performance data than the standard monthly deliverables provide.

Third, focus on the problem areas. Though the CPR can be a sizable document, it lends itself to fairly cursory review. A quick scan of variance information will highlight areas that require detailed reviews and careful reading of the variance analysis. Finally, establish a regular review process. This is important for several reasons: It ensures that EVM continues to play a central role in program management decisions, it allows a PM to identify problem areas early, and it makes it easier for the

¹¹⁶ lbid, pp. 9-10.

PM to maintain situational awareness and to track earned value trends over time. This is not to suggest that the PMs should not avail themselves of more frequent or updated earned value data as situations warrant but rather to make sure that EVM does not get pushed to the periphery of program-management processes.

Maintaining Accountability—Replanning, Rebaselining, Reprogramming

The PMB is a plan, and like most plans it is bound to change over time as it is implemented. The PMB is also a baseline or standard against which the government measures and evaluates contractor performance. Because of this, the government needs to be cognizant of changes to the PMB. Some changes to the PMB are benign and purposeful. Others are made necessary by poor planning or poor performance. It's important to distinguish between the different changes to the PMB and to understand when it's advisable to "replan" or "rebaseline" the PMB.

Replanning is generally an "internal" change to the baseline that moves work within the PMB but does not change the overall cost or schedule for a project. DAU suggests that "replanning should happen whenever the shape of the future baseline needs revision to reflect realism, and should never—theoretically—modify the shape of the baseline for time past unless that work was never begun." The important point is that replanning is not used as a "cover" for poor performance. Examples of replanning include:

- When existing budgets for remaining work are deemed sufficient, but need to be rephased to a different work plan or schedule.
- When a reorganization of work or people to increase efficiency becomes necessary.
- When the decision is made to use a different engineering or manufacturing approach.

Replanning may also reflect the allocation of MR to activities or work packages.

All replanning activities are purposeful, generally forward looking, and do not change the overall scope or size of the baseline (PMB). Replanning should not be undertaken by the contractor without noti-

¹¹⁷The words "replan" and "rebaseline" and "reprogram" cause a great deal of confusion, and various sources sometimes use them interchangeably. There are substantial differences between replanning, rebaselining, and reprogramming that government PMs need to understand.

¹¹⁸ Acquisition Community Connection, https://acc.dau.mil/CommunityBrowser.aspx?id=227391

fying the government. Government review, whether by program office or DCMA personnel, should ensure that replanning is indeed purposeful and forward looking and *not* simply a ploy on the contractor's part to forestall CVs or SVs by moving activities into the future. Excessive replanning, even if not designed with this objective in mind, can have this effect by creating a bow wave of activity that substantially reshapes the baseline.

Rebaselining equates to creating a *new* baseline (PMB), with changes to the overall cost, schedule, or both. Rebaselining can occur as a result of either directed, purposeful changes on the part of the government or in acknowledgement that the current baseline is so unrealistic as to be meaningless for evaluating contractor performance. Legitimate causes for baseline changes include new requirements or a change in design or approach as directed by the government. "Requests for equitable adjustment" or REAs—unintended changes to the scope of work directed by the government—may also result in a new baseline.

Where rebaselining results from government direction and is reviewed and authorized by the program office, it's important that rebaselining activity be limited to the new work scope or requirements and not be used to erase "the sins of the past." That is, if a contractor is carrying SV or CV on an effort before a rebaseline, the new baseline should not erase these variances unless they legitimately resulted from the new authorized scope.

Rebaselining may also be authorized by the government when the existing baseline is so unrealistic that it is not useful. Rebaselining of this type is also referred to as "reprogramming." The two variations on this theme include the "Over Target Budget" (OTB) and "Over Target Schedule" (OTS). To quote from the DoD EVM guide:

An OTB is a PMB that has been formally reprogrammed to include additional performance management budget in excess of the contract's negotiated cost. An OTB increases the performance budget without modifying the work scope or other constraints of the contract.... An OTS condition is created when the contractor replans the schedule to a schedule that exceeds the contract milestones or delivery dates. This new schedule also becomes the basis for the performance budgets. While it is possible to have an OTS without a corresponding increase in cost, normally an OTS is accompanied by increased costs and therefore by an OTB. 119

¹¹⁹ DoD EVMIG, p. 57.

DAU wisely counsels that "reprogramming never should be undertaken to eliminate variances for the sake of 'starting over' unless the baseline is so unrealistic that retaining the variances would forever skew performance data so much as to be unusable." As with other changes to the PMB, the objective is to create a baseline by which the government program office can monitor and assess contractor performance against cost and schedule objectives and hold the contractor accountable. In replanning, rebaselining, and reprogramming, PMs must assess whether changes to the baseline ultimately allow them to achieve these goals.

EXTERNAL, INDEPENDENT REVIEWS

Most people resist asking for help because it may be viewed as a sign of weakness. But in truth, asking for help is a sign of confidence and maturity. It says, "I'm not afraid of honest criticism. I know I don't have all the answers, and I am not afraid to use an idea that I did not originate." What is true for people is equally true for programs.

When facing difficult problems—where easy answers don't exist—senior leadership frequently invites external, independent boards to assist in developing options and fleshing out the second- and third-order effects associated with a decision. Consider the U.S. government's debt challenges in which presidents from both parties have established commissions to identify options and assist in making politically viable recommendations for an arguably intractable matter.

Major acquisition programs and very large organizations frequently establish a standing independent review board of "gray beards" to capture the experiences and thinking of former senior government leaders, academics, and industry leaders. Although there is no formal requirement for establishing a program review panel of experts, the practice is widespread because many leaders find it a very useful tool.

There are several reasons to seek an independent review of your program. The first and most obvious reason is that you may actually learn something. If one accepts that "the first responsibility of the key leaders in the acquisition workforce is to think," then anything that aids your thinking is a step in the right direction. This is precisely what independent review groups should be chartered to accomplish. They should critically examine your acquisition strategy, major issues, and the most significant challenges and provide candid, thoughtful advice. All parties

¹²⁰ Acquisition Community Connection, https://acc.dau.mil/CommunityBrowser.aspx?id=227391

¹²¹Kendall, "The Optimal Program Structure."

must clearly understand that since the PM is ultimately accountable, the decisions remain with him or her. Although having a team of smart folks think critically about your program direction and decisions can prove uncomfortable, the legitimate and thoughtful challenge to your thinking is exactly what you should seek as the PM.

A second reason related to the first is that if things do go south for whatever reason, having an independent review may help you and your team during the "what happened to your program and what were you doing to fix it?" phase. This should not be seen as a defense posture (although it may help in that regard). Rather, it could offer genuine help in understanding the dynamic of a failing program. There is a fair chance that independent reviewers will either have firsthand experience with the issue or know of a program that faced similar challenges. And even though a suggested remedy may fail, you can still look at yourself in the mirror and know you applied the best medicine available at the time.

A third reason for an external review is that the review board members may be able to assist in ways that would be difficult for the PM. It can be very useful to enlist the ability of external members to facilitate a dialogue with other senior leaders in either the government or industry. The relationships and credibility of your review-board members can make a big difference but must be carefully and judiciously employed: You and your program team's credibility is always in play when independent reviewers directly engage on your program's behalf.

Scientific Satellite Turned Off Due to Funding Shortfall

The Communications and Navigation Outage Forecasting Satellite (C/NOFS) had been on orbit 4 years, collecting space weather data for both scientific and operational use. But there was no plan to fund future operations of the satellite. C/NOFS was built by the Air Force Research Laboratory, Space Vehicle Directorate, and launched in 2008. The purpose of this experimental satellite was to collect space weather data, particularly those associated with the ionosphere, that would warn Global Positioning System (GPS) and satellite communications users that scintillation in the ionosphere would degrade navigation or communication capability.

Adding to the frustration was the fact that C/NOFS was designed and calibrated to be on-orbit during the peak activity of the sun, known as the solar maximum (in this case, about the year 2003). Unfortunately program delays resulted in a launch during a "quiet sun" or solar minimum (in 2008). Because the sun has an 11-year cycle, keeping C/NOFS operational long enough to collect data during the time of a maximally active sun meant better scientific data and improved definition of a possible follow-on system.

As with most laboratory space experiments, the system was designed to collect 1 year of data, and any residual operations capability could be offered to Air Force Space Command (AFSPC) for continued operational use. In the case of C/NOFS, the Air Force Weather Agency and the operational users around the globe

were using the system and building confidence in the data and their utility. Without additional funding for satellite operations, data analysis, and system support (approximately \$2 million per year), the satellite would be turned off—providing no more data for science or operations.

Since 2003, AFRL Space Vehicles had a strategic advisory board composed of 14 retired general officers drawn from Army, Navy, and Air Force senior strategists, as well as other former senior leaders from across the government. This Independent Assessment Team (IAT) met with the Space Vehicles director twice yearly to review and advise on issues facing the directorate.

Because the funding required for operational support is O&M, the laboratory could not legally use its Science & Technology funds even if it wanted to. The weather program office in Los Angeles faced numerous other bills and challenges and had no means to assist keeping C/NOFS operating and its data flowing. Without senior leader involvement, the Air Force would have invested approximately \$160 million to build and launch the satellite to collect 4 years of on-orbit date but lose another 3 years of data during a more active sun because they could not come up with another \$2 million to support operations.

When the members of the IAT learned of this, they immediately offered to engage directly the four-star commander of AFSPC who could direct O&M funding in the near years as well as include funds in future years. Because they were careful to prebrief subordinate leaders, ultimately the issue was raised directly at the four-star level by a retired four-star member of the IAT. Resolution followed shortly and C/NOFS continued to provide scientific data and a forecasting capability for communication and GPS users.

A final note: Although it is easy to understand independent review boards for major programs, the practice is scalable. The fundamental idea is to solicit input and thinking from experienced PMs and leaders. Taking the time and effort to review your program with credible peers and other senior PMs (which in this case may be a major or GS-13) will almost certainly sharpen your thinking.

Proverbs for PMs

Ask for something in every brief you give.

- It may just be for support of your position.
- It may be for more people, time, or money (do this in a prebrief first).
- Ask only for something the receiver is empowered to give you.
- Make it clear what you are asking for up front and in the summary—be direct!

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SECTION II: CRITICAL ARTIFACTS

Definition

Artifact: any object made by human beings, especially with a view to subsequent use.

Too often we become so busy chasing the 40 things we have do that we lose sight of the handful of products that matter most. Like an adventurer preparing to set off into the wild, we must keep our compass and map in a secure place and be disciplined about where they are, lest we lose our most vital tools.

All products matter ... some matter more than others

Colonel John Bryant, USMC (ret.)PM, Expeditionary Fighting Vehicle and DAU professor

In the following three chapters, we present the four most important artifacts 122 for PMs: the strategy, the baseline, the master plan, and the IMS. 123

It will without a doubt be debated whether these are the most important, as some will argue that the systems-engineering documentation, technology maturation assessments, or test documentation merit inclusion in this short list. More often than not, those who argue the importance of other products typically do so either out of self-interest or because it is the lens through which they've learned to view acquisition programs. The debate aside, your authors, along with many other PMs believe these four are the keys to a PM's success.

ACQUISITION STRATEGY

What is strategy but resource allocation?

-Jack Welch (former chairman of General Electric)

Business is like war in one respect. If its grand strategy is correct, any number of tactical errors can be made and yet the enterprise proves successful.

-Robert E. Woods (1879–1969) U.S. Army brigadier general and businessman

The word "strategy" is perhaps one of the most easily confused in the English language. It is used in various contexts—military, business, games, interpersonal relations, and sports to name a few. Each usage comes with a slightly different understanding. For the particular

¹²²The contract is a "critical artifact," but not included here as it was discussed in the prior section

¹²³Some argue that the requirements document is a critical artifact: No warfighter requirement, no program. We agree that the requirements document is key. However, because the PM has limited ability to modify the "warfighter requirements," we do not include it in our "critical artifacts" discussion.

case of government acquisition, PMs are required to develop a strategy¹²⁴ that takes a very specific, well-defined form in that your Service and the Defense Department¹²⁵ as a whole have an "acquisition strategy" template to ensure all elements of a sound acquisition strategy are addressed. There is a subtle but important distinction here: acquisition strategy is focused more on the contract, incentives, and business arrangements, as will become evident by examining the acquisition strategy template. ¹²⁶ A "program strategy" is far broader and encompasses all aspects of the program—stakeholders, contracts, role of government, future approaches, "on-ramp" or "off-ramp" technologies or capabilities, to name a few. So before jumping in and "filling out" the series of slides that your Service acquisition executive requires, it is worth considering a broader understanding of strategy, as this will aid you in developing a good and enduring strategy for the entire program.

Some of the various definitions of strategy include:

- "A plan to achieve desirable ends with available means" 127
- "A pattern in a stream of decisions" 128
- "The determination of the basic long-term goals and objectives of an enterprise, and the adoption of courses of action and allocation of resources necessary for carrying out these goals" 129
- "A high-level plan to achieve one or more goals under conditions of uncertainty"¹³⁰

The important point to note in these definitions is the common elements: (1) *ends* (or goals), (2) *means* (or resources), (3) *uncertainty* (or risk), and (4) *plan*. These four key elements are the building blocks for a strategy and require a thorough understanding and clarity if the strategy is to be sound. An unstated but equally important fifth element is the particular *context* for which a strategy is formulated. The first three elements—ends, means, and uncertainty—are covered in detail elsewhere in this book under different acquisition program management terms.

¹²⁴FAR Part 34 requires PMs to develop an acquisition strategy tailored to the particular major system acquisition program (FAR 34.004).

¹²⁵For the DoD, refer to the *Defense Acquisition Guidebook*, Chapter 2: "Defense Acquisition Program Goals and Strategy and the Federal Acquisition Regulation (FAR) part 7 and 34."

¹²⁶A later section titled "Competition and Contractor Selection" provides additional considerations for the contract strategy.

¹²⁷Max Mckeown, *The Strategy Book*, Pearson Education Limited, 2012.

¹²⁸Henry Mintzberg, "Patterns in strategy formation," *Journal Management Science* 24, no. 9 (1978)

¹²⁹ A. D. Chandler, Strategy and Structure (Cambridge, MA: MIT Press, 1962/1998), p. 19.

¹³⁰The Wikipedia definition—which may be the best.

"Ends" are performance requirements, "means" are the resources your Service provides, and uncertainty is captured as "risk." Rather than review those three elements, we will focus this section on the remaining two elements of strategy—the particular context and the high-level plan. Understanding the context and formulating a plan is at the core of strategy development.

Elements of Strategy

- Ends (or goals): clear articulation of the desired outcome of a strategy
- Means: the resources available
- Uncertainty: limited knowledge of current state and constraint on predicting future outcome, or more than one possible outcome
- Plan: list of steps with timing and resources, used to achieve an objective
- Context: the elements of a particular situation that make it unique

Before formulating a plan¹³¹ as part of a program acquisition strategy, a PM must thoroughly understand the particular context and environment of the acquisition. The context should include any and all elements that can influence the program. Some of the key context considerations include (to name a few) industry capability and competition; potential legacy system and user expectations; the role of the government team in the overall program; congressional interest; relevant joint partnerships and collaborations; and open architecture and industry standards.

Two simple examples illustrate the importance of context. If you are responsible for procuring computers or information-technology (IT) systems, you will likely find robust competition in the industry with multiple sources. However, your users probably will demand capability commensurate with what they can commercially buy for themselves for use at home. You may also find that many of these users are relative "experts" with IT systems and understand (or at least think they understand) the systems and seek to provide you and your program office "helpful" advice and counsel. Another key contextual element affecting your strategy in this example will certainly include testing and certification for cybersecurity along with an in-depth understanding of potential source companies and their supply chain, as the manufacturing location and country of origin of the components will surely be of interest.

¹³¹The terms "plan" and "strategy" are frequently used as synonyms which can cause confusion. This is also true in FAR and other documents. FAR part 34 requires an "Acquisition Strategy" while FAR part 7 specifies the elements for a required "Acquisition Plan." The two are interrelated and overlapping. We recommend not getting hung up on the terms—rather focus on thinking through the key elements needed for both and mentioned above.

A very different contextual acquisition situation is the procurement of space-qualified, very accurate atomic clocks needed for the GPS satellites. In this case, there is virtually no competition; in fact, there is only one company¹³² currently capable of building the high-performance clocks that can survive in the harsh radiation environment of space. Even more interesting, the specific individuals who make these exquisite clocks are at or near retirement, and their specialized skills and knowledge are at risk of disappearing from U.S. industry altogether. As a result, an aspect of the GPS strategy has been development of a second source for clocks. Beyond the unique single-source challenge related to spacequalified atomic clocks is the manufacturing of the very stable and highperformance electronic equipment that makes up the on-orbit GPS signal. Although more than one company has built the GPS payload, 133 it is a very high-performance system that PMs must factor into the strategy in a way that ensures testing and validation of the overall system performance as well as compatibility with the entire system.

In both examples, we touched only the surface of the particular contextual elements; a PM who is building an acquisition strategy would ultimately need to dig several layers deeper to gain the needed clarity and understanding for a successful strategy. We believe careful examination of these elements is at the heart of the Pentagon's most senior acquisition leader's charge to PMs that "The first responsibility of the key leaders in the acquisition workforce is to think." To aid you in the thorough analysis and understanding of the particular context, we recommend using a disciplined approach or framework. One framework to consider is provided here.

What Does It Mean to "Think"?

Although the directive to "think" may be obvious to some, others may struggle with exactly what it means. It also leaves one wondering, "How do I know I'm done?" or "Can I be sure I have thoroughly thought through a particular issue or strategy?" The good news is that there is an organization dedicated to helping find answers to these legitimate questions. The Foundation for Critical Thinking ¹³⁵ is an excellent resource that provides a well-structured approach to thinking through challenging issues. Although the foundation has a significant library available for those interested in delving into the subject further, we include its list of "Elements of Thought" here and the "Universal Intellectual Standards" in the Appendix. We have found both lists particularly useful to ensure the thinking process is thorough and disciplined.

¹³²The only company currently building GPS rubidium atomic clocks is Excelitas. Note that Symmetricom provided the cesium clocks for GPS II/IIA and IIF and that other companies are considering becoming a second source for clocks.

¹³³Both ITT Excelis and Boeing Anaheim manufactured GPS payloads in the past.

¹³⁴Frank Kendall, "The Optimal Program Structure."

¹³⁵More information is available at www.criticalthinking.org and in the Appendix.

