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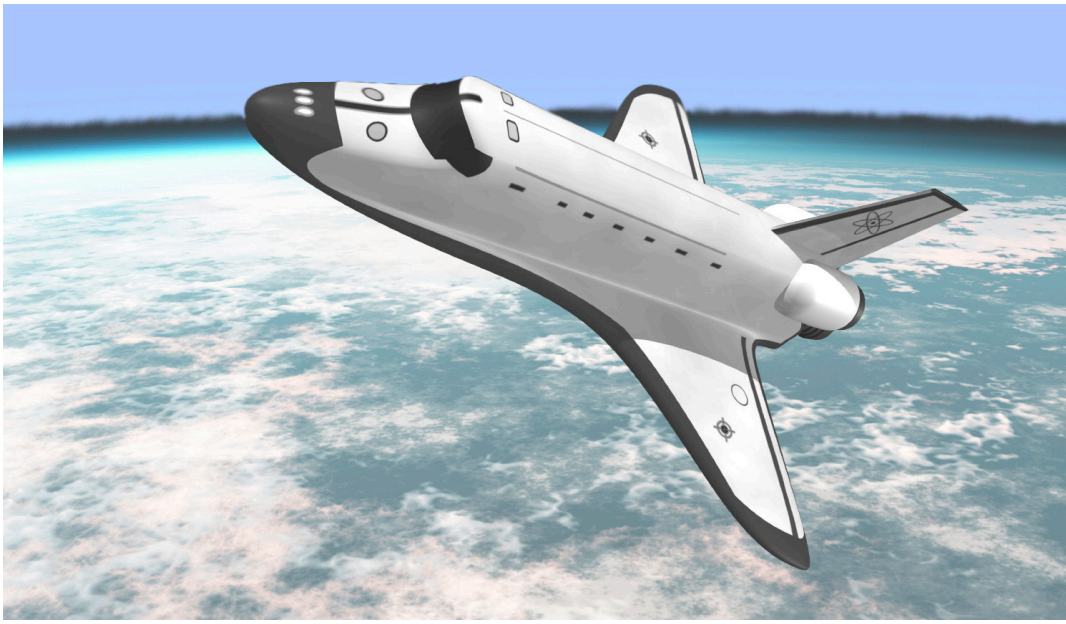


Can we afford our own future?

Why A&D programs are late and over-budget — and what can be done to fix the problem

Aerospace & Defense

Contents

Introduction

Program management and execution in the Aerospace & Defense (A&D) industry has always been an important critical success factor, but the stakes are getting higher. U.S. defense spending climbed over 60 percent during the Bush administration, and will total at least $612.5 billion in fiscal 2009, including $542.5 billion for the basic defense budget and $70 billion for the wars in Iraq and Afghanistan[1]. In March 2008, the Government Accountability Office (GAO) issued a study of 95 weapons systems programs that showed an average schedule delay of 21 months and average budget overrun of 26 percent for 2007[2]. In dollar terms, the combined cost overrun for all studied programs was $295 billion, up from $42 billion for a similar study conducted seven years earlier.

To gain a deeper understanding of the problem, Deloitte conducted an extensive analysis of Major Defense Acquisition Programs (MDAPs) using cost and unit data published in the Department of Defense's Selected Acquisition Reports going back to the early 1990s. The data shows that over the past 15 years the problem has steadily gotten worse. At the current pace, unless game changing mitigations are implemented to address the root causes, the analysis forecasts that in 10 years the average cost overrun may exceed 46 percent, up from 26 percent today.

Recent media reports have also shone a bright light on acquisition problems in A&D. For example, budget overruns for a European military transport, a U.S. next generation fighter jet and an Asian space launch vehicle, have been widely publicized. Commercial aircraft program delays have also made headlines – and elicited a strong reaction from the capital markets. This problem appears to span commercial aircraft, defense and space sectors, without regard to country boundaries.

In a recent Deloitte survey to support this study, 43.6 percent of participating government and A&D executives and professionals reported they believe the A&D program execution problem is at least as serious as the current crises in housing and banking[3]. It should also be noted that the unprecedented government expenditures required to shore up the financial system and economy are likely to increase the pressure on defense contractors and the Department of Defense (DoD) to reduce costs and improve efficiency. Prior to the election, the Pentagon's acquisitions chief said the department was close to finishing its updated six-year budget plan, which included "painful" cuts for all the services[4].