$Critical\ Thinking-Elements\ of\ Thought^{136}$

- Purpose: You should be clear and justifiable about your purpose.
- Question at Issue: Define the problem.
- Information: data, facts, observations, experiences
- Interpretation and inference: conclusions, solutions
- Concepts: theories, definitions, axioms, laws, principles, models
- · Assumptions: presupposition, taking for granted
- Implications and consequences
- Points of view: frame of reference, perspective, orientation

Although all the elements of thought are important to your strategy analysis, the three most likely to add insight to your acquisition-strategy development are "information," "assumptions," and "points of view." The examples given above illustrate the need for relevant information such as industry facts, competitive environment, and user expectations. Collecting the relevant "information" should go well beyond a series of Web searches and likely will require contacting companies directly, engaging with industry experts, and consulting with veteran acquisition staff. Of course, you should always consider the possible bias of your data sources. For example, when you ask industry sources if they are capable of producing something in a particular quantity or quality, they are incentivized to say "yes" and attempt to provide data to support that assertion. Although the effort to gather information may seem burdensome, the resulting strategy relies heavily on these data.

When laying out an acquisition strategy, another key step is to examine the assumptions you and your team may have regarding the context and constraints. Assumptions made as part of your acquisition strategy (sometime referred to as "framing assumptions" include, for example, that industry is capable of producing a particular system or subsystem at a particular quality and quantity. Another example of a framing assumption is that the design of a particular system is mature and able to move into full-scale production without significant problems. According to the OSD office responsible for lessons learned in acquisition programs, the F-35 program made both assumptions during development—and both turned out to be poor assumptions that caused signifi-

¹³⁶Richard Paul and Linda Elder, *The Miniature Guide to Critical Thinking: Concepts and Tools* (n.p.: The Foundation for Critical Thinking, 1999).

¹³⁷ Gary R. Bliss, *Best Practices for Improving Program Productivity*, presentation at the Senior Leaders' Acquisition Training (SLAT) Conference, November 14, 2012.

¹³⁸Performance Assessments and Root Cause Analysis (PARCA) is within the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics (OUSD[AT&L]).

cant difficulties for the program when transitioning from development to production. 139

Write down the assumptions and then examine each closely. Ask "what would happen if the assumption were wrong." Look for similar acquisition programs and review their assumptions and mitigation strategies. In the case of the F-35, the lack of a mature production design is causing significant cost growth and delays. When examining each assumption, you should consider ways to test the assumption or think of possible mitigation strategies that may reduce risk or provide alternatives.

Look closely at program requirements that are in law (congressional statute) versus those that are DoD or Air Force regulations. Both laws and regulations can have exceptions. However, it is far easier to get a deviation for a regulation. So if that is the right approach for a particular context, factor it into your strategy.

A final element of thought that merits highlighting for acquisition strategy development is "point of view," which requires you to consider the perspective and expectation of other stakeholders, including industry. Ask yourself some or all of the following questions: Is your acquisition business strategy structured to motivate industry's participation? Are the incentives enough to prompt a particular company to respond to a request for proposals (RFP)? Knowing that the RFP is a necessary but not sufficient form of communication, have you conversed with industry so it thoroughly understands your needs? Is the structure of your competition likely to motivate industry's best or so limit legitimate competitors that it becomes an opportunity to price-gouge? Are the selection criteria you've identified and communicated to industry likely to increase competition or be perceived as favoring a particular company? These are a few of the tough, but important, questions you and your team must wrestle with if your strategy is to be successful. This is the thinking part.

To help you navigate these key strategy questions, a helpful approach is to deconstruct, analyze, and prioritize the "goal" or "ends" in a way that identifies what you *value* most in the program. Identifying that which is the greatest value and being able to articulate why and how much you value it relative to other program elements can greatly aid your strategy development.

Because the Services, as well as the Department of Defense, change their strategy templates periodically, we do not attempt to provide a detailed description of required elements in the current acquisi-

¹³⁹ Bliss Rest Practices

tion strategy documentation. However, we list the major elements expected in the acquisition strategy documents to provide insight into the expectations of senior DoD decision makers. You may also find this helps you think through every key aspect of your program.

Acquisition Strategy Elements¹⁴⁰

- Business Strategy: Address the main contracting approach, including contract types; how competition will be sought, promoted, and sustained; source selection procedures, provisions, and sources; product support considerations; and leasing arrangements.
- 2. Contracting Strategy: Explain and, to the extent necessary, provide the analysis and rationale for the contracting strategy. Justify the use of fixed-price or cost-plus vehicles. Explain why the incentives provided were chosen and why there is confidence that they will successfully motivate the contractor to provide the performance desired by the government.
- 3. Major Contract(s): Identify the number and type of contracts, deliverable items, options, exit criteria, contracting plan (competitive versus sole source and future down-select options), along with any other considerations. 141
- 4. Incentives: For each major contract, describe the contract incentives in detail. State how contract incentives are going to be employed to achieve required cost, schedule, and performance outcomes. If more than one incentive is planned for a contract, the Technology Development Strategy (TDS) and Acquisition Strategy should explain how the incentives complement each other and do not interfere with one another.
- 5. Technical Data Management: The strategy for Acquisition Category I and II programs shall assess the long-term technical data needs for the system and reflect that assessment in both the TDS and the acquisition strategy.
- 6. Sustainment: The acquisition strategy should provide an overview of the sustainment-related contract(s) and performance-based agreements, with government and industry providers describing how the integrated product support package will be acquired for the system being supported. The discussion should include the contract/agreement and length, along with major terms and conditions; performance measures being used; and the portion of the system covered with the associated sustainment-related functions, plus hardware and data covered in each contract/agreement.

¹⁴⁰ Defense Acquisition Guidebook, Chapter 2.2, "Program Strategy Document Requirements."

¹⁴¹ Ibid

A final thought to conclude this section is that strategy is not limited to what is captured in the Acquisition Strategy Document (ASD). Developing a strategy means considering an array of execution options that include how to acquire, how and where to test, how to maintain flexibility, how to get it funded (and keep it funded), and even a political approach to defending your programs (via advocates, independent review stakeholders, and messaging). This is a large, exciting balance that deserves a lot of consideration. By contrast, things like the ASD are part of that strategy, but the existence of an approved ASD doesn't mean you have a well-thought-out strategy. It's important that PMs not get so focused on completing paperwork approvals that they forget there is an underlying strategy that must be thoughtfully considered, developed, maintained, and documented throughout the program.

ACQUISITION PROGRAM BASELINE

Understanding the concept of a "baseline" is fundamental to program management. The term is used so frequently and incorrectly while discussing programs that it is important to clearly capture the idea. In short, a baseline is the calculated cost, schedule, and performance the PM is expected to deliver. The reason to think of it this way is simply that a baseline defines an agreement: You will deliver "P" performance on "S" schedule and within "C" cost. A more formal and exacting way to understand a baseline was defined by Congress as the Acquisition Program Baseline (APB), 143 a formal signed contract between the PM and service acquisition executive or the defense Milestone Decision Authority (MDA).¹⁴⁴ But regardless of the program's size, developing an APB is useful for clearly spelling out expectations: for defining precisely what product(s) and performance you will deliver and for accomplishing key milestones on a particular schedule within an agreed-upon funding profile and overall cost. An APB is now required for all programs by DoD Instruction 5000.02. Typically, this is done by first defining the performance within the requirements community followed by input from your Service, which sets budget constraints on the cost profile over time. Schedule is usually the most malleable of the three "legs of the triangle." But to arrive at a baseline that gives a PM a reasonable chance to deliver usually requires an iterative process. The conversation with your Service

¹⁴² Sometimes referred to as an Acquisition Strategy Plan.

¹⁴³The applicable statute is Title 10, USC Code, § 2435 which demands an APB for all MDAPs and for all designated subprograms under MDAPs.

¹⁴⁴The MDA is formally responsible to Congress as the accountable decision maker for an acquisition program and, depending on the cost of the program, the MDA can range from a colonel-level acquisition professional to the USD (AT&L).

headquarters and the requirements community might go something like this:

If you (the Service) want "P" performance, I (the PM) can deliver an initial operational capability (IOC) by "S" schedule at "C" cost defined by a time-phased funding profile. If you say "Oh, we can't afford that," can you accept "P-minus" performance for "C-minus" dollars? That would mean we would reach IOC in "S+2 years."

And so the negotiation goes until an acceptable balance is reached among the three key elements of a baseline.

Throughout this iterative process, it is essential that PMs pay close attention to two items. First everyone involved in the discussion must clearly understand what is "part of the program" and what is not. It is too easy to think mistakenly that another program will provide a key component when in fact they are counting on you to include it as part of your system. So define what is inside the triangle. The second item is that close attention should be paid to every performance, cost, and schedule position discussed while examining the Tradespace. You will be held to a particular combination of cost, schedule, and performance that you and your program team believe you can deliver. So give careful attention to every C/S/P position you endorse. As the PM, you have the clear responsibility to assess whether a particular cost, schedule, performance combination will "close."

Thinking of the triangle analogy again, the particular combination of sides may not align to form a closed triangle. If two sides (length) are defined, the PM must calculate the exact length of the missing side within an acceptable risk tolerance.

If the baseline does not close, you need to change something specific—decrease performance, lengthen schedule, find more money, or accept more risk. Asserting that you have a closed baseline, or ignoring that it doesn't close, will eventually catch up to you. Chances are that your program will only go downhill from today—costs only increase, margin get expended, performance expectations decrease, and schedules slip. The opposite is far rarer. So, if the baseline doesn't close, and your program is "broken," start figuring out a strategy to fix it.

When the performance/cost/schedule negotiation ends, the agreement is written up in a formal and simple APB that is usually approved at or shortly after Milestone-B (MS-B). Usually it is four pages long—a cover page with signatures of the PM, the PEO, and the MDA; one

page for the required performance; one page with a variety of important cost figures; and one page for the key schedule events. Although the document is short, the three key pages of performance, cost, and schedule require a bit more explanation.

The performance page of the APB is "lifted" directly from the documented requirements developed by the requirements community. For major acquisition programs, the document that codifies all the requirements is the CDD. 145 Although some CDDs are hundreds of pages long, 146 by far the most important performance requirements, and the only performance requirements included in the APB, are the KPPs. As discussed in the "Basics" chapter earlier in this book, KPPs have two values associated with each testable measure—a threshold and an objective value. Using a simple example of aircraft range, the objective (desired or target performance) may be 1,500 miles, while the threshold (minimally acceptable performance) may be a range of only 1,000 miles. It is important to specify any key caveats early to avoid, or at least reduce, the chance of future misunderstandings during test. In this case, that level of performance is required of the aircraft when it is fully loaded (carrying its maximum weight) and at altitudes greater than 25,000 feet. The key element for the performance page of the APB is that it comes directly from the documented requirement and includes only the KPPs.

The cost page in an APB contains several elements, all of which a PM must clearly understand. The several elements are total life-cycle cost (LCC), program acquisition unit cost (PAUC), average procurement unit cost (APUC), and the funding profile across the years for this phase of the acquisition program. The LCC is the government's cost of acquiring and owning a system over its useful life (sometime called total ownership cost). Because LCC includes everything—research and development, acquisition, sustainment, operations and maintenance, and disposal—the calculation requires cost-estimating expertise. The PAUC is the total cost of development and of procurement funding required for a weapon system divided by the number of units the government plans to purchase.

The APUC will always be less than the PAUC because it is the same basic calculation but does not include the cost of development—so it is simply the cost of purchasing each system (procurement funding) divided by the number of units purchased. The final element on the cost

¹⁴⁵The development of the detailed requirements was discussed in an earlier section and although there is a great deal of detail associated with writing, coordinating, and approving a CDD, we will not elaborate on it further.

¹⁴⁶The requirement community has recently started to limit the CDD to no more than 40 pages, according senior leaders in the Joint Staff.

page is the by-year funding that will be required in this phase of the acquisition in "then-year" and "constant-year" dollars. Both numbers are included because inflation is only an estimate. As future inflation varies from your estimate for inflation—the dollars required for future years will also vary. So to compensate for this effect in the calculation of a baseline breach (discussed below), we include "then-year" (in which the funding profile included our inflation adjustments) and "constant-year" dollars based on single- and future-year funds not adjusted for inflation. Although the cost page of the APB may sound complicated, this is the comfort zone of your financial management team.

The final page of the APB is devoted to schedule. Again, this may be where the PM has the greatest flexibility to influence what key milestone is tracked. Almost all APBs include IOC and full operational capability as well as any milestone decisions. Beyond these, the PM may wish to add other key events—for example, a significant review with the contractor (e.g., the Critical Design Review)—or not, and keep a minimal set of schedules to track. The advice of your authors is to keep to a minimal set, as that provides the greatest flexibility for the PM. The dates associated with each key event include both a threshold and objective date. The objective date is your best estimate for when the event will occur (sometimes described as a "green-light schedule" with realistic schedule margin included, based on the program's risk element). The threshold schedule date is 6 months later. So the schedule page is usually the shortest and easiest to understand and very likely a simple table (e.g., see Table 3).

Table 3. Example of Schedule Elements in an Acquisition Program Baseline

Key Event	Objective	Threshold
Critical Design Review (CDR)	January 2014	July 2014
Initial Operational Capability (IOC)	April 2018	October 2018
Milestone C	November 2019	May 2020

A baseline is not just a good idea for all MDAPs but a good idea for all programs or projects regardless of size. For without the discipline to define precisely what you are attempting to deliver (performance) with which resources (cost) and on what timeline (schedule), there is arguably neither a plan nor any accountability for the effort. The APB is the PM's promise to deliver—and you can take great pride in delivering what you promised.

BREACHES AND NUNN-MCCURDY

Returning to the idea of a closed and well-aligned triangle, everything fits and "closes" on the target performance, cost, and schedule. But if one of the sides begins to grow, shrink, or change shape, at some point the deformed side will break and no longer "close." This geometry discussion is a useful way of thinking about a breach. If development of a particular widget on the critical path is behind schedule, your program may be delayed for 5, 6, 7 months and result in a schedule breach. But because the longer schedule causes inefficiencies in the rest of the production, the cost may also grow. Alternatively, during development, you may find that achieving a particular level of threshold performance is not possible with the current technology, again resulting in a cost or a schedule breach or both. The interrelationship between performance, cost, and schedule means a challenge or change in any one affects all three. So what are the consequences?

When an existing baseline is breached, for whatever reason, the PM should seek to "rebaseline" the program. This is simply the calculation of a new point at which the "triangle closes." If the program is delayed 7 months on any of the key events listed in the APB, then after you notify your leadership of this, you and your team should assess the factors that caused the delay and modify the new objective date (recall, the threshold is determined by simply adding 6 months to the objective). At the same time, you must assess the impact on cost to ensure your cost threshold and objectives are still valid. Once you have defined a program that "closes," the PM signs the new APB and seeks signatures from his or her PEO and MDA. This rebaseline process results in a new agreement.

Cost (unsurprisingly) gets special attention, not only from your Service, but from Congress. The implementation of this special attention from Congress is codified by the Nunn-McCurdy law. The statute tracks two levels of cost breach—significant and critical. It also compares cost to the current baseline as well as to the original baseline. The current Nunn-McCurdy red lines for PAUC, APUC, and procurement unit cost are provided in Table 4.

Either level of Nunn-McCurdy breach results in a significant review process to determine whether the department should continue to fund the program or simply cancel it. This is a serious and trying process with unpredictable results—sometimes programs are certified as critical to national security, are rebaselined, and continue. Other times, programs are canceled.

 $^{^{147}\}text{Nunn-McCurdy}$ is defined in the U.S. Code, Title 10, Subtitle A, Part IV, Chapter 144, § 2433.

Table 4. Nunn-McCurdy B	Breach Criteria
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Nunn-McCurdy Breach Levels	Against Current Baseline	Against Original Baseline
Significant Breach	PAUC, APUC, or pro- curement unit cost Cost growth of ≥ 15%	PAUC, APUC, or pro- curement unit cost Cost growth of ≥ 30%
Critical Breach	PAUC, APUC, or pro- curement unit cost Cost growth of ≥ 25%	PAUC, APUC, or pro- curement unit cost Cost growth of ≥ 50%

Because breaches get special attention from Congress, the Performance Assessments and Root Cause Analysis (PARCA) office was established in OSD¹⁴⁸ to track breaches, capture lessons and trends, and provide additional insight for future programs to avoid cost and schedule growth. Table 5 shows the predominant root-cause distribution of programs examined by PARCA in the nine categories specified in the WSARA statute. (Note: Most of the programs studied by PARCA are in Nunn-McCurdy breach.)

Table 5. Causal Factors Across Programs Studied by PARCA¹⁴⁹

Program Inception Issues (Planning)				
Unrealistic cost or schedule estimates	36%			
Immature technology, excessive manufacturing, or integration risk	7%			
Unrealistic performance expectations	7%			
Other	7%			
Program Execution Issues				
Change in procurement quantity	21%			
Inadequate funding/funding instability	0%			
Unanticipated design, engineering manufacturing, or technology issues	7%			
Poor management performance	57%			
Other	0%			

¹⁴⁸PARCA was created in the OUSD(AT&L) in December 2009 to comply with section 103 of the Weapons Systems Acquisition Reform Act (WSARA) of 2009, Public Law 111-23.

¹⁴⁹Department of Defense, Performance Assessments and Root Cause Analyses, *2012 Annual Report*, March 2012, p. 4.

It is interesting that more than half of the troubled programs studied by PARCA included "poor management performance," which included the following symptoms:

- Translation of user requirements into testable specifications—failed systems-engineering functions like flow down of requirements, interface management, and management of holistic performance attributes such as reliability weight.
- Contractual incentives—not well aligned for corporate environment or program goals, or not well enforced.
- Risk management—shortfalls in identification, quantification, evaluation or mitigation of program risk.
- Situational awareness—resulting in less effective and less timely responses.

Not all breaches are bad. A good example of this is the Army's Guided Multiple Launch Rocket System. During the internal Army review, the number of missiles the Army planned to purchase was reduced from 147,000 to 40,000. The cost breach was due to the change in quantity, which unsurprisingly increased the cost of the PAUC (remember that PAUC includes the cost of development, so when the RDT&E cost is divided by a much smaller number, it's contribution to the overall cost of the program increases significantly).

On baselines, keep in mind for the coming chapter on the contract a recent OSD "root cause" analysis of failures, ¹⁵⁰ which claimed that one of the most common causes of failure in programs is the lack of clear program definition. The assessment added that the two key elements of program definition are the baseline and the contract. Too often these two critical artifacts for the PM are not well synchronized and thought through. The key point related to the baseline discussion is simply that the contract (and therefore the RFP) must show direct traceability to performance requirements in the baseline.

¹⁵⁰ Bliss. Best Practices.

INTEGRATED MASTER PLAN AND INTEGRATED MASTER SCHEDULE

Plans are worthless; but planning is everything.¹⁵¹

-Dwight D. Eisenhower

How does a project get to be a year behind schedule? One day at a time.