Earlier this year, Defense Secretary Robert Gates acknowledged that DoD has been "adding layer upon layer of cost and complexity onto fewer and fewer platforms that take longer and longer to build" and that this trend "must come to an end.[5]"

But how? What is behind this troubling pattern of cost overruns and schedule delays – and what can be done to address it? This study examines five root causes – technology complexity, talent, supply chain, politics, and program management – and offers specific solutions and practices that we believe can help tackle the problem.

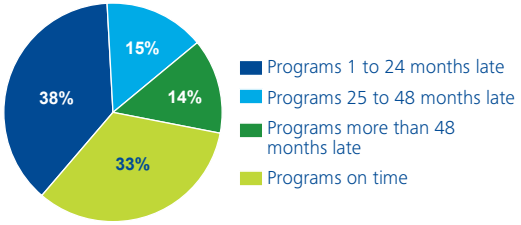
Cost overruns and schedule delays are getting worse

As previously cited, the GAO reported acquisition costs for major weapons systems programs were over budget by an average of 26 percent in 2007 with cost overruns totaling $295 billion, up from $42 billion for a similar study conducted in 2000.

Our analysis of the major programs cost data shows that cost overruns are increasing by an average of 1.86 percentage points per year. If this trend is allowed to continue, the analysis suggests that in 10 years the average overrun will exceed 46 percent as illustrated on the following chart (Figure 1).

The GAO report indicated that the average schedule delay was 21 months, with 33 percent on schedule, 38 percent 1 to 24 months late, and 29 percent more than two years behind (Figure 2).

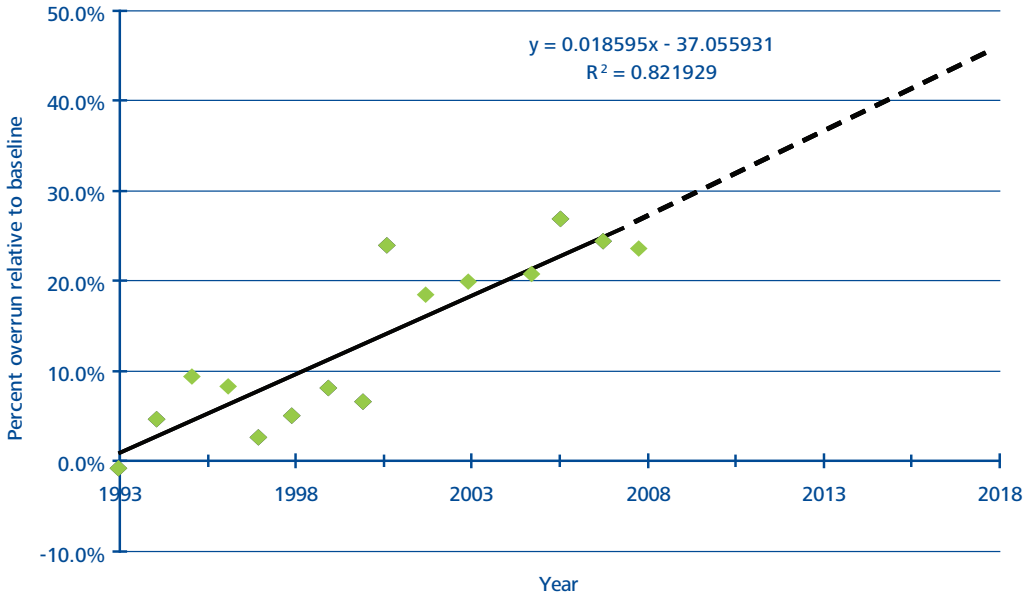
Figure 2: Schedule delays [7]



Source: GAO analysis of DCO data.

Note: This reflects planned or actual delivery of initial capabilities for programs with comparable schedule data.

Figure 1: Budget overruns continue to accelerate [6]



(Note: analysis based on real baseline year dollars)

Understanding the root causes

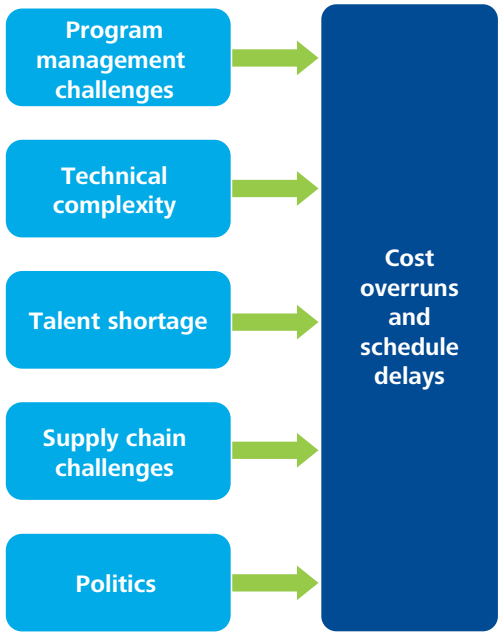
Delays and overruns for DoD programs are not without precedent. In 1986, the Packard Commission report found that DoD weapons systems development "takes too long and costs too much." In the 1990s, Congress passed several laws designed to improve acquisition performance: the Federal Acquisition Streamlining Act of 1994; the Federal Acquisition Reform Act of 1996; the Defense Reform Act of 1997, and the Federal Activities Inventory Reform Act of 1998. Yet, in 2005, a series of Senate Armed Services Committee hearings concluded that although some improvements had been made, the same basic problems existed.

In his opening statement at the Senate Armed Services Committee Hearing on DoD Acquisition of Major Weapons Systems, June 3, 2008, Senator Carl Levin said, "These cost overruns happen because of fundamental flaws that are built into our acquisition system. DoD acquisition programs:

- Fail because the Department continues to rely on unreasonable cost and schedule estimates
- Establish unrealistic performance expectations
- Insist on the use of immature technologies
- Costly changes to program requirements, production quantities and funding levels in the middle of ongoing programs."

Our in-depth analysis and experience suggests that the underlying causes for cost overruns and schedule delays in A&D fall into five major categories (Figure 3).

Figure 3: Root causes



The remainder of this study takes a detailed look at each of these root causes, and offers solutions and practices we believe can help address the problem.

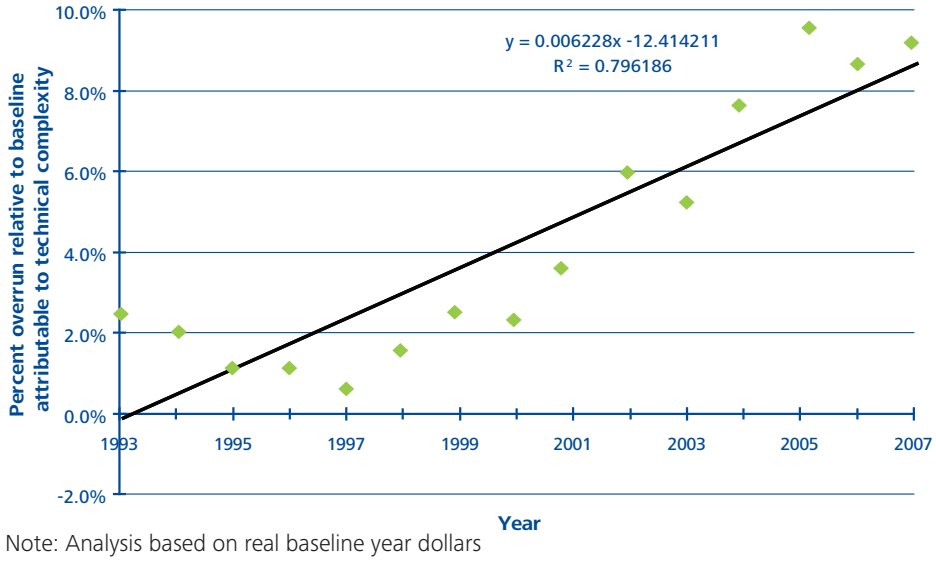
Technical complexity

The aerospace industry has made great technological advances in functionality and performance over the past 50 years. Digital product definition, computational fluid dynamics, and sophisticated engineering analysis have enabled vast improvements in materials, propulsion, communications and avionics. These advances, in turn, have resulted in important contributions to society and history, including the moon landing, the end of the Cold War, and ubiquitous and affordable global freight and passenger jet transportation.

product development process. Unpredictable interface errors, integration challenges, difficult cost/functionality tradeoffs, and variability can challenge even the best managed programs, resulting in schedule misses and cost overruns.