-Fred Brooks D. Meyer Illinois Construction Law

Performance impacts schedule and time is money—closely monitoring and holding to planned schedule nearly always means success.

-Steve Wert Air Force Program Executive Officer Battle Management

We begin with a quick explanation of the IMP and IMS. In short, the IMP details the specific key events and the exit criteria associated with each event. The IMS maps those events to a schedule and includes the various tasks required to complete each of the events. 152

The *Defense Acquisition Guidebook* and supporting documents provide the following definitions for the IMP and IMS:¹⁵³

¹⁵¹Speech to the National Defense Executive Reserve Conference in Washington, D.C. (November 14, 1957); from *Public Papers of the Presidents of the United States, Dwight D. Eisenhower, 1957*, National Archives and Records Service, Government Printing Office, p. 818.

¹⁵²Note that on June 19, 2012, OUSD(AT&L) issued new guidance to use an IPMR, which combined the CPR with the IMS. This change does not alter the program management "best practice" to develop an IMP and IMS.

¹⁵³ Integrated Master Plan and Integrated Master Schedule Preparation and Use Guide, Version 0.9, October 21, 2005. Available at http://www.acq.osd.mil/se/docs/IMP_IMS_Guide_v9.pdf

Definition

Integrated Master Plan (IMP): The IMP is an event-based plan consisting of a hierarchy of program events, with each event being supported by specific accomplishments, and each accomplishment associated with specific criteria to be satisfied for its completion. The IMP is normally part of the contract and thus contractually binding. The IMP is a narrative explaining the overall management of the program.

Integrated Master Schedule (IMS): The IMS is an integrated, networked schedule containing all the detailed, discrete, work packages and planning packages (or lower level tasks or activities) necessary to support the events, accomplishments, and criteria of the IMP. The IMP events, accomplishments, and criteria are duplicated in the IMS. Detailed tasks are added to depict the steps required to satisfy the criteria. The IMS should be directly traceable to the IMP and should include all the elements associated with development, production or modification, and delivery of the product and high-level program plan.

Because the IMP makes up the elements of the IMS, both are frequently referred to as simply the "program schedule." We will use this term in the remainder of this section. However, you should keep in mind that there are two pieces to the program schedule that are developed sequentially. First, the IMP identifies the specific events that must occur and defines the exit criteria (e.g., test a specific element of software with zero errors) to "reflect what must be done to clearly ascertain the event has been successfully completed." The IMP provides the basis for the IMS, which depicts the relationship (predecessor or successor) between all of the events described in the IMP, event durations, and constraints that control start or finish dates. It is important that the IMS also includes all of the detailed tasks "necessary to support the elements, accomplishments, and criteria of the IMP...." The IMS is a more detailed, time-phased rendering of the framework described by the IMP.

The program schedule is perhaps the most important and fundamental tool in the PM's toolbox. ¹⁵⁶ The easiest way to determine whether a program is proceeding according to plan is to refer to the schedule. PMs speak of "managing cost, schedule, and performance," but cost and performance are largely constrained by budgets and established requirements. Schedule, on the other hand, is where the PM can often see the

¹⁵⁴Ibid, p. 26.

¹⁵⁵ Ibid, p. 5.

¹⁵⁶William T. Cooley, Brian C. Ruhm, and Adrian Marsh, "Building an Army: Program Management in Afghanistan," *Defense AT&L* 35, no. 4 (2006), pp. 14–18.

greatest gains or (more often) the greatest losses. Both cost and risk are byproducts of the schedule. All other things being equal, costs typically increase with schedule duration, while technical risks are inversely related to the time allowed to accomplish a task or solve a problem. Most risks eventually translate into schedule delays.

If the program schedule is the most important tool in the PM's toolbox, it is also very often the most underutilized, for several reasons. First, many program schedules are not useful in that they do not reflect either the critical dependencies or the interrelationships within a program. Another reason schedules fall by the wayside as a program management tool is they are not kept up-to-date. Finally, PMs often pay more attention to earned value measures and other tools than to the underlying schedule upon which earned value metrics are based. Earned value is another useful program management tool, but PMs need to track and understand basic schedule status before assessing earned-value metrics.

We offer two warnings to PMs either creating or receiving a program schedule. The first is to avoid schedules developed in PowerPoint or any other format not specifically designed for project management scheduling. Most reasonably complex programs entail hundreds or thousands of discrete activities, many of which are interrelated and must occur in a particular sequence. A PowerPoint slide simply cannot capture the complexity or critical interdependencies needed for a useful program schedule. PowerPoint schedules are also difficult to maintain and, because they do not show relationships and dependencies, cannot predict the effect that a delay in one activity might have on the larger program. You can slide an icon on a PowerPoint chart to the right, but you don't necessarily know what impact that has on all the other icons you have so carefully rendered on your "schedule." Another reason PowerPoint schedules are inadequate is that they are not "resource-loaded." This means they do not take into account the resources (people, facilities, test equipment, etc.) that an activity requires to be accomplished. Since they are not resource-loaded, they cannot predict when competing claims to a resource—a software integration facility, test aircraft, production jig, or flight test range—might delay completion of a task. Because of the many shortcomings associated with informal scheduling tools, savvy PMs will include explicit contract requirements for a resource-loaded program schedule to be delivered (and updated periodically) in a format that depicts both internal and external interdependencies.

The second warning is to be wary of schedules that show thousands of tasks cascading though time to the program's planned comple-

tion but that fail to clearly illustrate "the critical path." The critical path in a program schedule is the specific sequence of interrelated activities that drive the program's overall duration—the proverbial "long pole in the tent." While thousands of other activities may be occurring in parallel to the critical path, this sequence of tasks determines when a project will be delivered because these activities ultimately take the longest time to complete.

Home Renovation and Knowing the Critical Path

A recent example from a friend's home-renovation project helps to illustrate the idea of a critical path. Pete was undertaking a major expansion to his home that entailed pouring a new foundation; framing and roofing the addition; expanding heating, plumbing, and electrical systems; purchasing and installing new appliances; and a host of additional activities. In the end, the task that ultimately delayed the completion date was delivery and installation of kitchen cabinets, which Pete had relegated to the "back burner" in prioritization. If Pete had had a critical path schedule that depicted the timeline to design, order, fabricate, deliver, and install his custom cabinetry, he might have placed greater emphasis on managing or expediting the tasks along his critical path.

This example also illustrates another reason why identifying the critical path is important: It allows PMs to focus their attention on this (typically much smaller) set of activities that drives their overall schedule ... at least until delays in some other part of a project create a new critical path.

Schedules, however, are useful only if they are accurate and current. This idea underlies Field Marshal Helmuth von Moltke the Elder's statement that "no plan survives contact with the enemy." The same is true in managing any program. Program schedules will inevitably deviate from the original plan shortly after a program starts. This explains why PMs sometimes fail to use their schedules as effective management tools: If no one is assigned to track and update the program schedule, it quickly becomes irrelevant to the program and useless as a means to track performance, predict completion dates, reallocate resources, or develop alternative execution plans.

If, on the other hand, someone is assigned to regularly update the program schedule, track and document actual task start and completion dates, and monitor the delivery of key deliverables and availability of critical resources, the program schedule can be the PM's most useful tool. As completion dates slip or critical resources fail to materialize, PMs can use their schedules to predict the overall program impact and evaluate alternative strategies to mitigate delays.

This highlights the importance of anticipating requirements and levying requirements in the contract statement of work to monitor, update, and deliver the program schedule on a regular basis. An even better

strategy is to have the contractor maintain two or even three program schedules: the baseline schedule (original plan), the actual schedule, and a "what if" schedule. The baseline and actual schedules allow a PM to compare actual performance to the original plan, while the "what if" schedule allows a PM to evaluate alternative plans to contain costs or mitigate delays. Believe it or not, a fourth schedule may also be necessary. Where the government plays a significant system-integration role or where programs depend on one another, the government may need to maintain a separate master schedule that tracks government deliverables, the intersections of different programs, and the availability of government assets and resources. Again, the temptation and common practice are often to develop and maintain this product as a spreadsheet chart or PowerPoint slide, but this invites all the problems discussed above. Where a government master schedule is necessary, government program offices should consider hiring personnel well-versed in program management software and sufficiently well-informed in the program details to build and maintain a schedule that tracks government commitments and performance.

The final reason we cited for underutilization of the basic program schedule is that PMs frequently pay more attention to their earnedvalue measures. At first glance, this would seem reasonable; earned-value reports provide useful schedule performance measures such as schedule variance and the schedule performance indices. Because earned-value metrics aggregate overall program status, they can mask problems in specific areas that might delay programs. A PM might discover that his overall SV and SPI are favorable because most of his tasks are completed or ahead of schedule, but a subset of these tasks may still cause the program to be delayed. SV and SPI measures will not reveal this. Similarly, it will be difficult to discern schedule status if the initial earned-value baseline is not carefully structured and a large percentage of the program earned-value baseline is allocated to "level of effort" tasks-scheduledriven overhead work such as program management and administrative support that typically charge at a predetermined rate. In such a case, the PM would have to dig into specific cost accounts and understand where these lie on the critical path. Though the earned-value baseline is fundamentally derived from the program schedule, the schedule itself should be the PM's primary reference to determine the likelihood of completing a project on time and at cost.

Similar to Lewis and Clark filling in the map as their expedition continued westward, PMs must continually update their program schedule with new information and at a manageable level of fidelity. This is the only way to build confidence in this critical artifact.

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SECTION III: INTANGIBLES

Definition

Intangibles: ... incapable of being perceived by the sense of touch.

Biographers of George Washington agree that our first President was not exceptionally charismatic, brilliant, well-educated, or born to a prominent family. As a child and young man, he did not display innate qualities that would have clearly marked him for future success above his peers. Although he was ambitious, not afraid of hard work, and politically savvy, there was no particular reason to believe he would become the commander-in-chief of the Continental Army, the unanimously elected president of the Constitutional Convention, and our nation's first President.

The precise reasons for his impact and success are many. They have been documented in dozens of biographies and are outside the scope of this book. However, in a greatly simplified sense, the attributes widely considered essential to his success include honesty, civility, and tenacity, to name a few. It is interesting that none of these attributes would show up on a resume if Washington were applying for a job. Yet these qualities made all the difference.

We highlight George Washington to emphasize the importance of intangible attributes that are critically important in determining one's success as a PM. As important as any tool or critical artifact discussed in the previous sections, the intangible characteristics you bring to the role are vital elements for your success.

In the following three chapters, we discuss the key role of what we believe are the three most important intangible elements: integrity, leadership, and collaboration. Because each of these words is understood in a variety of ways in the English-speaking world, with varying shades of meaning, the following chapters attempt to expose the complexity of these words to (1) provide a way to think about these intangible attributes and (2) provide practical application for PMs.

INTEGRITY

 ${\it If you are out to describe the truth, leave elegance to the tailor.}$

-Albert Einstein¹⁵⁷

Integrity is the No. 1 priority, because acting with integrity in everything you do is the only foundation for success. Emphasizing the need for integrity should be a statement of the obvious. You may be saying to yourself: "Why read on? ... I've heard this lesson all my life in everything

¹⁵⁷Although this quote is widely attributed to Albert Einstein on quotation websites, this may be a misattribution. Einstein is known to have quoted his friend Ludwig Boltzmann as saying "Elegance should be left to shoemakers and tailors." It is used here as it illustrates the key idea.

from elementary school to advanced leadership classes. I fully appreciate the importance of being honest, and incorruptible. I got it." If that is true, then great, you understand the most common of the definitions of "integrity." The first definition listed in *Merriam-Webster's Dictionary* describes integrity¹⁵⁸ as a "firm adherence to a code of especially moral or artistic values." Most people frequently use the word "honesty" as a synonym for "integrity."

But, as with many words in the English language, there are multiple meanings, each with subtle and sometimes not-so-subtle differences. The word integrity can also mean "the quality or state of being complete or undivided" or "an unimpaired condition." The synonyms that capture these meanings of integrity are "completeness" and "soundness." These definitions describe a characteristic or physical state of something. Both synonyms convey the idea of a well-designed, fully integrated, competently assembled object. These additional meanings of the English word "integrity" capture what PMs are charged with delivering—complete and sound materiel solutions.

The job of the PM is both to act with integrity (honesty) and ensure the program has integrity (complete and undivided). We use this double meaning to gain insight to program management. This chapter is divided into three parts corresponding to the three definitions of "integrity." The first portion of this chapter focuses on doing the right thing—honesty, transparency, and truthful reporting. Our hope is that the proverbs, quotes, and stories in this section will resonate in a way that helps these simple and well-known ideas stick for the specific context of program management. More often than not, problems arise because the principles of honesty, transparency, and straightforwardness are ignored somewhere along the way. The second and third portions of this chapter focus on the second and third definitions of integrity—the PM's responsibility to make the program complete and sound.

DEFINITION I: HONESTY

Arguments of convenience lack integrity and inevitably trip you up.

-Donald Rumsfeld, "Rumsfeld's Rules"

No other job in the government tests your integrity as much as program management. The temptation and opportunity to "spin" the program status or performance is very high. Exaggerate the truth a bit to ensure advocacy and funding support for the program.

 $^{^{\}rm 158}$ Merriam-Webster Dictionary Online, http://www.merriam-webster.com/dictionary/integrity

A-12 "Avenger II" Program¹⁵⁹

It was the Navy's top aviation priority in 1990. It had Pentagon and congressional support. It looked trouble-free. What went wrong?

Until his forced transfer in December, the Navy's principal overseer for the A-12 program was Captain Lawrence G. Elberfeld, an aviation engineer with three advanced degrees. As PM since June 30, 1986, Elberfeld had full authority and responsibility for the program. He commanded a small staff with assistance from onsite personnel at the two defense plants. As portrayed in a follow-on investigation, Elberfeld was protective of the A-12 and showed "good news" slide presentations to accentuate the positive, despite increasingly ominous signs.

One early indication of trouble came from a Navy cost analyst, who in March and July 1989 presented Elberfeld with a range of cost estimates predicting that the contract could exceed the ceiling by as much as \$200 million. In reports to superiors in November 1989 and February 1990, Elberfeld replaced the analyst's estimate with a lower calculation, "which he believed would result in an improvement in the contractor team's cumulative cost performance," according to the investigation.

Despite the warning signs, Elberfeld continued to present the A-12 as an unqualified success. In an April 14, 1990 briefing, he made no mention of the then \$1 billion cost overrun estimate and said the A-12 was "on track." He also warned that renegotiating the contract would strap the Navy with legal liabilities. On April 26, not long after the conclusion of the Major Aircraft Review, Secretary Cheney appeared on Capitol Hill to reassure key Senators and congressmen that the program was doing well.

Less than a year later, on a chilly Saturday in January 1991, Defense Secretary Dick Cheney headed to the Pentagon to meet with a small band of senior officials, including Navy Secretary H. Lawrence Garrett III. The capital was in the throes of Persian Gulf War fever, but this January 5 session focused on another crisis: what to do about the Navy's A-12 aircraft, which was at least \$1 billion over budget, 8,000 pounds overweight, and 18 months behind schedule.

Garrett argued for a federal bailout to rescue the plane. Others demurred. After 6 hours of discussion, Secretary Cheney dropped a bomb: He would reject a bailout. He would kill the A-12 outright.

The first and most common definition of integrity is honesty. This essential principle is foundational in our society and imbued in stories like George Washington telling his father he had cut down their cherry tree. Although the idea is simple enough, honesty can be a particular challenge for a PM who is often also responsible for program advocacy. There is an understandable but unfortunate natural tension to "see the glass half full" and spin the status in the most positive light.

¹⁵⁹David Montgomery, "How the A-12 Went Down," *Air Force Magazine* 74, no. 4 (1991). Available at http://www.airforce-magazine.com/MagazineArchive/Pages/1991/April%20 1991/0491navy.aspx

Proverbs for PMs

Be honest in everything you say, write, and do.

- You will always get caught in a lie (eventually).
- If you are perceived as a deceptive person, you are finished as a PM.
- Conversely, ignorance is forgiven regularly.
- "I don't know" is acceptable (except to you).

The above proverb captures the foundational ideas. We only emphasize the word "perceived" in the second bullet above. For a PM of a complex system, there is much to know and usually a broad spectrum of things that can go wrong—leaders understand that. Paint a picture that includes the whole story. Don't fall into the trap of emphasizing the "good news" story because that's what leaders enjoy hearing, or playing lawyer with documentation by pointing out how you have met an objective based on the "letter" but maybe not the "intent." Honesty is telling the whole story to include differing interpretations, views of others, and issues not directly asked for that may have a bearing on your program.

Leadership is a combination of strategy and character. If you must be without one, be without the strategy.

-General H. Norman Schwarzkopf

One way to be a program advocate¹⁶⁰ while maintaining complete honesty is to provide derogatory information as "views of others," "my critics might say ...," or "pros and cons" to ensure a balanced representation. If you agree with a criticism, say so, as it will only increase your credibility as an honest PM. If you don't agree with others' criticisms, then it is fair to explain why. The real trouble (and by this we mean loss of credibility) comes when a PM simply does not address criticisms forthrightly. Not providing important information to senior leaders—even if you might disagree with the information or question its validity—is perceived as telling half-truths. In most cases, senior leaders are smart enough to know there are two sides to everything, so you are always better off acknowledging both sides, stating your bias, and presenting your perspective. Failure to be forthcoming with information erodes your most important commodity with leadership—your credibility.

Do not make assertions you can't defend. They come across as your statement of truth (and therefore eventually your lies, if they don't

¹⁶⁰Program advocacy is an important role, but in general the user/warfighter with a valid requirement is the major advocate for the system; the PM is the advocate for the acquisition strategy that will meet the warfighter's requirement in a timely and affordable manner.

pan out as hoped). For example, don't say "this program will reduce Service costs" unless you have some analysis or data to back it up. If you can defend it, say, "our analysis shows ..." or "our data prove" Otherwise state something more honest, such as, "We are seeking to reduce Air Force costs as a major goal of this program and are working to mature that analysis for your review."

Story: Bad Actor Gives Acquisition a Black-Eye¹⁶¹

A former senior Air Force acquisition official was released from prison in Marianna, Fla., Friday after serving nine months for giving Boeing Co. preferential treatment in contract awards in exchange for a job. Darleen Druyun's sentence also included a \$5,000 fine, 150 hours of community service and seven months of community confinement upon release.

Druyun, 57, in April 2004 pleaded guilty to giving Boeing preferential treatment. She served as principal deputy assistant secretary of the Air Force for acquisition and management from 1993 to 2002, where she oversaw contract negotiations for Boeing's leasing of tanker aircraft for the Pentagon. That deal was worth \$20 billion.

Druyun secretly met with Michael Sears, then a senior executive for Boeing, at the Orlando airport in October 2002 to discuss her salary, bonus, and starting date at the company.

In January 2003, Druyun accepted a position as vice president and deputy general manager of Boeing's missile defense systems, where she remained until she was terminated in November 2003.

Druyun and Sears, who was sentenced to four months in prison in February, agreed to lie about their discussions.

"Darleen Druyun placed her personal interest over the interests of the Air Force and American taxpayers," said Paul McNulty, U.S. attorney for the Eastern District of Virginia, in April 2004. "Secretly negotiating employment with a government contractor, at the same time you are overseeing the negotiations of a multibillion dollar lease from that same contractor, strikes at the heart of the integrity of the acquisition process."

Proverbs for PMs

Be the first to deliver bad news.

- If someone above you in the food chain hears about it elsewhere, you will lose his or her trust.
- Likewise, be the first to deliver good news.

¹⁶¹Quoted, with edits, from Kimberly Palmer, "Former Air Force Acquisition Official Released from Jail," *Government Executive*, October 3, 2005. Used with permission from GovExec.com.

Reporting

Integrity in reporting is vital. In all programs, your headquarters office will require various reports on your program's progress. Don't get irritated because they are "looking over your shoulder." This is serious business, spending taxpayer's money (your tax dollars also), and as stewards, we must be clear, accurate, and transparent.

It is very easy to link your ego to your program, but don't do it. At times, you need to think about what is best for the larger enterprise versus what is best for your piece of the enterprise. There may come a time when you should recommend canceling your own program.

Senior leaders are usually very smart and practical. They typically possess ample shares of both intellectual capacity and experience. They also very likely have been in positions where they did not know the answer to something asked of them, or had little to no insight into specific details of a complex project. In other words, they are human—and they also know you are human and don't expect you to know everything. What they do expect is honesty and forthrightness.

Another benefit of full disclosure and honesty is that your bosses may have had your job, and likely did it well enough to get promoted. They may actually have some good ideas for fixing problems. They can't help you if you don't tell them the issue.

Proverbs for PMs

- Be transparent in your efforts.
- Attention to detail is critical; the details matter, so work the details.
- Speak truth to power.
- You can't surge trust.

Context

If I had only 1 hour to save the world, I would spend 55 minutes defining the problem, and only 5 minutes finding the solution. 162

-Albert Einstein

¹⁶² Although this quote is widely attributed to Albert Einstein, there is no evidence that he said it—so it is probably a misattribution. Alternatively, William H. Markle, an employee of the Stainless Processing Company, wrote a piece in 1966 titled "The Manufacturing Manager's Skills" in which he quoted the head of the Industrial Engineering Department of Yale University as saying, "If I had only one hour to solve a problem, I would spend up to two-thirds of that hour in attempting to define what the problem is." The Einstein quote is used here as it emphasizes the importance of context for problem solving.

If you've ever spent time listening to great leaders during interviews on complex subjects, 163 you've probably noticed how their answers are dominated by describing context—history, key interests, stakeholders, practical limitations, to name a few common contextual elements. Although some may view these context-rich responses as evasive or burying their position in caveats, we believe these elements are vital to solving problems. Issues associated with national security and foreign policy are complex, and identifying the optic through which the problem can be viewed and understood is arguably the most important part of any answer because it sets the stage for any proposed solution. If key contextual elements are missing or not appropriately weighted, the resulting way forward will lack effectiveness.

The same principles apply to PMs reporting on the status or challenges in their program. The key is to ensure that you and your leadership have a thorough understanding of the context and particular details associated with your program. Developing and delivering something new means, by definition, it has never been done before, so we don't know for certain what challenges we will find and which factors may dominate. Based on similar programs and experience, we may have a good idea of what the key challenges are. But changes in technology, people involved, and integration within the overall system will be different, and unexpected challenges will appear. A thorough understanding of context is the best approach to support decisionmaking in an uncertain world.

Story: Telling the Truth¹⁶⁴

Mr. A. Ernest (Ernie) Fitzgerald worked as a management systems deputy for the Department of the Air Force, where he was responsible for the development of improved management controls. In 1968, Mr. Fitzgerald reported a \$2.3 billion cost overrun in the Lockheed C-5 aircraft program. As a congressional witness before the Joint Economic Committee, he rejected the advice of Air Force officials and testified with candor and transparency about billions of dollars in avionics program cost overruns and other technical problems. In response to Mr. Fitzgerald's testimony, President Richard M. Nixon directed that he be fired. "It was reported that Nixon told aids to, 'get rid of that son of a bitch." Executing the president's order, Defense Secretary Melvin Laird ultimately terminated Mr. Fitzgerald. Because of his candor and commitment to the truth, Mr. Fitzgerald was a driving force for whistleblower protections. Mr. Fitzgerald continued to fight a four-decade-long campaign against fraud, waste, and abuse within the Department. Consequently, he was instrumental in the enactment of the Civil Reform Act of 1978, a precursor to the Whistleblower Protection Act of 1989.

¹⁶³General Colin Powell explaining his approach to foreign policy, or General David Petraeus explaining his approach to stabilizing Afghanistan are two examples.

¹⁶⁴Quoted from Eric B. Kempen and Andrew P. Bakaj, "Marshalling Whistleblower Protection," *The Journal of Public Inquiry*, Spring/Summer 2009, p. 6. Available at http://www.dodig.mil/pubs/jpi/pdfs/JPIBook2009.pdf.

Acting with great integrity (honesty) is easy to say, but hard to live up to. Tell the whole story. Be clear on what you know, what you suspect, and what you don't know. If you do all this, you will at least be perceived as a PM who tries hard and is honest.

DEFINITION II: COMPLETENESS

Success is dependent on us being stewards of the whole and not just owners of the parts.

-Joe Dyer, President of iRobot Corporation¹⁶⁵

The multiple definitions of the word "integrity" conveniently point to three distinct ideas—each is important for PMs. In addition to "honesty," the word "integrity" also means "the quality or state of being complete or undivided," with a corresponding synonym, "completeness." This meaning provides us another important principle required for successful program management.

Completeness conveys the idea of a well-designed, fully integrated, competently assembled object. As a PM, it also means you are responsible for thinking through all aspects to use and maintain the program. In the case of a major weapon system like a tank, aircraft, or ship, this means the program also needs to deliver a training process for users of the new equipment, training for maintenance crews required to keep the system operational, and spare parts, to name but a few of the elements. In the case of information-technology-type systems, PMs must consider the need to maintain the software as well as ensure that the operating system software and commercial licenses to use the software are up-to-date and compatible with any software or hardware that interacts with the program. In all cases, PMs should consider the likely need for future system upgrades and establish Pre-Planned Product Improvement (P³I) details.

Thinking through the entire program from inception to disposal—including testing, sustainment, and related contract actions—is a priceless cerebral exercise. Eisenhower's well-known quote regarding the utility of the thinking exercise he referred to as *planning* makes this point. Thoroughly thinking through all aspects of a program—e.g., assumptions, key elements, decision points, branches, and sequels—focuses our attention on key elements and prepares us for future events regardless of how they unfold. Completeness requires PMs to think through all

¹⁶⁵NDIA PMSC Meeting Minutes, Joint Government/Industry Meeting, Aug. 15, 2012, p. 2, available at http://www.ndia.org/Divisions/Divisions/IPMD/Documents/Events/2012-08-QuarterlyMeeting/presentations/August2012NDIAPMSCJointMeeting.pdf

aspects of a program to avoid the "Oops" moments and the "Oh, I never thought of that" embarrassments that are inevitable if we fail to sufficiently exercise our planning muscle and think critically. 166

In many ways, systems engineering, discussed in the prior chapters, encompasses the idea of completeness within a disciplined framework; however, the notion of completeness goes well beyond the "ilities" (manufacturability, sustainability, suitability, etc.). Completeness demands that PMs consider all aspects that will affect a program—including politics, certification by external agencies, budget-cycle considerations, and future enhancements. Although several of the elements will be discussed in later chapters, here we emphasize ensuring they are properly considered—as they are key program elements required for a complete solution.

This meaning of "integrity" captures what PMs are charged with delivering—materiel solutions that are complete. This understanding of the word "integrity" should shape a PM's thinking and action.

There is one other aspect of this definition of integrity that may be helpful for PMs. "Integrity" and "completeness" are nouns. "So where is the action," you ask. The active and vital role of a PM is to *integrate* all aspects of a program into a unified whole. The verb "to integrate" means "to form into one whole; to make entire; to complete; to renew; to restore; to perfect." It is fair to think of the verb "integrate" as the action required to ensure "integrity." In many ways, the PM is the master integrator, responsible for bringing together a variety of functional disciplines—requirements definition, engineering, contracting, financial management—into a coherent effort that delivers a complete product. So the verb "integrate" is one of the actions required of a PM—along with verbs like lead, manage, and negotiate, discussed in later chapters.

DEFINITION III: SOUNDNESS

A final definition for the word "integrity" is "an unimpaired condition," and it has a corresponding synonym, "soundness." Indeed, ensuring the program is structurally solid, free of defects, and able to meet the expectations of users is clearly a PM's responsibility. The assessment for soundness is usually accomplished as part of the testing regime defined for a program. Both developmental and operational tests should be designed to assess the system's *soundness*.

¹⁶⁶The Foundation for Critical Thinking provides an excellent structure for those who appreciate a disciplined approach to dissecting a problem. The "Elements of Thought" and Intellectual Standards are included in this book's Appendix for easy reference. More information is available at http://www.criticalthinking.org/index.cfm

¹⁶⁷ Definition from http://en.wiktionary.org/wiki/integrate

But if we stretch the synonym linkage with "soundness" a bit further, we discover an additional idea that merits our attention, because there are two definitions of "soundness." The first is "a state or condition free from damage or decay," which closely overlaps the idea embedded in the word "integrity." The second understanding of the word "soundness," however, is "the quality of being prudent and sensible." We believe this idea is also directly applicable for PMs, as it captures the call for PMs to think.

Although we don't normally link the words "integrity" and "sensible," we believe it captures important ideas. PMs must apply good sense and judgment. The following two proverbs capture the idea of being *sensible* and *prudent*.

Proverbs for PMs

No directive, regulation, or policy justifies a dumb decision.

- If it does not "feel" right, don't do it.
- Don't "hide behind uninformed guidance."
- Go as high as you must to turn around a bad decision.

Proverbs for PMs

Forgiveness is easier to obtain than permission.

- If you feel that an action is proper and correct for the program, go ahead within legal limits.
- Be certain you can justify your actions to yourself.
- Is the action in the best interest for your Service and the taxpayer?
- Document your actions in a memo for the record and let your boss know.

The three definitions of integrity and the corresponding synonyms—honesty, completeness and soundness—point to three different and important considerations for PMs. So the "takeaway" idea here is simply that the word "integrity" captures several important and intangible ideas:

Integrity for PMs means:

- Honesty and straightforwardness in everything you do and say
- Completeness and thorough planning for all aspects of the program
- Soundness in thoughts and decision—being prudent and sensible

LEADERSHIP

To become successful leaders, we must first learn that no matter how good the technology or how shiny the equipment, people-to-people relations get things done in our organizations. People are the key or fundamental assets that determine our success or failure. If you are to be a good leader, you have to cultivate your skills in the arena of personal relations.

-Ronald R. Fogleman, General (retired), Air Force Chief of Staff (1994–1997)

There are many books on leadership, including some specifically targeted for leading military units, ¹⁶⁸ but few address the complex task of leading an acquisition program. Yet those who find themselves, either through deliberate effort or by accident, in a program management job will discover the role largely requires leadership. The good news is that most leadership principles are universally applicable.

General Fogleman—along with a long list of successful leaders—said it well: People are what make things happen in an organization, and learning how to engage them in a meaningful way that motivates their best effort is fundamental to leadership. But leadership is not limited to "being good with people," it demands our full effort in setting and communicating a vision and strategy, and in bringing the energy and optimism to inspire your team.

The importance of leadership in program management is not news to those who have firsthand experience managing acquisition programs. Program management is a "contact sport" involving a plethora of stakeholders with competing interests and often poorly defined or ambiguous roles. The notion that success in program management requires only mastery of the tools covered in the first part of this book—the "technical" skill associated with "program management"—is simply not true. The best evidence of this simple statement is that two individuals with similar experience and qualifications can have vastly different results managing the same program. There are numerous examples of a PM either leaving or being replaced by a new manager with very similar qualifications, yet the new PM turns a program around and makes it successful. The difficult-to-measure quality of leadership is vital to program management.

¹⁶⁸ David L. Goldfein, Sharing Success, Owning Failure: Preparing to Command in the Twenty-First Century Air Force (Maxwell AFB, AL: Air University Press, 2001). Also see Army Leadership: Competent, Confident, Agile, Field Manual No. 6-22 (Washington, DC: Headquarters, Dept. of the Army, 2006). Available at http://usacac.army.mil/cac2/Repository/Materials/fm6-22.pdf

Perhaps the most nebulous of the "intangible" characteristics is leadership. The term itself is so fuzzy that it conjures up a very large number of synonyms and closely related ideas. Among these are charisma, influence, vision, decisionmaking, self-confidence, and personal energy, to name a few.

This chapter begins by providing what we consider a useful definition of leadership—useful because it offers a way to think about your role as a leader in any environment. We next consider the important role of vision, strategy, setting expectations, responsibility, and personality and conclude with the idea we started with, captured in the Fogleman quote above.

DEFINITION

There are many useful definitions of leadership—useful because each provides a different nuance of understanding of this complex subject. Some of the definitions you may know include:

- "Leadership is about people; management is about things." 169
- "Leadership is the art of accomplishing more than the science of management says is possible." ¹⁷⁰
- Leadership is the self-confidence to stand apart and do the right thing.

While each definition helps us appreciate some of the aspects of leadership, we prefer the definition below because it applies to every situation we can think of and captures the key elements of leadership—decisionmaking and people.

Leadership is: discretionary problem-solving in an ill-defined social domain.

-Fleishman et al. 171

This is a dense definition that needs unpacking and a bit of explanation beyond simply reading the sequence of words. The first part, "Discretionary problem solving," means the human brain must be engaged to make judgments and decisions regarding an issue. When you think about leadership, virtually any imaginable situation that requires a leader is a new "problem set" never previously faced. Because circumstances, personality dynamic, and external forces constantly change,

¹⁶⁹Goldfein, Sharing Success, p. 51.

¹⁷⁰Colin Powell, guoted in Oren Harari, *The Powell Principles* (New York, McGraw-Hill, 2003).

¹⁷¹E. A. Fleishman, M. D. Mumford, S. J. Zaccaro, K. Y. Levin, A. L. Korotkin, and M. B. Hein, "Taxonomic Efforts in the Description of Leadership Behavior: A Synthesis and Functional Interpretation," *Leadership Quarterly* 2, no. 4 (1991), p. 245.

successful leaders must employ judgment and decisionmaking to adjust to the specific situation at hand. It is the challenge of dealing with a particular situation, in a particular context, with a particular task, with particular individuals, and the judgment to incorporate these multiple factors into finding a path forward that constitute the "problem-solving" aspect of leadership.

This is certainly true for PMs. Every year stakeholders change, technology advances, Congress authorizes and appropriates based on the dynamic political environment. And the factors that motivated the program's establishment have very likely evolved. In short, the dynamic environment requires judgment and decisionmaking—a checklist will not succeed in this complex domain; leadership requires problem solving and decisionmaking.

Some readers may be inclined to think that the "ill-defined social domain" aspect of the definition above does not apply to the military or government organizations because of the established hierarchies and bureaucracies. Indeed, a well-defined hierarchy exists in the government; however, the forces of personality and credibility frequently alter the power and decisionmaking dynamic.

The key to successful leadership today is influence, not authority.

-Ken Blanchard

In our Western culture, it is not enough to have a position or title to direct subordinates. The mere fact you are the "boss" does not mean people assigned to you, either under direct "supervision" or subject to your "positional leadership," will follow your direction. One of the distinguishing characteristics of Western culture—rooted firmly in early Greek politics—is the need to motivate or persuade people to action. We can think of no better example for this than when Alexander the Great faced a mutiny in 326 B.C.E.

Western Civilization Leadership in 326 B.C.E. —Persuasion Required¹⁷²

Alexander the Great (356–323 BCE) is arguably the greatest military leader of all time. He conquered the known world by the time he was 32 years old, and created an empire that spread Hellenistic culture across the Middle East. Among his great victories was the battle at Gaugamela in 331 BCE in which Alexander decisively beat a much larger Persian army and toppled the Persian Empire that had dominated the Middle East for over 200 years.

The organizational and leadership culture that existed in Persia, as well as most societies at the time was characterized by absolute power and authority in a single individual monarch—total hegemony. The monarch exercised complete authority and decisionmaking over his subjects and was under no obligation to explain or rationalize his decision(s) to anyone. This, however, was not the case for the Greeks from whom our Western society grew.

Despite Alexander's incredible leadership and amazing military victories, in 326 BCE, Alexander's army mutinied at the Hyphasis River in what is today Northwest India, refusing to march farther east. His soldiers would not continue marching east without a clear explanation and compelling reason—they were tired and longing to return home after 8 years of conquest. Alexander had plans to continue his campaign across the Indus river and conquer what is India today, but his army was weary and unwilling to follow the greatest military leader in the world at that time (and arguably since that time) without a clear and convincing reason. Alexander could not articulate a compelling reason to continue marching east into India and shut himself in his tent for 3 days, hoping his men would agree to his plan. But when his men did not change their desires, Alexander gave in. The Greek army had reached its most eastern point.

In virtually every other culture from the region, the monarch (considered a God) giving an order would have been unquestioned. But not so for the Western mind—we expect to see and understand the reason for a particular course of action. Leaders must present their argument to the led to convince them of the merits of a vision or direction. In short, persuasion and the ability to articulate a rationale are required. General David Petraeus captures this idea in No. 8 of his 12 Rules to Live By: "Don't rely on rank. If you rely on rank, rather than on the persuasiveness of your logic, the problem could be you and either you're thinking or your communication skills." (Note: the complete list of the 12 Petraeus "Rules to Live By" is provided in the Appendix.)

This is the "ill-defined social domain" in which a hierarchy that faintly exists requires us as leaders to communicate to our fellow human beings what is to be done, how it should be done, and why something is to be done. Our Western culture includes a healthy dose of skepticism. So when someone in a position of authority tells us to do something—if it sounds reasonable, legal, and moral—we may comply without additional

¹⁷²Christopher Kolenda, *Leadership: The Warrior's Art* (Carlisle Barracks, PA: Army War College Foundation Press, 2001), pp. 114-116.

discussion. But if the request is suspicious, or we don't readily agree, we naturally will question and seek some rationale and justification for the request.