The challenges associated with technical complexity continue to grow over time. Deloitte's analysis of DoD data from 1997 to 2007 shows that technical complexity accounts for an ever-increasing percentage of DoD cost overruns (Figure 4). In 2007, technical complexity on average produced an

Figure 4: Technical complexity increases overruns[8]



Note: Analysis based on real baseline year dollars

For the defense industry, technology advances make it possible to develop weapons systems that are more powerful and sophisticated than ever before. However, this increased functionality – combined with ever-increasing precision, tighter tolerances, and increasing complexity – make it extraordinarily difficult to manage the

8.7 percent overrun relative to the baseline budget; this represented roughly a third of the total budget overrun of 26 percent. Our analysis shows a very high correlation of the data over the last 10 years, suggesting the problem will get worse unless the industry addresses this crucial root cause.

One reason for this growing trend is that many A&D programs rely on leading edge technologies that are still maturing. Today's programs often include sophisticated software and other advanced technologies that deliver greater functionality, but require a much higher level of integration and interoperability. To illustrate how far we have advanced, one needs only to recall the fascinating CNN live footage from the first Gulf War that showed GPS precision-guided missiles launched at sea 200 miles away from Baghdad striking the vent on the roof of Saddam Hussein's Presidential Palace – an unimaginable precision that seemed like something right out of a Star Wars movie. Also, consider the evolution of the jet fighter (Figure 5). A fifth generation aircraft with multi-targeting, stealth, and net-centric warfare capabilities is clearly superior to a Vietnam-era aircraft such as the F-4 Phantom. Yet it is also far more complex and must be rigorously designed and tested to ensure the various sub-systems work together.

Generation	Characteristics	Armaments
1st Generation Mig 15, F-86 Sabre	Basic turbojet, less than Mach 1, no radar	Dumb bombs, rockets, and guns
2nd Generation F-100	Efficient turbojet, supersonic speeds, basic radar	Basic air-to-air missiles
3rd Generation F-4 Phantom II	Multi-purpose fighters with relatively advanced radars	Air defense and ground attack weapons
4th Generation Mig 29, F-16	Increasingly sophisticated avionics with more emphasis on maneuverability than speed	Weapons supporting multirole ability of fighter such as long-range air-to-air missiles
4.5th Generation F-18 E/F Super Hornet	Limited stealth characteristics, advanced AESA radars and vastly improved electronics; Use of composites in the structure	Smart munitions
5th Generation F-22	Ability to operate in a net-centric system, digital cockpit, and stealth features	Smart munitions

This phenomenon of increased complexity is even evident within a single integrated system. For example, advances in jet engine technology have delivered remarkable improvements in thrust and reliability. Through the use of advanced materials and design tools, fuel efficiency has improved by more than 90 percent[10]. However, the downside is that today's jet engines must be designed and built to much tighter tolerances and require more time to develop, test, and manufacture.

When weapons systems were less complex, the development cycle was much shorter. For example, the Manhattan project created the most advanced and powerful weapon of its time (the atomic bomb) and was completed in less than three years. In contrast, a modern bomber or jet fighter – with all of its complex subsystems and avionics – generally takes at least 10-15 years to design and produce. (Figure 6)

As the timeline increases, so does the number of technology developments that occur during the course of the program. After all, technology doesn't stand still while complex weapons systems are being developed.

Parts and subsystems continually evolve and their designs continue to change and improve after they are sourced to suppliers, which means they are often obsolete before the first unit rolls off the production line. Customers naturally want the latest subsystem technology advances incorporated into their products – even for products they ordered years earlier. Unfortunately, designs that continue to evolve once the product definition is "frozen" can become a root-cause problem. With the increased inter-connectivity of designs, a change to one part often affects other parts in unpredictable ways – creating a ripple effect that can have serious consequences for the overall cost and schedule. The recent Deloitte survey of

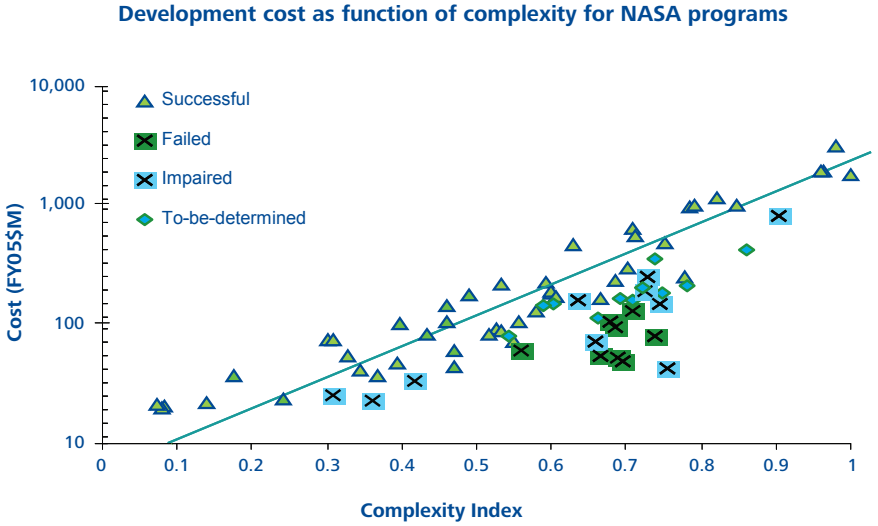
Figure 6: Today's complex projects take longer than ever [11]

Program and year of first use	Years to 1st use from contractor start
Historical Programs	
Manhattan Project (1945)	2.5
F-104 (1958)	5
Intercontinental Ballistic Missile (1958)	3.5
SR-71 (1962)	3
Apollo (1967)	8
Recent Programs	
Bomber Program (1993)	11
Satellite Program (2009 expected)	10
Satellite System (to be determined)	>20
Jet Fighter A (2005)	14
Jet Fighter B (2009 expected)	13

government and A&D professionals showed that one of the main problems related to technical complexity was "configuration changes made [without] enough attention to interoperability, interface integration, and test requirements[12]."

The riskiest programs are generally those that combine high complexity with tight budgets (Figure 7). According to the data, the risk of program failure (or significant impairment) generally rises with increased complexity – especially for programs that may have been under-funded to begin with.

Figure 7: High complexity, low budgets projects are riskier [13]



Solutions and recommended practices

Both industry and government have a shared role in tackling the issue of technical complexity. Key activities:

- Dividing programs into less complex work packages with shorter durations. Time is a clear predictor of budget and schedule risk. The longer the program, the greater the risk.
- Not approving contracts for system development and demonstration (SDD) until the underlying technology is proven. Technology maturity is critical to program success, and should therefore be required prior to committing billions of dollars to development contracts.
- Requiring the DoD and armed services to set a program's critical design requirements and priorities. Defense contractors cannot be expected to make the appropriate affordability trade-offs and "stand-in" for the customer.
- Improving defense contractor capabilities in systems engineering, integration, and testing. Providing more slack time in the schedule to react to unanticipated technical challenges.
- Creating budgets that reflect technical complexity risk and realistic assumptions.