Proverbs for PMs

Members of your team should all be owners of your program.

- Communicate daily with as many people as you can.
- Keep them informed and keep yourself in touch.
- Let them know you appreciate their work.
- Face the hard issues immediately.
- Give them (delegate) responsibility so they share in accomplishment and grow.

But even when we are inclined to comply, our desire to understand the reason and motivation for the task is gratified by a leader taking the time to articulate "why" the requested action is important. Clearly communicating the "what," "how," and "why" is responsible leadership. These are known in some circles as vision and strategy and are the subjects of the following section.

VISION AND GOALS

The fundamental task of strategic leadership is getting the big ideas right and setting the appropriate tone and energy level.

-General David Petraeus¹⁷³

Part of a PM's responsibility as a leader is to articulate a vision for the program and the team. Although the terms of a program are very likely defined by others (the Service requirements community), the PMs always have latitude and discretion to define a vision for best meeting those requirements

Among the most important—strategic level—contributions you can make to the program are to clearly identify and articulate your goals. It is easy to say, but quite another thing to do well. Part of what makes this difficult is the confusion of terms. Some of the terms tossed about in a *goal-setting* discussion include but are not limited to "strategy," "goals," "milestones," "objectives," "plans," "approach," "ends," "ways," and "means."

¹⁷³Paula D. Broadwell, "Leadership, Petraeus style," *The Boston Globe*, April 21, 2009, p. A11.

Leaders simplify.

-Jack Welch

Chairman and CEO, General Electric, 1981-2001

Rather than get bogged down in a pedantic discussion of these terms, we will only repeat the wisdom of others and illustrate it with a nonfiction vignette that is well known at DAU.

Story: Setting a Clear Goal¹⁷⁴

On Friday, December 20, 1995, the phone rang in Terry Little's office. Terry was the System Program Director (SPD) for the Joint Direct Attack Munition (JDAM) program. It was a job he held for 4 years, and he had expected to be there until he retired in 2000. Darleen Druyun, the Principal Deputy Assistant Secretary of the Air Force for Acquisition and Management (and Little's boss's boss), was on the phone from the Pentagon. She wasted no time with Christmas greetings. "Terry," she said, "I want you to go take over JASSM [Joint Air-to-Surface Standoff Missile] as soon as you get back from Christmas leave." Terry thought for a moment and then muttered, "What about my replacement?" Her answer was clear, "Not your problem. Any other questions?"

Terry was shocked. There was dead silence. Seconds went by that seemed like hours. Finally he said, "What do you want me to do? What are my directions?"

She was quick to answer: "Just do your thing."

After Terry hung up the phone, he tried to recall what he knew about JASSM. Although that program office was just downstairs from his JDAM office, he suddenly realized he knew very little about the program.

Somewhat reluctantly, Terry walked downstairs to see John Heinrich, the JASSM PM. It was evident from the look on John's face that he had already received the bad news. After they commiserated about neither of them wanting to change jobs, Terry asked John what had precipitated this change. John didn't know; the only problem he offered was that his program was funded with \$25 million FY 1996 money, and he could find no way to move the program through a Milestone 1 Defense Acquisition Board, get a validated requirement, develop an RFP, do a major source selection, and get on contract before the money became a potential bill payer. "I have to get on contract quickly. If I don't get on contract soon, I'll be forced to delay the start of JASSM until at least FY 1997." John then explained how he and his people had explored every conceivable alternative before he had told Headquarters getting on contract in FY 1996 just wasn't doable.

As Terry listened he found himself agreeing that this was an impossible task. A sense of impending doom began to surround him.

On Wednesday, January 3, 1996, his first day on the job, he started off with an all-hands meeting. Terry simply stated, "We are going to be on contract by July of this year, seven months from now. Questions?" Everyone began looking around, and heads began shaking.

One brave woman raided her hand. "How?" she asked.

Terry stared at her for some time before replying. Then he said to the group, "I don't know. But this I do know. If we can't figure it out, there will be no JASSM program and we will all be looking for jobs."

¹⁷⁴Quoted from Mary-Jo Hall, Norman Patnode, and Mike Mochel, "Works of the Government from DAU," Program Managers Class (PMT 401) case study No. 401-071, March 2001 (revised December 2006).

Finally, the same woman stood up and said, "I think you are being unreasonable! There is no way we can do this. We have already looked at every possibility; it's impossible to do this in less than a year!"

"Well," Terry replied, "I don't know what alternatives you have considered, but I'll bet that every alternative you've considered was in strict compliance with the rules and with what you thought would be acceptable to those higher up. The reason I'm here is because I don't do rules. I don't try to please everyone. It's going to be the entire team's job to come up with a common-sense approach that gets us on contract in July. My role in this will be to use my credibility to sell that approach, including getting the OK to break the rules. Come Friday morning, we will meet again, and you will tell me just how we are going to do this. Anyone not on board to be on contract by July need not come back." And with that, Terry turned and walked out of the room.

Although this story may cause the reader to wonder about the personalities involved and the flexibility or lack of flexibility in DoD acquisition, it makes the point that a clear goal can focus a team very effectively. It also illustrates that setting goals also requires prioritizing. By establishing a goal for you and your team, you are by default prioritizing it above other activities. In the case of Terry Little, his priority was clear: get on contract. Strict compliance with acquisition regulations was a lower priority.

If you want to be successful and you know where you want to go, start looking at what the law says—regulations can be waived, but the law is a whole different story.

-Blaise Durante, SES

There are lots of ways to articulate goals for your program—mission and vision statements, posted list of annual commitments, and calendar milestones that are tracked and reported on during "all hands" meetings are just a few of the possible methods to explain your vision. It is less important how you format and communicate these goals, and far more important that you think hard about the objectives to make sure they will move the program in the right direction.

One idea that may prove useful for program leaders is to define an *exceptional future*. The idea is rather simple: Try to imagine your organization with the attached program responsibilities in 3 to 5 years if everything between the present and future state went extremely well, or at least better than expected. The imagined future state should be your target as you lead the program and organization (or team) toward an exceptional future. This should help you define a vision for where and how you hope the program to be running over time. It should form the basis of your vision in enough detail that your team understands where you are driving—replacing vague descriptors like "disciplined systems engineering process" or "responsive contracting capability." Your exceptional fu-

ture should provide a mental picture of where your program will be and how it may be operating. For example:

- "Software systems based on Open Source codes with program office directly overseeing developmental testing;" or
- "Disciplined systems engineering in which all program changes are vetted through the configuration control board process;" or
- "Superb communication across all program stakeholders such that users and headquarters know program details and advocate."

Articulating an end state for where you want the program and program office to be is a key responsibility, because as the song¹⁷⁵ goes, "If you don't know where you are going, any road will get you there."

EXPECTATIONS AND RESPONSIBILITY

The price of greatness is responsibility.

-Sir Winston Churchill¹⁷⁶

People will work hard to live up to expectations. So it is critical that you clearly articulate your expectation so all understand. Leading a team requires making sure all team members are aware of their roles and responsibilities, putting effective processes in place, and instilling discipline, responsibility, and accountability. In a system as difficult and bureaucratic as the DoD acquisition process, and particularly in large program offices, clarity of roles and responsibilities is essential to save time and prevent frustration.

One of the best ways to clarify expectations is through job titles. It is an intriguing phenomenon, but if an engineer on the program goes from a duty title of "Mechanical Engineer" to "Chief Structural Engineer," even though the job may be virtually identical, the terms "chief" and "structural" explicitly communicate expectations and responsibility. In this case it means the PM expects this engineer to lead (to be the chief) and be specifically responsible for the system's structural integrity. One way to get the most from your team is to give the team members titles to live up to. If you have the latitude as a PM to adjust duty titles, use it. Not only does it communicate expectations and responsibility to the individuals involved, but it signals your expectations to the entire program team and identifies whom you intend to hold responsible for particular duties.

¹⁷⁵Refrain from "Any Road" by George Harrison.

¹⁷⁶From a speech given at Harvard University in 1943 (available at http://www.winstonchurchill.org/learn/speeches/speeches-of-winston-churchill/118-the-price-of-greatness).

There is nothing more disloyal than an employee knowing that his boss is going to do something wrong, and not tell him.

-Arleigh Burke, Admiral, U.S. Navy

Although job titles are helpful to "empower" the program office workforce, there is also danger in giving too many people responsibilities—especially if they overlap or are perceived to overlap. Bureaucratic paralysis can set in when there are too many people with fancy titles and ill-defined responsibilities.¹⁷⁷

Confusion regarding expectations and responsibility is not limited to the individuals within a program office. In fact, confusion and resulting friction most commonly come between organizations. It is not uncommon for headquarters resource managers to start thinking they are the PMs and should be involved with every program decision, no matter how minor. This can prove very unhealthy, since the acquisition responsibilities and accountability reside with the PM. If funds are misappropriated, the headquarters staff will not be held accountable: the PM will.

Proverbs for PMs

Maintain absolute control of your program.

- If you don't, someone else will.
- Only *you* should decide what is best for your program (that is why you are the PM).
- Vigorously defend your subordinates' decisions.

One method for clarifying this area is to formally define, in writing, and enforce a "Roles, Responsibilities, Accountabilities and Authorities" memorandum that sets forth the "swim lanes" for each participating headquarters or organization. In addition, it is helpful to define the giver and receiver of "deliverables" for each organization. This makes it easier to identify issues early and set expectations for the interactions.

Proverbs for PMs

Know the rules of your game.

- Insist on all direction in writing.
- Learn to discriminate *direction* from *suggestion*.
- When in doubt, write a "memo for the record."

¹⁷⁷Colin Powell speaks of this in Chapter 28 of It Worked for Me.

Another best practice is to formally document and communicate decisions in a memorandum for record. This helps to avoid revisiting resolved issues. Too often programs find that the same issues and decisions resurface, so without a clear record of what prior decisions were made and why, PMs may have an experience like the *Groundhog Day* film, by reliving an issue with the same arguments, same stakeholder posturing, and very likely the same result—all at a cost in time, effort, and energy. Exerting a bit of additional effort may save a significant amount of time in the long run.

PEOPLE

People don't change that much. Don't waste time trying to put in what was left out. Try to draw out what was left in. That is hard enough.

-Buckingham and Coffman¹⁷⁸

Most books on leadership will advise you to keep your team small and select it carefully. In the early days of space acquisition, Colonel C. L. Battle was asked to characterize what made him and his program office so successful, 179 to which he wrote an often-cited memo in September 1961 now known as "Battle's Laws." 180

The first and most important guideline of "Battle's Laws" is "Keep the program office small and quick-reacting at all cost." The second is "exercise extreme care in selecting people, then rely heavily on their personal abilities." This approach is supported by research of commercial business as well. In Jim Collins' book, *Good to Great*, the second of six principles is "first who … then what." Selecting the right people for your team is more important than your task.

Unfortunately, most PMs will not have the opportunity to select their teams. However, in some cases you may have some latitude to shape or select particular members of your team and size it correctly. When in that position, exercise your authority and build a winning team. But if you do not have the option of selecting your team and instead are provided with a program team, you will very likely discover both diamonds and duds.

 $^{^{\}rm 178}{\rm Marcus}$ Buckingham and Curt Coffman, First Break All the Rules (New York: Simon & Schuster, 1999).

¹⁷⁹A similar list gives a defense contractor's perspective: "Kelly's 14 Rules and Practices" by Kelly Johnson, director of Lockheed Martin's "Skunk Works." It is available at http://www.lockheedmartin.com/us/aeronautics/skunkworks/14rules.html

^{180 &}quot;Battle's Laws" is provided in the Appendix.

¹⁸¹ Jim Collins, *Good to Great: Why Some Companies Make the Leap ... and Others Don't* (New York: HarperCollins, 2001), p. 41.

The good news is that most people are largely self-motivated, and they understand the challenges they face. As the program leader, you must make sure that you don't demotivate them by your actions. In *Good to Great*, Collins points out that one of the most significant demotivators is to fail to face the harsh reality you are in.¹⁸² Facing the real challenges with honesty and forthrightness will bring out the best in your team.

My main job was developing talent. I was a gardener providing water and other nourishment to our top 750 people. Of course, I had to pull out some weeds, too.

-Jack Welch Chairman and Chief Executive Officer, General Electric, 1981-2001

Proverbs for PMs

Don't just stand there, do something!

- If you just want to watch, buy a ticket.
- Teach your people to be action-oriented (write a letter to fix that by ..., call ..., go see)
- If your communications are working, your people will know what to do.
- If they screw up, back them up.

Proverbs for PMs

Be (ummm ...) decisive.

- Become known as a decision maker (that's what you are being paid for).
- Once you make a decision, do not reopen discussion unless something changed.

¹⁸²Ibid, p. 74.

PERSONALITY

To thine own self be true, And it must follow, as the night the day, Thou canst not then be false to any man.

> -William Shakespeare Hamlet, Act I, scene 3, line 78

The manner in which you as a leader interact with people makes a difference. The single best advice we can offer is to be genuine. There are lots of successful "personality types" among leaders. The easiest illustration of this is a quick review of personality types of U.S. Presidents and famous military leaders. Abraham Lincoln was very much an introvert while Bill Clinton was an "off-the-scale" extrovert. General Dwight Eisenhower was gregarious and a collaborator, while General George Patton was hard-nosed and bombastic. The variety of personality types and descriptors is great—far greater than the simple examples given here—but the one consistent descriptor of successful leaders is genuineness. Shakespeare said it best—"to thine own self be true." This must be the foundation, as humans have an innate ability to recognize falsehood or any attempt to "act" in a particular role that lacks genuineness.

It is easy to fool yourself.
It is possible to fool the people you work for.
It is more difficult to fool the people you work with.
But it is almost impossible to fool the people who work under you.

-Harry B. Thayer, President and Chairman of Western Electric (1908–1919), President and Chairman of AT&T (1919–1928)

Although it is difficult to draw definitive conclusions regarding failed military leaders, anecdotal evidence suggests that, in a number of cases, leaders attempted to "play a role" they believed they should, rather than be true to themselves and rely on the skills, tools, and personality that "got them promoted to the job in the first place." This is not difficult to understand given the influence of Hollywood on our culture. It is possible that military officers perceive how senior military officers act by watching George C. Scott play the role of General Patton in the 1970 film *Patton*. So when you get promoted to a senior rank, it may seem appropriate to push people harder, not tolerate mediocrity, and be more demanding. We do not advocate putting on someone else's clothes or leadership personality. Be true to yourself and consistent with those around you.

The foundation of genuineness, however, does not mean you should simply do what you feel and ignore the importance of your interaction with others. As a PM and leader, you must use your energy to vis-

ibly set the example of behavior you expect of your team and to encourage your team by the approach and tone you set. As a result, you should spend some time to think deliberately about your approach to your role as a PM and leader.

There are several behaviors that you can model that go a long way toward setting a healthy tone in your workplace. The first is to ask a lot of questions. Not only will the answers aid *your* understanding of the program but the questions also will aid *your team's* understanding. It is amazing how frequent a "simple" or "stupid" question will evoke responses like "I was wondering the same thing" or "I'm glad you asked that."

A second behavior is to get to know your people. Not everyone is open and personable, and in fact many shy away from discussing anything that is not strictly business. That is not a bad thing in the workplace, but there are very likely opportunities to get to know your team in a way that communicates your concern and interest in them. Even though you may not feel comfortable asking your team members about their weekend, making an effort to get to know them as people is always appreciated.

The final two behaviors are best stated by two of our most famous generals:

Perpetual optimism is a force multiplier.

-Colin Powell

A sense of humor is part of the art of leadership, of getting along with people, of getting things done.

-Dwight D. Eisenhower

Bringing energy, optimism, and a sense of humor creates an environment for your team that is positive and success oriented, while letting team members know you are human. The large majority of your team genuinely wants to contribute, be appropriately recognized for hard work, and enjoy the work. But the tone at work is highly influenced by "the boss." So, others will look to you as the PM to set the tone and personality of the workplace. Bringing energy and enthusiasm and engaging with your team sets a tone for a productive and healthy environment.

Proverbs for PMs

If you were not the PM, would you enjoy working on your program?

- Do your people really own your program?
- Do they fully understand who depends on them?
- On whom do they depend?
- Do they know how their contributions affect the program?
- Are they proud to say they are part of the program?
- Would you get them a cup of coffee?

Proverbs for PMs

If you are sitting at your desk, you are not managing your program.

- Your people need to feel important; see them on their home turf. (Reprimand on your turf.)
- It is amazing what you pick up while you are wandering around.

COLLABORATION AND COMPROMISE

I searched for glory ... And I did not see. I searched for victory ... And victory eluded me. I searched for teamwork ... And I found all three.

> —Anonymous words posted in the locker room of the 2004 U.S.A. National Hockey Team

In 6 months, nobody will care if you held your ground over an issue—sometimes you need to compromise to keep your program moving forward.

—Thomas Owens, Lieutenant General, U.S. Air Force Commander, Aeronautical Systems Center

All politics are local, all relationships personal.

-Randy Mahr, Rear Admiral, U.S. Navy, Program Manager (PMA-251) Aircraft Launch an Recovery Equipment programs

Brigadier General Raymond Shulstad, in his case study based on his experience as a PM on the B-1B program, observed that "not all of the people who need to be influenced work directly for the manag-

er or leader." 183 Similarly, one of the first truths you will discover when taking over as PM is that your job necessarily entails collaborating with other program stakeholders, including users and warfighters (customers in traditional parlance), program advocates, members of the Service headquarters or Joint Staffs, and occasionally congressional members. Collaboration means much more here than simply "communicating." Communication is important, and more is almost always better, but successful collaboration also entails understanding the responsibilities, perspectives, and priorities of other members of the DoD community. All stakeholders involved with DoD acquisition programs share one common objective: producing effective and affordable weapon systems that preserve our national security. Beyond that shared objective, however, stakeholders' interests often diverge, leading to disagreements about how to proceed with an acquisition program. Effective program management requires understanding different stakeholder objectives and trying to bring them into alignment for the betterment of the program. Quite often this collaborative exercise involves compromise or negotiations.

One way to visualize this is through the classic Venn diagram (Figure 11). Each stakeholder community member has a set of objectives. Some objectives coincide or overlap, and some don't. One of the PM's jobs is to find that area of overlap that satisfies all of the stakeholders' essential objectives. Sometimes this exercise entails persuasion—showing stakeholders how the solution you offer fits within their preferred solution sets. Sometimes this exercise necessitates accepting solutions that, from your vantage point, are suboptimal. The point to take away from this is that, whether you like it or not, running a large acquisition program is a joint endeavor. There are certain decisions that PMs can make on their own. There are others—typically more strategic in scope—that they cannot make alone. Collaboration, compromise, and the search for common ground are an essential part of the PM's job description.