Talent shortage

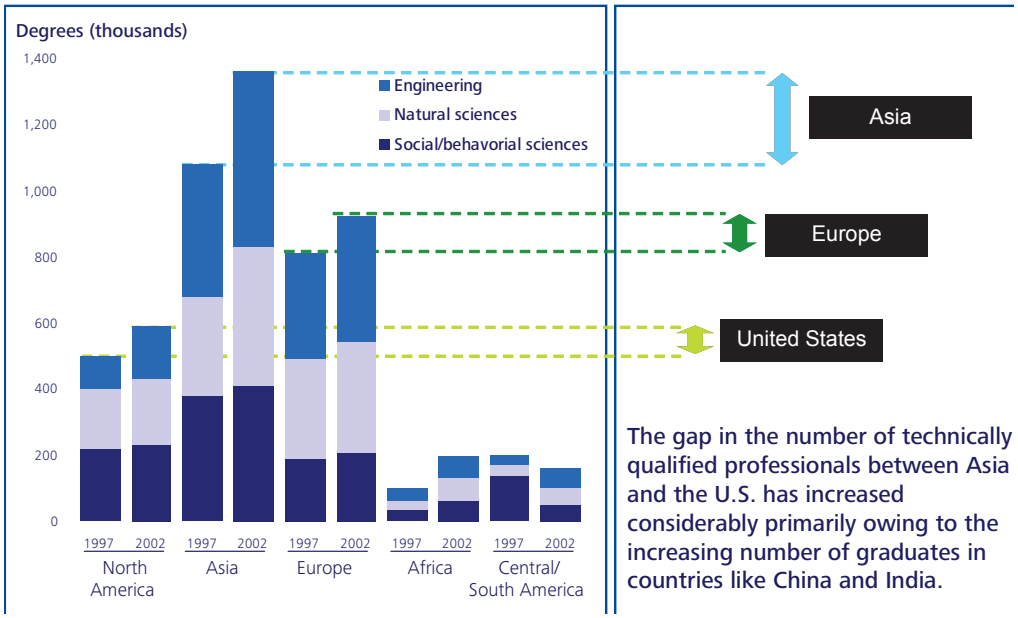
In Deloitte's recent survey, one third of participants called the current A&D talent shortage a "crisis" and a "root cause of the $295 billion cost overrun cited by the GAO." Another 30 percent predicted that a talent crisis is "right around the corner[14]."

> *"NASA has three times as many technicians over the age of sixty as under the age of thirty"*
>
> **Sean O'Keefe**
> Former NASA Administrator[18]

Numerous studies suggest that the A&D talent shortage is likely to get worse before it gets better. According to a study by the Defense Manpower Data Center, baby boomers and older workers comprise more than 70 percent of the DoD and civilian AT&L (acquisition, technology & logistics) workforce, while people under the age of 30 comprise less than 10 percent[15]. Another study estimates that by the end of 2008, 27 percent of our nation's A&D manufacturing workforce will be eligible for retirement[16]. And according to the National Science Foundation, the number of science, technology, and engineering retirements will increase dramatically over the next 15 years[17].

One of the biggest challenges is that the educational system in the United States is producing fewer qualified scientists and engineers, a long-term trend that threatens to undermine the competitiveness of our defense industry. Between the years 1997 and 2002, the percentage of college students pursuing science, technology, engineering and math (STEM) degrees in the United States declined significantly, while the percentage in Asia and Europe continued to rise (Figure 8).

Figure 8: Asia and Europe are producing far more science and engineering graduates [19]



The gap in the number of technically qualified professionals between Asia and the U.S. has increased considerably primarily owing to the increasing number of graduates in countries like China and India.

Source: National Science Board, Science and Engineering Indicators 2006

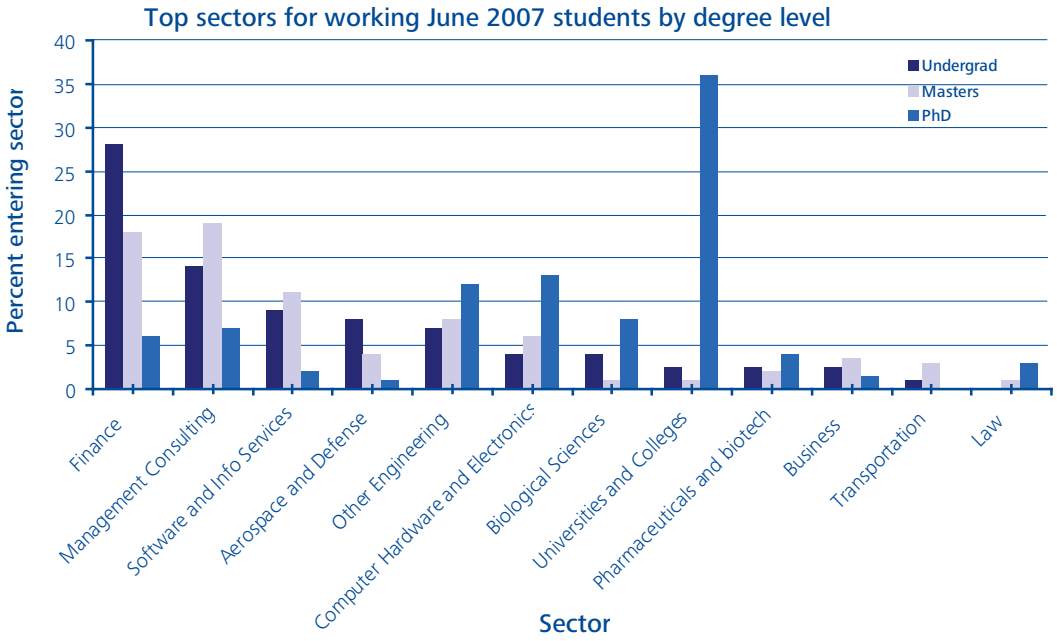
And, we could find no evidence that this trend has abated in the last six years.