Program management is not *all* about finding "common ground," however. The second truth you will likely discover upon assuming the mantle of PM is that, on prominent or troubled programs in particular, many stakeholders believe they can do your job better than you can. Defining and defending your "swim lane"—as well as understanding and respecting others' swim lanes—is one of the most difficult tasks a PM faces.

¹⁸³Raymond A. Shulstadand Richard D. Mael, "Leading and Managing Through Influence," *Air & Space Power Journal* 24, no. 2 (Summer 2010), available at http://www.airpower.au.af.mil/airchronicles/apj/apj10/sum10/01shulstad.html

The difficulty presents itself on three levels. First, the PM's authority and responsibilities, especially as they pertain to out-year planning and strategy, are sometimes ill defined. In this regard, a well-written and coordinated document that identifies swim lanes is an invaluable reference when other members of a program community intrude upon the prerogative of the PM. $^{\rm 184}$



Figure 11. Notional Venn Diagram of Stakeholder Interests

Second, difficulty also arises from the fact that other community members often play key roles in determining the program's success. Ultimately, the PM cannot succeed without other members' assistance and support. Therefore, the PM must be wary of alienating key players, appearing standoffish, or turning allies into enemies.

¹⁸⁴For the Air Force, the document that serves this purpose is known as the Program Management Directive (PMD).

Proverbs for PMs

Do not tell your customer what he wants; do not let him tell you how to manage it.

- The customer is the only one who knows what he wants (needs).
- It is your job to translate those wants into words a contractor will understand and your contracts people can enforce.
- $\bullet \ \ Negotiate who will be responsible for what before you start your journey.$

Finally, defending your swim lane can be difficult, or at least difficult to justify, if the program office also fails to recognize the "sovereignty" of other members' turfs. We all can become a little defensive or even self-righteous when outside stakeholders intrude into the programmanagement domain, but we often don't hesitate to assert our opinions regarding the validity of user requirements or the efficacy of the operating command's budgeting process. Though PMs play a key role *informing and influencing* requirements, budgeting, and other processes that fall outside the program management domain, we are well advised to keep this phrase in mind when tempted to intrude into other stakeholders' domains: "We are but the humble tin benders."

STAKEHOLDERS

Definition: Stakeholder¹⁸⁵

- 1. A person entrusted with the stakes of bettors
- 2. One who has a stake in an enterprise
- 3. One who is involved in or affected by a course of action

DoD acquisition guidance makes clear that the PM actually sits near the *bottom* of the acquisition hierarchy. DoD Instruction 5000.02 notes, "The chain of command for acquisition programs runs upward from the Program Manager, through the PEO to the CAE, and for Acquisition Category (ACAT) 1 and 1A and other programs so designated, to the Defense Acquisition Executive (DAE)." ¹⁸⁶

¹⁸⁵ Merriam-Webster Dictionary Online; http://www.merriam-webster.com/dictionary/

¹⁸⁶ Interim DoD Instruction 5000.02, November 26, 2013, p. 73. Available at http://www.dtic.mil/whs/directives/corres/pdf/500002_interim.pdf

That said, it is clear that the PM bears responsibility for program execution. At least according to Air Force guidance, the PM will:¹⁸⁷

- "Be accountable for assigned programs ... on all matters of program cost, schedule, risk, and performance," and
- "Be responsible for program execution, and deliver systems that meet documented user requirements while seeking to minimize costs and improve readiness throughout the life cycle."

There are also documented roles for the governance chain: product support manager, developmental tester, implementing command, and operating command. Though PMs are "accountable" and "responsible," they can count on getting a lot of "assistance" as they do their best to "deliver systems that meet documented user requirements."

Service Headquarters Staff

Headquarters staff representation on a program typically includes two distinct communities: the Service acquisition staffs and the "numbered staffs" (A/G/N 188 -2/Intelligence, A/G/N-3/Operations, A/G/N-4/Logistics, etc). At the <code>program</code> level, 189 Service acquisition staff representatives fulfill at least four functions:

- (1) Manage funds allocated by Congress for an acquisition program and oversee the program element within which these funds reside
- (2) Represent the Service Acquisition or Component Acquisition Executive (SAE or CAE) in reviewing and approving acquisition plans and budgets and ensuring programs comply with DoD and Service acquisition policy 190
- (3) Participate in the annual planning, programming, and budgeting process and oversee the development and presentation of budget documents to Congress
- (4) Represent the program at the Service staff level and with Congress and through the budget process¹⁹¹

¹⁸⁷ Air Force Instruction 63-101, March 7, 2013, p. 17.

 $^{^{\}rm 188}$ The "A" designates Air Force Staff, "G" stands for "ground" and the Army Staff, and "N" designates the Navy staff elements.

¹⁸⁹This distinction is important. At the Service or institutional/corporate level, the acquisition staffs perform a number of additional functions, including managing policy and the industrial base, developing and accrediting the acquisition and technology workforce, and overseeing basic and applied research programs.

¹⁹⁰ Alternatively, they delegate this authority downward in the acquisition hierarchy.

¹⁹¹Headquarters Air Force Mission Directive 1-10, April 8, 2009, p. 3.

On a day-to-day basis, the acquisition staff officer is the most prominent and active Service representative on a program. Though acquisition staff officers typically are not very senior (O-4 or O-5), they often interact with the program on a daily basis and, by virtue of their access to the Service staffs, Joint staffs, and Congress, exercise influence disproportionate to their rank. As we describe elsewhere in this book, acquisition staff officers work on behalf of the program and advocate for the program within the Services and with Congress, but their primary loyalty lies with the Service acquisition staffs and the senior acquisition executives. An acquisition staff officer will be unlikely to stand behind PM initiatives that run counter to Service acquisition priorities, are inconsistent with acquisition policy, or are likely to create difficulties for the SAE.

The role of representatives associated with Service headquarters' numbered staffs is less well defined, but these representatives generally oversee and coordinate the organize, train, and equip (OT&E) function within a functional discipline and ensure that programs support the Service's OT&E strategy. In this capacity, the numbered Service staffs review all formal requirements documents associated with a program, including ICDs, CDDs, and CPDs. An excerpt from the Air Force governing instruction provides an example. ¹⁹³ It outlines responsibilities for the Air Force/A2 staff in the capability development process. These include:

- Providing Air Force policy guidance on intelligence issues associated with force-modernization-associated programs, activities, or initiatives
- Ensuring all operational capability requirements documents are reviewed for accurate assessment of threat and documentation of intelligence supportability and infrastructure requirements
- Identifying intelligence, surveillance, and reconnaissance (ISR) needs and gaps across air, space, and cyberspace mission areas and supporting development of proposed operational solutions
- Guiding Air Force mid- and long-range ISR operational capability and requirements development and leading end-to-end capability portfolio management activities

The numbered staffs' role in reviewing requirements documents, "providing policy," identifying gaps and advocating for material solutions, and overseeing the OT&E function ensures they also wield significant influence on a program. Numbered staffs answer primarily to their

 $^{^{\}rm 192} \rm Recall,$ PEMs were discussed in the Financial Management chapter in the "Congress" section.

¹⁹³AFI 10-601: "Operational Capability Requirements Development," July 12, 2010, p. 19.

functional communities and, by extension, to their chiefs of staff. Their loyalty to a program extends only as far as they see it benefiting their institutional OT&E requirements.

Operating Command and Field-Operating Agencies

Operating commands and field-operating agencies play prominent, but very specific, roles in programs: they analyze, develop, and author requirements documents and oversee the ongoing requirements process. Operating commands "Develop and document capability based requirements and accomplish analysis to ensure needs of capability users are met."194 Sometimes the requirements documents are specific and limited, such as for those programs already in production, operation, or sustainment. At the other end of the requirements spectrum, operating commands also author the capability-based documents that serve as the basis for the JCIDS process. These include ICDs, CDDs, and CPDs. These much more expansive requirements documents provide the basis for overall weapon system design and strongly influence both acquisition and sustainment strategies. Though the operating commands are also influenced by Service OT&E requirements, the capability-based nature of today's requirements process mandates that they be responsive and attuned to warfighter and end-user requirements.

Participating Commands, End Users, and Test Organizations

Other prominent DoD stakeholders include participating commands, the operational test community, the RTO, and "end-user" organizations. Participating commands often include Service component commands like U.S. Army in Europe or U.S. Air Forces in Europe, which will ultimately operate and maintain weapon systems on behalf of their Services and in support of unified commanders. Their role in an acquisition program should be self-evident. They want systems that are (to use operational-test terminology) "operationally effective and suitable," that require reasonable infrastructure and training to support, and that will not drag too heavily on their O&M budgets or personnel pools. Participating commands are often charged with responsibility for MILCON necessary to support fielded weapon systems. In these cases, participating commands must ensure that MILCON schedules support weapon-system-fielding timelines and that unique weapon-system requirements—power, cooling, environmental controls, or security for example—be fully accounted for in the MILCON program.

¹⁹⁴AFI 63-101, March 7, 2013, p 19.

"End users" are typically representatives of the military units who will actually operate and maintain the weapon systems under development. Their concerns often overlap with those of the participating commands (because they are typically subordinate units to the command), but their concerns also tend to focus on specific details of the system design. User System Interface and maintainability generally rank high on their list of priorities. End users can add tremendous value to the requirements-and-design process because of the unique subject matter expertise they possess. Alternatively, they can bring a program to a standstill if they are dissatisfied with elements of a system's design. Bringing them into the design process sooner rather than later can go a long way toward alleviating headaches and delays later in a program.

The RTO is charged with overseeing Developmental Testing. The RTO is generally, though not always, independent of the program office. 195 Operational Test agencies (OTAs) are the organizations responsible for designing, executing, and reporting Operational Testing. 196 They are fully independent from the program office and report directly to the OSD director of Operational Test and Evaluation (OT&E). Both groups play a key role in program life-cycle authoring and in coordinating the program Test and Evaluation Master Plan. The OTA in particular exerts even more leverage once weapon-system design and development are complete by assessing its operational suitability and effectiveness. As with the user community, PMs are encouraged to solicit OTA input early and throughout a program's development. This provides OTAs the opportunity to participate in the development of requirements and KPPs against which they will eventually be tasked to evaluate a weapon system. It also ensures that they are kept in the loop as system design evolves and that they have the opportunity to highlight potential issues before those issues emerge in Operational Testing. As with the user community, involving the test community early in a program generally pays dividends later.

Congress and Industry

Some authors would be inclined to end the "stakeholder" discussion here, after having fairly well covered the subject in terms of government and DoD entities. But this would leave out two important and sometimes hugely influential entities—Congress and industry. It is not

¹⁹⁵AFI 99-103, paragraph 4.5.

¹⁹⁶Each service has an Operational Testing organization: Army Test and Evaluation Command, Navy OT&E Force, Air Force OT&E Center, the Marine Corps OT&E Activity, and Joint Interoperability Test Command (JITC).

by accident that we introduce these two players together. Congress is the source for *all* funding that eventually flows to an acquisition program. And although Congress is genuinely interested in promoting cost-effective weapon systems that protect our national security and vital interests, it is *nearly as interested* in programs that provide income, investments, and jobs to congressional constituencies. Industry recognizes this and often employs a significant lobbying or "business development" force to keep legislators fully apprised of opportunities or threats to programs within their constituencies. The scale of congressional interest and involvement will generally be proportionate to the budget associated with a particular program.

Government PMs rarely interact directly with elected officials. Staffers, representing either individual members of Congress or committees, generally act as the conduits between Congress and DoD acquisition programs. Staffers¹⁹⁷ are paid professionals who often come with years of DoD acquisition experience. They are to be both feared and respected. They're to be feared because they wield the authority of their congressional "masters" to influence program funding. They are to be respected because of the experience they bring, their eye for detail, and their insight into the inner workings and deal making at the highest levels of government. Staffers will inevitably detect inconsistencies in program documents and identify trends that reflect adverse program performance. Especially in instances where a program's interests align with those of their boss, they can also provide invaluable counsel or advice. Staffers can be a program's greatest ally or its worst foe.

Vignette-How to Lose \$10 Million Without Even Trying

While most of Congress was in recess during the dog days of summer 2012, congressional staffers were busy reading and analyzing the budget documents delivered in support of the President's FY13 budget. One staffer associated with the House Appropriations Committee Defense Subcommittee (HAC-D) noticed an anomaly in the Joint STARS Prime Mission Equipment Diminishing Manufacturing Sources. The program "P Docs" showed \$10.3 million of funding in FY13 for installations and another \$10.3 million for installations in FY14, but it showed all six installations actually taking place in the second year. The subcommittee subsequently "marked" the program for \$10.3 million in FY13, citing the funding as "early to need" since no installations were actually taking place (according to the documents). The discrepancy was an error—the program actually planned three installations each year, consistent with the funding—and the program submitted a Budget Fact Paper to appeal the mark, all to no avail. The committee had moved on by then, the Air Force had bigger fish to fry, and the mark stuck in the House

¹⁹⁷Keep in mind there are two broad categories of congressional staffers. Professional staff members who support a particular committee (e.g., HAC-D, SAC-D, House Armed Services Committee, Senate Armed Services Committee) and the staffs supporting congressional members. Most interaction with programs will be with the committee staffs.

Appropriation and was subsequently carried over into the Senate bill. The program was out \$10.3 million. Staffers don't miss a thing.

Proverbs for PMs

Treat your contractor with respect, cooperate with him as much as possible.

- You need him as much as he needs you.
- Believe that he has your best interest at heart until he proves otherwise.
- Remind him often that you are the customer.
- Be open with what you are considering so he can help (within the limits of the FAR).
- Always try for the win-win situation.

PMs often view industry and defense contractors through blinders. They see contractors as the entities that the DoD pays to design, develop, and build weapon systems and services. This "transactional" view of contractors is not entirely inaccurate, but it fails to take into account other interests and objectives that influence contractor behavior, and it entirely disregards the notion that contractors also have a genuine interest in promoting our national security. The transactional view also neglects to consider that, like other public companies, defense contractors need to maximize return on investment, reward stockholders, defend or increase market share, look out for the well-being of their workers, and protect their reputations. PMs who fail to take these competing motives into account are almost bound to be disappointed when contractors fail to perform in a manner that is consistent with the PM's transactional lens.

Another problem with the transactional lens is it leads PMs to view their industry partners *not* as partners, but as employees or paid servants. PMs who adopt this view expect that contractors will "do as they are paid to do." More dangerously, PMs who take this view may lose sight of the fact that *they are utterly beholden to their industry partners to succeed*. No other entity inside or outside of government has as much influence on a program's success or failure as your industry partner. PMs who view their jobs as "zero sum" win-lose propositions face long odds against success.

Viewed through a wider aperture, contractors' roles and responsibilities extend well beyond simply doing as they're paid to do. They are still responsible for designing, developing, and building weapons systems and services, but they have other competing priorities as well, and

these competing interests mandate a highly collaborative relationship between government PMs and their industry counterpart.

THE PROGRAM OFFICE—THE BUCK STOPS HERE

This lengthy discussion of roles and responsibilities associated with headquarters staffs, operating commands, users, the test community, Congress, and industry may leave the reader wondering what is left for the program office and PMs to do. In a word: execute. Air Force Instruction 63-101 is instructive: the "Program Manager...will be responsible for program execution and delivery of systems that meet documented user requirements while seeking to minimize costs and improve readiness throughout the life cycle." This responsibility entails overseeing functions that we describe in detail in other sections of this book: acquisition planning, financial management, contracting, systems engineering, and others.

Conflicts between the PM and other stakeholders—or "swim lane" issues as we referred to them earlier—generally arise over two issues: (1) execution decisions and (2) direction to the contractor. These conflicts often involve issues of funds allocation or expenditure, but they may also involve design decisions, sourcing, contracting strategy, financial management, or even contractor-performance assessment. Regardless of all that, DoD and Service regulations are remarkably consistent in their view toward the authority vested in the PM. As long as the PM acts in accordance with federal, DoD, defense agency and Service regulations, as well as documented program plans and requirements, execution authority and execution responsibility rest with the PM.

DoD Instruction 5000.01—the foundation for DoD acquisition policy—goes so far as to draw a line between the collaborative responsibilities of the stakeholders and the execution responsibilities of the PM. In a paragraph titled "Collaboration," the instruction counsels that "the DoD acquisition, capability needs, and financial communities, and operational users shall maintain continuous and effective communications with each other by using Integrated Product Teams (IPTs). Teaming among warfighters, users, developers, acquirers, technologists, testers, budgeters, and sustainers shall begin during capability needs definition." When it comes to execution decisions, however, the instruction draws the line, explicitly excluding these stakeholders. Only "MDAs and PMs

¹⁹⁸ Air Force Instruction 63-101, Integrated Life Cycle Management, March 7, 2013, paragraph 2.6.2, p. 17.

 $^{^{199}\}mbox{DoD}$ Directive 5000.01, The Defense Acquisition System, paragraph E1.1.2., Enclosure 1, p. 5.

[program managers] are responsible for making decisions and leading execution of their programs, and are accountable for results."²⁰⁰

Another source of potential conflict between the program office and other program stakeholders involves who is empowered to provide direction to an acquisition program prime contractor. The choice of "program office" as opposed to "program manager" is purposeful here; the only government official empowered to provide direction to a contractor is the contracting officer. Still, this is a dividing line that other program stakeholders often cross, either inadvertently or deliberately.

Again though, federal and DoD guidance on the issue is unambiguous, and there are several reasons why PMs and contracting officers need to adamantly defend their areas against swim-lane violations. First, stakeholders who provide contractors with direction outside of their legitimate authority put the government at risk of financial claims. Second, allowing other stakeholders to intervene in the primacy of the contracting officer-contractor relationship ultimately undermines the authority of the contracting officer and the credibility of the PM. Finally, as the old adage says, "Too many cooks spoil the broth." On programs as complex as most DoD acquisition efforts, unity of command and clear guidance to the contractor are prerequisites for success. Allowing other stakeholders to interact directly with the contractor almost guarantees that the government will transmit mixed messages and the contractor will end up wasting energy and money.

Proverbs for PMs

If things are running smoothly in your program, stand by.

- It is either Christmas Day or you are out of touch.
- Use the time to revisit your vision of the program.
- Talk to your customer to verify your own understanding of his needs.
- Seize the opportunity to improve the program.

GOOD FENCES MAKE GOOD NEIGHBORS

How do programs avoid conflicts like those described above and ensure all stakeholders "stick to their swim lanes?" Documenting roles and responsibilities is a good start. At least for the Air Force, program management directives (PMDs) are required documents for all programs. The MDA signs the PMD and uses it to "identify the various organizations, along with their essential responsibilities, necessary for en-

suring the success of a program or other effort." 201 Neither the Army nor the Navy identifies PMDs within its acquisition process, but Army programs often include "Charters" that serve the same purpose. 202

PMDs serve two purposes. First, they provide a common, agreed-upon reference—a "rule book" of sorts—to help resolve conflicts arising over roles and responsibilities. Even in advance of this, however, programs and stakeholders can benefit from the process of creating a PMD. The "Defense Acquisition Enterprise," an online blog on defense acquisition matters, has sage advice on this topic. It states:

PMDs are not often thought of as a major program document and often collect dust on shelves once signed. Yet the process to create or in most cases update a PMD is where the valuable discussion and often debate occurs. Clearly identifying who is responsible for what leads to debate over authority (perceived or real), assigning responsibility to undesirable tasks, and identifying all stakeholder organizations.²⁰³

In other words, PMDs are as much about the journey as they are the destination. Unfortunately, the composition and membership of the stakeholder community will evolve over the time span of a typical DoD acquisition program, and waving the PMD in another stakeholder's face may be a suboptimal conflict-resolution strategy. If a PM needs to resort to the PMD as a means of defending himself against "swim-lane violations" by other stakeholders, the "collaborative relationship" has likely already deteriorated to the point where it may be irrecoverable. A proactive approach that focuses on keeping lines of communication open and maintaining positive relations is likely to be much more effective. What follows, then, is a concise list of activities every PM should consider to maintain open communications with program stakeholders and preserve a constructive, collaborative relationship:

1. Be honest and (for the most part) open. The first part of this advice should require no explanation, and yet in countless cases PMs have misled their hierarchy, their customers, or their industry partners. In almost every example, their lack of honesty or transparency led to adverse outcomes. There are several reasons why honesty with your stakeholders is important. The first relates to trust. Program management is in many

²⁰¹Hagan, Glossary, B-180.

 $^{^{202}\}mbox{DAU}$ Ask a Professor, https://dap.dau.mil/aap/pages/qdetails.aspx?cgiSubjectAreaID=9&cgiQuestionID=25114

²⁰³Defense Acquisition Enterprise 2.0 Blog posting, July 7, 2010, titled "Wiki Program Management Directives," at http://www.defenseacquisitionenterprise.com/2010/07/wiki-program-management-directives.html

respects an exercise in trust. DoD acquisition programs typically are highly complex and expensive undertakings, and the community often has to "trust" the PM's technical, financial, and programmatic recommendations. Stakeholders will quickly lose faith in a PM they discover to be dishonest or not forthcoming with important information. Once a PM has lost the trust of the stakeholder community, the likelihood that stakeholders will "go along" with a PM's recommendations decreases dramatically, consensus becomes more difficult to arrive at, progress slows, and it becomes increasingly difficult to maintain schedule or stay within budget. The second reason honesty is important involves reciprocity. Simply put, if you expect other stakeholders to be honest and open with you, you need to be the same with them. Stakeholders often have information that is important to a PM. Sometimes that information is sensitive. The more honest and forthright a PM is with other stakeholders, the more open and forthcoming they are likely to be with the PM, and the more likely it is that the PM will receive important information in a timely manner. There are caveats to the "open and honest" rule. There is some information—often involving contract strategy—that most stakeholders simply don't need or are not entitled to know. There are also instances where one stakeholder might confidentially share information with the PM. The prime contractor in particular might share information with the PM that the contractor wouldn't want divulged to the larger community of stakeholders. Unless the PMs are willing to jeopardize these relationships, they often must respect these requests.

You learn to overcommunicate, and I'll learn not to overreact

–Joe Dyer, Vice Admiral, U.S. Navy, former
 Commander Naval Air Systems and President of iRobot Corporation

2. Schedule frequent, regular forums for routine communication. We all have the best of intentions. We all intend to regularly "communicate" and "reach out" to our partners and stakeholders. Then we fall prey to routine workload and "critical taskers" that eat up time. We eventually look up and discover we haven't spoken to our customer, or our contractor counterpart, or even our boss, for weeks. This is why it's important, even essential, to set up regular, frequent stakeholder forums. Structure (an agenda) is typically less important than periodicity, regularity, and inclusion. The critical thing is to make sure that all stakeholders have the opportunity to speak with one another on a monthly, biweekly, or even weekly basis. These are not events for major presentations or careful, extended deliberations—there will be other times for that. These forums serve two purposes. They keep everyone abreast of status and develop-

ments on a program, and—by bringing stakeholders together on a routine basis in an informal, low-threat environment—they help to preserve collaborative relationships. Though PMs often organize and "chair" these events, it's important that they not dictate the agenda, dominate discussion, or suppress other stakeholder's views. Teleconferences or video-teleconferences work well for these sorts of events. In some instances it may be necessary to set up a separate "government only" forum or to schedule different events for different subsections of the stakeholder community, but every prominent stakeholder needs the opportunity to participate in at least one of these events.

- 3. Schedule less frequent program management reviews (PMRs) and separate executive management reviews (EMRs) to discuss larger, more complex topics. The lexicon will vary here, but these are the forums within which stakeholders tackle more complex topics and resolve major issues. These are also the forums within which stakeholders assess program performance and status in greater detail. What we refer to as "PMRs" and "EMRs," though, involve different audiences and serve slightly different purposes. The PMR is the forum within which the contractors present cost/schedule/performance/risk status to the PM and his or her staff. If the PM is supervising a group of lower-level project managers, the subordinate project managers may either collaborate in the presentation with the contractor or sit at the "right hand" of the PM. The important point is that this is an exchange between industry and the PM or managers. It preserves the primacy of the relationship between the contractor and the program management office, and also protects the authority and credibility of lower-level PMs. Other stakeholders may or may not be invited to this event. The PMs "own" and chair this event, and it is their prerogative to determine who attends. The EMR is ideally scheduled shortly after the PMR, and the PM's role in the EMR is entirely different. The EMR is the forum within which the PM and staff brief program status to the stakeholder community, present the results of the PMR, and surface any prominent issues that require discussion, deliberation, or resolution among the stakeholders. The PM often co-chairs this event with his Service headquarters or operating command counterpart. The EMR also provides the other stakeholders with an opportunity to speak to their responsibilities, issues, perspectives, and concerns.
- 4. Use the phone frequently. Weekly stakeholder teleconferences and periodic PMRs and EMRs are great for dealing with topics that involve the entire community and that are not so urgent that they require immediate attention. Occasionally, a PM confronts a topic that needs to be dealt with immediately, or an issue arises that is primarily related to

one stakeholder and that is too sensitive to discuss with the larger community. This is where the good old-fashioned telephone comes into play. Calling and speaking with someone directly has several benefits. First, it ensures a level of confidentiality. Unless the person is recording the call, it's unlikely you'll see a text of your conversation in print. It's private. Second, it reminds the person on the other end of the line that he or she is dealing with another individual, and not just an organization or institution. Finally, it demonstrates to the other stakeholder that you cared enough about the issue to place a call and you were thoughtful enough to call the stakeholder directly. It also shows that you're willing to risk dealing with the topic person-to-person. Though we suggest using the phone for issues that are urgent or more appropriate for one-on-one discussions, the best PMs often spend a significant percentage of their time on the phone, just to maintain relationships. These people realize that, even in this time of email, texting, and social media, the human voice is one of the most powerful tools at their disposal to build and preserve relationships.

5. Divide responsibility for "up and out" versus "down and in." There are only so many hours in a day. This is a reality that eventually confronts almost every PM. With this in mind, most PMs need to decide: Are they going to do a lot of things poorly or do fewer things well? Though the two options we present are somewhat pedagogical, the fact remains that the job of PM can be overwhelming, and a PM needs to make choices. This chapter focuses on the importance of collaboration and strategic partnerships, but your internal program management staff also demands (and deserves) comparable guidance and "relationship tending." One way to deal with these competing commands is to divide "up and out" and "down and in" responsibilities between yourself and someone else. A common strategy on major acquisition programs is to have the PM focus on external or strategic relationships and issues, while the deputy focuses on internal matters and day-to-day program-management decisions. Alternatively, the PM can rely on a group of deputies of functional leads to manage routine matters while he or she focuses on program advocacy and strategic guidance. "Muddling through"—dealing with strategic matters one day, tactical another, and never clearly identifying who is responsible for what—is not a strategy we recommend. On major acquisition programs with important strategic stakeholders, there is too much at stake, and too much to do. The PM needs to decide in which role he or she will excel.

Proverbs for PMs

Go to their office and ask for help.

- The next time, they will come to you.
- One face-to-face interaction is worth a thousand phone calls.

People are smarter than they look. Listen to them.

- Get an opinion from every person at every meeting.
- Ask open-ended questions
- Let them talk or don't invite them.

6. "Keep your friends close and your enemies closer." We all like to surround ourselves with our friends and maintain distance from our foes. We find it unpleasant and unenjoyable to associate with people who hold views contrary to our own. As we discussed at the outset, however, collaboration entails trying to understand the perspective of other stakeholders—even those we dislike—and attempting to persuade them that the course or strategy we recommend serves their interests. Neither objective is likely to be attained unless PMs spend at least as much time working with their "adversaries" as they do with their allies. It's often unpleasant work, but it gets to the heart of why collaboration is essential to a PM's success.

FINAL THOUGHT—WHAT DOES A PM DO?

Success is the ability to go from one failure to another with no loss of enthusiasm.

-Anonymous²⁰⁴

People often ask us what we do for work. As DoD acquisition PMs, we're frequently challenged to answer that question in a concise manner—for good reason. DoD PM responsibilities span a wide array of functions and vary greatly depending on the program to which you are assigned and where you find yourself in the acquisition process. DoD PMs also work in an environment and with a lexicon that doesn't easily translate into language that people outside the DoD acquisition community understand.

Still, when pressed to explain "what we do," we typically take a

²⁰⁴Although this quote is widely attributed to Winston Churchill on quotation websites, this is known to be false. The earliest close match appeared in a 1953 book about public speaking titled *How to Say a Few Words* by David Guy Powers. The author did not claim credit, and the ascription was anonymous.

chronological approach, describing program management responsibilities over the lifespan of a system, from concept exploration to technology maturation to design and manufacturing to operations and sustainment. A "Readers Digest Condensed" list of responsibilities might read something like this:

- Work with weapons systems users, customers, or warfighters to define meaningful system requirements.
- Perform "trade study analysis" as necessary to determine where the government needs to compromise on requirements in order to meet cost, schedule, or performance constraints.
- Prepare cost estimates, budgets, and schedules that support all phases of the acquisition program, from technology development to sustainment and disposal.
- Identify and mature technologies necessary to realize weapon-system requirements.
- Write RFPs, conduct source selections, and award contracts that support all phases of the acquisition process (technology maturation, engineering and manufacturing development, production and deployment, and operations and sustainment).
- Work with government engineers and contractor personnel to design and develop weapons systems.
- Supervise program execution and ensure that contractors are fulfilling their requirements and delivering supplies and services to the government according to the contract.
- Constantly perform risk analysis to anticipate what might go wrong and what the government needs to do to mitigate risk.
- Supervise testing to ensure weapon systems, subsystems, and support systems satisfy requirements and are operationally effective and suitable.
- Work with the operations and sustainment communities to ensure training and resources are in place to support operations and maintenance of the weapons systems we field.

This list provides a good starting point for the type of conversation we described, but it also leaves out several prominent responsibilities that span the acquisition process, are common to all programs, and may even trump some of those described above.

REPRESENT THE PROGRAM

The PM is the spokesperson and in many cases the "face" of the program. In this capacity, the PM must be intimately familiar with the

weapon system requirements, technologies, acquisition strategy, funding strategies, and current status. PMs are constantly required to explain, justify, and defend their programs. If they are ineffective in exercising this responsibility, they may well jeopardize program support or funding. Several implications are associated with this responsibility. First, PMs need to be more than just "cost/schedule/performance" technical experts. They need to have excellent communications skills and a willingness to interact and speak publicly on behalf of their programs. Second, they need to understand the technical, fiscal, and political context within which they are working. Programs often fail because their PMs fall short in this regard, either by not recognizing opportunities or by overreaching when the external environment no longer supports their demands. Finally, good PMs need to embrace their role as "defenders of the program," albeit in a balanced, honest, and objective manner. They need to be ready to defend the program against critics, prepared to explain it to potential allies or advocates, and willing to admit when the program faces challenges.

ORGANIZE FOR SUCCESS

The "spokesperson" role emphasizes the prominent individual and public responsibilities that PMs must take on, but every PM is also a team leader and a team member. PMs who focus exclusively "up and out" without also taking care of business "down and in"—making sure the program office itself is functioning smoothly and efficiently—are unlikely to succeed. The two spheres of responsibility do not necessarily need to compete. The most effective PMs initially spend a greater percentage of their time organizing their program for success. Once they have the right organization, effective processes, and a reliable leadership cadre in place, they can afford to devote more time to their external responsibilities.

One of the first steps toward organizing for success is to make sure the organizational structure aligns with program goals and products. Though this may sound like management mumbo-jumbo, natural program evolution, externally mandated reorganizations and mergers, and other factors often result in organization charts that have little bearing on the products the program office is responsible for producing. Aligning the program office structure with program goals and products means that all offices and organizations in the program should have clear product or process responsibilities. That is, they should either be "building something" or "doing something." The "building something" tasks are

typically associated with a specific weapon-system product, increments, subsystem, or services. The "doing something" tasks are typically associated with financial, contracting, systems engineering, and other processes that support the program management tasks. All staff members should clearly understand their roles and responsibilities and be able to quickly describe what they are building or doing.

Once a rational organization structure is in place, PMs must ensure there is leadership that allows the program office to continue to function smoothly and effectively without the PM's constant intervention. PMs often inherit a staff, and in the best of circumstances that staff is qualified and committed to the same goals as the PM. Unfortunately, a PM often inherits a staff with mixed leadership skills and maybe even mixed loyalties. PMs need to move as quickly as possible to make their own objectives and expectations clearly known, evaluate the competency and loyalty of the leadership team they inherit, and put in place people who can be trusted to execute in the PM's absence.

It may seem that the "organizing for success" would be complete with a properly aligned organizational structure and an effective leadership team in place. However, this overlooks the importance of program office processes. Efficient and well-understood processes—programmatic, systems engineering, financial, contracting, administrative, and personnel-related—are critical to success, especially in a large acquisition program office responsible for complex weapon-system programs. Efficient, well-documented, and well-understood processes also ensure that a program office will continue to function in the absence of its leader.

TAKE CARE OF THE PEOPLE (NOT JUST THE PROGRAM)

Unfortunately, many PMs often spend a disproportionate amount of time managing *their program* and not enough time supervising *their people*. Routine administrative and personnel tasks—mentoring, providing feedback, writing award packages, and completing performance reports—may seem mundane, but savvy PMs realize these tasks are important and ultimately benefit the program and the PM. They are important because they ensure that the best performers are recognized, encouraged, developed, and promoted. They are also important because they set the tone for how the program will be run. A PM can hardly expect his people to perform their tasks in a professional and timely manner if he or she sets a poor example on administrative and personnel matters. These tasks benefit the program because people take note when a program office is run in a professional manner and when the PM takes time

to recognize and develop his or her subordinates. Taking care of your people makes recruiting and retaining quality personnel far easier and ensures the long-term viability of the program.

There is another component of "taking care of people" that deserves more attention in the program management domain than in other work spheres. Program management can be thrilling and rewarding, especially when a program office successfully fields a decisive operational capability, but it can also be exhausting and frustrating. The DoD acquisition process is purposefully bureaucratic and slow-moving. People who would rather compete than collaborate sometimes make already complex processes even more difficult to navigate. In cases like this, PMs need to remind their staffs periodically of the importance of what they are doing and inspire them to perform to the utmost of their abilities.

Inspiration comes in many forms and styles, but at least two ideas that PMs need to bring to the forefront of their team's consciousness are (1) the criticality to the warfighter and the nation of the products they are producing, and (2) the vital role each and every member of the team plays in producing those products. These ideas should be self-evident—if they're not, the PM has more serious questions to answer. But they are also easy to lose sight of when a subordinate is mired in paperwork, grappling to understand the purpose of a complex approval process, or otherwise trudging through the bureaucracy that is the DoD acquisition process. PMs must enable all members of the program office team to understand and appreciate fully the critical role they play in producing weapon systems and services that help to keep our nation's military second to none.

SO WHAT DOES THE PM DO AGAIN?

The PM list of responsibilities is long. PMs organize the program office; select and manage their leadership teams; ensure that efficient and effective systems engineering, financial management, contracting, and personnel processes are in place; and play hands-on roles in mentoring, developing, recognizing, and inspiring their staffs. And these are just "additional duties," routine and ongoing tasks that need to be accomplished while shepherding potentially large and complex programs through the labyrinth of the DoD acquisition system. This long list of responsibilities raises an entirely different question than this chapter started out with: "What doesn't a PM do?"

To capture this sentiment differently, and especially when in conversation with young PMs just entering the career field, we often

quote a former associate who posed and then answered his own question:

"What does the program manager do again? Oh yeah ... that's right. Everything!"

-Pete Tonelli

APPENDIX

A NOTE ABOUT CHECKLISTS AND A FEW THAT MIGHT BE USEFUL

Be careful of checklists—they frequently become an excuse to avoid thinking.

-Anonymous

Checklists are common among senior leaders and PMs. You have probably seen "Rumsfeld's Rules" and "Colin Powell's 13 Rules for Leadership," but the reality is that most senior leaders have a "Top 10" or "Magnificent 7" list that aids their thinking. The helpfulness of checklists is arguably self-evident—if they were not helpful they would not be so popular and so commonly used. The reason for their utility is they provide a manageable number of items to track. With limited time and resources, we want to focus our attention on things that make the most difference. The same idea underpins the DoD's requirements process—there may be a large number of requirements, but the KPPs are the vital few requirements that are tracked very closely and largely drive the key program decisions. As humans, we appear capable of focusing our attention and energy on only a few (three to seven) items. More than that and what's important begins to get diluted with the less important.

In general, we appreciate checklists because they help PMs keep track of important ideas or issues in a complex and dynamic environment. As a result, we've included several useful checklists in this Appendix:

- Critical Thinking—from the Foundation of Critical Thinking
- Battle's Law-Principles of Program Management from 1961
- The First 90 Days
- General Reynolds' Advice—for Success in Acquisitions
- Norm Augustine's "Checklist for an Acquisition Adventure or 'A Formula for Failure'"
- McKinney Rules for a Successful Acquisition Staff Officer
- Petraeus's Rules for Living
- Colin Powell's 13 Rules for Leadership
- Ten Pretty Good Rules
- Laboratory Program Management Key Questions

However, the single most important idea regarding checklists is captured in the quote above—that they *not* become a substitute for thinking. With excellent advice from very credible leaders, it is easy to fall into a false sense of security—surely if I follow their step-by-step instructions, I won't fail. However, every situation is unique and demands a thoughtful assessment and decisionmaking process. Successful expeditionary leaders constantly assess and reassess their plans based on ever-changing environmental conditions. Likewise, PMs constantly reassess their program and use checklists as tools to initiate, but not limit, thinking.

Checklist 1—Critical Thinking

Quoted from the Foundation of Critical Thinking (at http://www.criticalthinking.org/)

Intellectual Standards

- Clarity: understandable; the meaning can be grasped.
- · Accuracy: free from errors and distortion; true.
- Precision: being specific, with appropriate details.
- Relevance: applicable to the issue or problem.
- Depth: deals with complexities related to problem.
- Breadth: encompasses multiple viewpoints.
- Logic: makes sense, follows from facts or evidence.
- Significance: most important to issue.
- Fairness: objective and accounts for others' thinking; no prejudice.

Checklist 2—Battle's Law—Principles of Program Management from 1961²⁰⁵

From: SSZD/Col Battle/1512 05 SEP 1961

Subject: Program Management

To: SSV (Col Bleymaier)

- 1. Colonel Kucherman asked me to send you this memo on the principles of program management practiced in SSZD.
- 2. We operate more of less along the following guidelines, listed more or less in their order of importance:
 - a. Keep the program office small and quick-reacting at all cost.

²⁰⁵Dwayne A. Day, "Battle's Laws," *The Space Review*, Mar. 23, 2009, available at http://www.thespacereview.com/article/1333/1

b. Exercise extreme care in selecting people, then rely heavily on their personal abilities.

- c. Make the greatest possible use of SSD supporting organizations. You have to make unreasonable demands to make sure of this support.
- d. Cut out all unnecessary paper work.
- e. Control the Contractor by personal contact. Each man in the program office has a particular set of Contractor contacts.
- f. Hit all flight checkout failures hard. A fault uncorrected now will come back to haunt you.
- g. Rely strongly on Contractor technical recommendations, once the program office has performed its function of making sure the Contractor has given the problem sufficient effort.
- h. Don't over-communicate with higher headquarters.
- i. Don't make a Federal case out of it if your fiscal budget seems too low. These matters usually take care of themselves.
- j. Don't look back, History never repeats itself.

//SIGNED//

C.L. BATTLE, Colonel, USAF

Director, DISCOVERER Satellite System

Checklist 3—The First 90 Days—Developed by Joanne Schoonover (DAU Faculty)

Documents to review in advance:

- PM charter
- Most recent SAR, DAES, DAB briefing, program summary, PoPS/PoS
- Acquisition Program Baseline, ICD/CDD/CPD
- Budget info (including obligations/expenditures and P-docs & R-docs)
- Most recent CPAR(s) and program status reviews
- Contract: SOW, CLINs, Section H, incentives

Initial program assessment:

- Cost and schedule drivers
- Critical technologies
- Critical path and technical performance
- Interdependency with other programs
- Views of stakeholders including users, PEO, HHQ, OSD, Congress

Checklist 4—General Reynolds' Advice—for Success in Acquisitions 206

Lieutenant General Richard V. Reynolds' (USAF) advice on being successful in acquisitions:

- 1.Money-know everything about it.
 - Comptroller and execution issues.
- 2. Information about money.
 - Get the story straight and get to know the players.
- 3. Communication about money.
 - Story of money that defends/protects the money.
 - Develop a "Contact Plan."
 - Build relationships!
- 4. Leadership—selecting the right leaders.
 - Pick the right person.
 - Listen!
- 5. Pick the right contractor.
 - Once you go on contract—you are no longer the government or contractor—you are on the program team.
- 6. Compromise.
 - Be willing to find compromise.
 - Don't let the contracting officer become the PM.

Checklist 5—Norm Augustine's Checklist for an Acquisition Adventure or "A Formula for Failure" 207

- Settle for less than the best people—reduce payroll cost.
- Build an adversarial relationship between buyer and seller.
- Change management frequently—provide opportunities.
- Avoid evolutionary growth to new capabilities—take great leaps.
- Continually revise schedule and funding—generate excitement.
- Include all features anyone wants—make everybody happy.
- Allow no margins in funding, schedule or technical approach—nothing will go wrong.

 $^{^{\}rm 206}\mbox{Provided}$ by General Reynolds in his presentation to DAU classes on program management.

 $^{^{207}}$ Former Lockheed-Martin CEO Norman Augustine presented in 1997 this sarcastic list for acquisition PMs (what NOT to do).

 Divide management responsibility among several individuals—two heads are better than one.

- Whenever difficult problems are encountered, start all over with a new approach having no (known) problems.
- Promote continued debate over goals throughout life of project—variety is the spice of life.
- Give reliability low priority—especially avoid redundancy.
- Develop underlying technology and end-product concurrently.
- Do not plan intermediate test milestones—just one glorious display.
- Create as many interfaces as possible—help people get to know each other.
- Focus on the big picture. The details will take care of themselves.
- Disregard seller's track record. The law of averages will work out.
- Cut costs by reducing testing especially environmental and full-system testing.
- Ignore the users. They don't understand high-tech.
- Choose among the sellers based on what they promise. Nobody likes a
 pessimist.
- Get a head-start on work prior to finalizing goals, schedule and cost. This is especially true for software—which is easy to change.
- Share authority for project direction with staff advisors.
- Eliminate independent checks and balances—they just create friction.
- Don't compete potential suppliers at the outset. Pick a friend.
- Once under way, continue to compete selected supplier with outsiders. Change as often as possible to assure "Freshness."
- Minimize managers' latitude for judgment. Rely on regulations.
- Deal harshly with anyone surfacing problems. One can't afford troublemakers.
- Never delegate. Hold authority at the top where people really know what's going on.
- Maximize individual incentives. Teamwork is just the sum of the parts.
- Make up for schedule slips by overlapping design and build—especially when test results are disappointing.
- Include at least as many auditors on the project as workers. Reviews give everyone a chance to participate.
- Do all possible to minimize profits of participating contractors. Save the money.
- Don't waste time communicating (especially face-to-face)—It just takes time; and time is money.

• Eschew strong systems engineering. It complicates decision-making.

- Delay establishing configuration control until the last minute. Reduce the cost of management.
- Always pick the low bidder. They must know something special and are often courageous.
- Don't worry about the form of the contract. Just enforce it.

Score

- 0 Success Unavoidable
- 1-5 Success sometimes unavoidable
- 6-10 Success possible
- 11-20 Good chance of disaster
- 21-36 Disaster not left to chance

Checklist 6-McKinney Rules for a Successful Acquisition Staff Officer²⁰⁸

- 1. Your job = Support Program (in this building, power = Info + \$).
- 2. You work for the Under Secretary—protect his/her equities.
- 3. Build relationship and confidence with PM.
- 4. Think strategically, operationally, and tactically—in that order.
- 5. Knowledge is power—know everything about everything. And if you don't know it, know where to find it quickly.
- 6. You are the expert on your program in the building—everybody else thinks you are ... so live up to it.
- 7. Be consistent, truthful, credible—answer questions thoroughly, but know your audience.
- 8. Service positions are represented by government officials.
- 9. Take an action if necessary... the exception, not the rule.
- $10.\,Bad\,news\,does\,not\,get\,better\,with\,age-don't\,let\,the\,boss\,get\,surprised$
- 11. Take Notes \dots principals will turn to you for what happened.
- $12.\,Memorize\,key\,program\,facts.$
- 13. Work tirelessly to ensure competence and project confidence.
- $14. \, There \, are \, appropriate \, times \, to \, give \, up \, un executable \, funds.$

²⁰⁸Developed in 2005 by Richard McKinney, the director of space acquisition for the Air Force. The original list was "McKinney Rules for a Successful Program Element Monitor (PEM)," but it is applicable for all Services.

Checklist 7-Petraeus' Rules for Living 209

1. Lead by example from the front of the formation. Take your performance personally—if you are proud to be average, so, too, will be your troops.

- 2. A leader must provide a vision—clear and achievable "big ideas" combined in a strategic concept—and communicate those ideas throughout the entire organization and to all other stakeholders.
- 3. A leader needs to give energy; don't be an oxygen thief.
- 4. There is an exception to every rule, standard operating procedure, and policy; it is up to leaders to determine when exceptions should be made and to explain why they made them.
- 5 We all will make mistakes. The key is to recognize them and admit them, to learn from them, and to take off the rear-view mirrors—drive on and avoid making them again.
- 6. Be humble. The people you'll be leading already have on-the-ground conflict experience. "Listen and learn."
- 7. Be a team player. "Your team's triumphs and failures will, obviously, be yours." Take ownership of both.
- 8. Don't rely on rank. If you rely on rank, rather than on the persuasiveness of your logic, the problem could be you and either your thinking or your communication skills. Likewise, sometimes the best ideas come from bottom-up information-sharing (i.e., "Need to share" not "Need to know"). Use "directed telescopes" to improve situational awareness.
- 9. Leaders should be thoughtful but decisive. Listen to subordinates' input, evaluate courses of action and second- and third-order effects, but be OK with an "80 percent solution." "There will be many moments when all eyes turn to you for a decision. Be prepared for them. Don't shrink from them. Embrace them." Sometimes the best move is the bold move.
- 10. Stay fit to fight. Your body is your ultimate weapons system. Physical fitness for your body is essential for mental fitness.
- 11. The only thing better than a little competition is a lot of competition. Set challenges for your subordinates to encourage them to excel.
- 12. Everyone on the team is mission-critical. Instill in your team members a sense of great self-worth—that each, at any given time, can be the most important on the battlefield.

²⁰⁹Paula Broadwell, "Lessons on Leadership from General David Petraeus," *Newsweek*, Nov. 12, 2012, p. 64. Although the "Petraeus-Broadwell scandal" tarnished the personal reputation of a capable national security leader, the authors decided to retain this list because of its intrinsic merit.

Checklist 8-General Powell's 13 Rules for Effective Leadership²¹⁰

- 1. It ain't as bad as you think. It will look better in the morning.
- 2. Get mad, then get over it.
- 3. Avoid having your ego so close to your position that when your position falls, your ego goes with it.
- 4. It can be done.
- 5. Be careful whom you choose.
- 6. Don't let adverse facts stand in the way of a good decision.
- 7. You can't make someone else's decisions. You shouldn't let someone else make yours.
- 8. Check small things.
- 9. Share credit.
- 10. Remain calm. Be kind.
- 11. Have a vision. Be demanding.
- 12. Don't take counsel of your fears or naysayers.
- 13. Perpetual optimism is a force multiplier

Checklist 9—Ten Pretty Good Rules

- Never fall in love with your program—you'll break your heart and it's not real anyway.
- You can't lose money and/or capabilities that you never had.
- Don't become a prisoner of your own propaganda.
- You can't stop your boss from shooting his own foot.
- Know your enemy—the Administration will get you before Congress does.
- Be patient—a long time is shorter than forever.
- Know the limits of your influence—the system is political, not rational.
- Justify and defend your program in your listener's frame of reference not your own—find out what that is by asking.
- Quick fixes are often the genesis of tomorrow's problems—anticipate the unintentional consequences of what you do.
- No matter how weird it feels—RESULTS COUNT.

²¹⁰Colin Powell, *It Worked for Me: In Life and Leadership* (New York: HarperCollins, 2012), pp. 3–4. First printed in the August 13, 1989, issue of *Parade* magazine.

Checklist 10-Laboratory Program Management Key Questions 211

- Who is your customer and what are the customer's requirements?
- How will you demonstrate you have met the requirements?
- What are the technology options?
- Which is the best approach? (Support with analysis.)
- What are the risks to developing the selected technology?
- How will you structure your program to meet requirements and mitigate risk?
- What is your business-based transition plan that meets customer approval?

USEFUL QUOTES FOR PROGRAM MANAGERS

Although we have included a large number of quotes sprinkled throughout the chapters, we did not find a home for all of the quotes that you may find particularly applicable to PMs. Because many of the quotes encapsulate important ideas in a concise format and often carry the credibility of the originator, we include several additional quotes here that you may find useful communication tools.

If you don't have competition, create it!

David Ahern, Deputy Assistant
 Secretary of Defense for Strategic and
 Tactical Systems

You can talk to (and listen from) industry up until the final RFP is released.

-Frank Kendall Under Secretary of Defense for Acquisition, Technology, and Logistics

Choosing the right contractor is like choosing your spouse; select carefully cause you have to live with them.

-Anonymous, but good advice

...there is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things. Because the innovator has for enemies all those who have done well under the old conditions, and lukewarm defenders in those who may do well under the new."

-Machiavelli 212

²¹¹Greg Spanjers, personal communications. Adapted from Heilmeier's Catechism, developed by George H. Heilmeier for anyone proposing a research program or project.

²¹²From *The Prince*, chapter 6.

TENACITY PRAYER

Nothing in the world can take the place of Persistence. Talent will not; nothing is more common than unsuccessful men with talent.

Genius will not; unrewarded genius is almost a proverb. Education will not; the world is full of educated derelicts. Persistence and determination alone are omnipotent.

-Calvin Coolidge²¹³

Learn to say "I don't know." If used when appropriate, it will be often.

-"Rumsfeld Rules"

Do or do not. There is no try.

-Yoda, The Empire Strikes Back

What history is chiefly about is life, and while there are indeed great, often unfathomable, forces in history before which even the most exceptional of individuals seem insignificant, the wonder is how often events turn on a single personality, or the quality called character.

-David McCullough²¹⁴

When at the leading edge of technology and ploughing new ground ... if you do not have failures every now and then, you are not taking enough risks.

-Bernard Schriever²¹⁵

Tell me what you know. Tell me what you don't know. Then tell me what you think. Always distinguish which is which.

-Colin Powell²¹⁶

If you don't like change, you're going to like irrelevance even less.

-Eric Shinseki, General, U.S. Army

A positive attitude may not solve all your problems, but it will annoy enough people to make it worth the effort.

- Herm Albright

No battle plan survives contact with the enemy.

- Helmuth von Moltke the Elder

²¹³From a program at a Coolidge memorial service (1933); cited in *The Oxford Dictionary of Quotations* (1999)

 $^{^{214}}$ David McCullough, *Brave Companions—Portraits in History* (New York: Simon & Schuster 1992), p. xiv.

²¹⁵Thomas P. Hughes, *Rescuing Prometheus* (New York: Vintage Books, 1998), p. 137.

²¹⁶Colin Powell, "Colin Powell on the Bush Administration's Iraq War Mistakes," *Newsweek* [online], May 13, 2012, http://www.newsweek.com/colin-powell-bush-administrations-iraq-war-mistakes-65023

It is not the critic who counts; not the man who points out how the strong man stumbles, or where the doer of deeds could have done them better. The credit belongs to the man who is actually in the arena, whose face is marred by dust and sweat and blood; who strives valiantly; who errs, who comes short again and again, because there is no effort without error and shortcoming; but who does actually strive to do the deeds; who knows great enthusiasms, the great devotions; who spends himself in a worthy cause; who at the best knows in the end the triumph of high achievement, and who at the worst, if he fails, at least fails while daring greatly, so that his place shall never be with those cold and timid souls who neither know victory nor defeat.

-Theodore Roosevelt²¹⁷

Proverbs for PMs

Most common reasons protests are sustained

- Evaluation is inconsistent with RFP-stated criteria.
- Unequal treatment, including unequal discussions.
- Unsupported/undocumented evaluation.

Source: GAO Senior Attorney John L. Formica

Proverbs for PMs

Competition itself does not improve quality or reduce life-cycle costs.

- It will encourage the contractor to select the cheapest alternatives.
- It may force the contractor to take the lowest-risk approach rather than the optimum approach.
- You may have to select a source that does not know what it is doing.

²¹⁷From "The Man in the Arena," speech at the Sorbonne, Paris, France, April 23, 1910. Full speech available at http://www.theodore-roosevelt.com/trsorbonnespeech.html

ABOUT THE AUTHORS

Col. Bill Cooley and Mr. Brian Ruhm first crossed paths when they attended Air Command and Staff College together in 2002-2003. Both completed the program as Distinguished Graduates. About two years later, they found themselves working together in Kabul, Afghanistan, as part of the Office of Security Cooperation Afghanistan (OSC-A). They collaborated on an article upon their return (published in the July-August 2006 Defense AT&L magazine) that described how program management skills could be brought to bear in a deployed, security assistance environment. Another two years later, they again found themselves working together on the prominent but difficult Air Force Distributed Common Ground System (AF-DCGS) Program.

Col. Cooley currently is the program director for the Global Positioning System (GPS) at the Space and Missile Systems Center (SMC) on Los Angeles Air Force Base. He leads the multiservice, multinational systems directorate of about 750 staff responsible for development, acquisition, fielding, and sustainment of all Global Positioning System (GPS) satellites, ground-based satellite command and control systems, and military user equipment. The \$32 billion GPS program, with a \$1 billion annual budget, maintains the largest satellite constellation and the largest avionics integration and installation program in the Department of Defense. Col. Cooley's prior assignments include program manager for the Air Force Distributed Common Ground System employing global communications, program director for the Air Force Operations Command and Control programs, and director of the Air Force Research Laboratory Space Vehicles Directorate. Col. Cooley is a graduate of Rensselaer Polytechnic Institute, received a Doctorate of Philosophy in Engineering Physics from the Air Force Institute of Technology, and attended National War College.

Mr. Ruhm's program management career spans more than 26 years. He has worked on battle management, command and control, intelligence surveillance and reconnaissance (ISR), aircraft, satellite, and missile defense programs in all acquisition categories (ACAT). He retired from Air Force active duty in May 2011 and has since worked for the Air Force Life Cycle Management Center, first as deputy program manager for the E-8C Joint STARS Program and more recently as chief of the Program Execution Group for the Battle Management Directorate. He is a graduate of the U.S. Air Force Academy and Harvard's Kennedy School of Government, attended Air Command and Staff College, and completed Air War College. In 2009, he was awarded the Lt. Gen. John W. O'Neill

Award as the outstanding field-grade program manager within the Air Force Electronic Systems Center, and in 2014 he was recognized as the top U.S. Air Force civilian program manager for ACAT III level programs. He now lives in New Hampshire with his wife and daughter and spends as much time as possible skiing, running, hiking, and cooking. He volunteers as an adaptive ski instructor during the winter months and serves on several community boards.



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