This widening gap creates tremendous challenges for our A&D industry and puts our nation's security at risk. To make matters worse, many of the students in U.S. universities are foreign nationals who may have trouble qualifying for key security clearances, or who plan to return to their home country after graduation. In light of these trends, Nobel laureate Richard Smalley predicts that by 2010, 90% of all scientists and engineers with PhDs will be living in Asia[20].

Another problem is that many qualified students do not seem particularly interested in working in aerospace and defense. A 2007 survey of MIT undergraduates showed 28.7 percent going into finance, 13.7 percent into management consulting, and just 7.5 percent into A&D (Figure 9). Employers with the largest number of hires included McKinsey, Google, Morgan Stanley, and Oracle. No A&D contractor or government office was in the top 10.

These trends may lead to a "hollowing out" of core talent in defense contractors, NASA, and the DoD. To make matters worse,

Figure 9: Top graduates shy away from A&D [21]

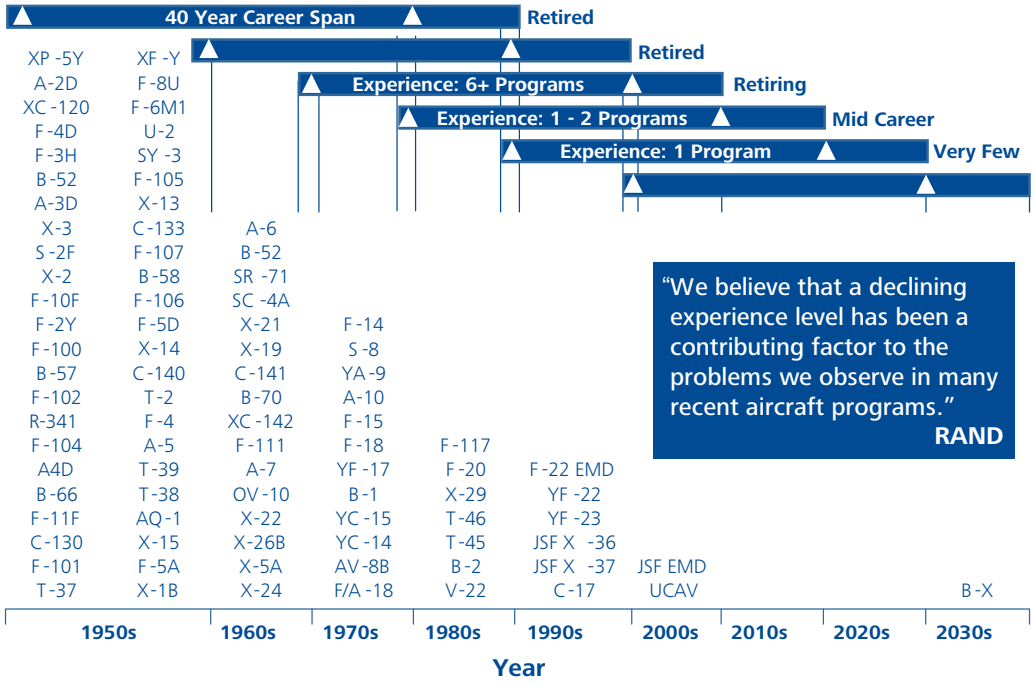


according to a RAND study, today's A&D workers do not enjoy the same breadth and diversity of programs as previous generations. With each successive decade, there have been fewer new aircraft programs, resulting in less professional exposure over a 40-year career (Figure 10). This declining experience level was cited as a contributing factor to the problems experienced by many recent aircraft programs[22].

The talent shortage in systems engineering is particularly acute, contributing to widespread quality and budget problems. This is true both for buyers and suppliers. According to a recent estimate, the number of civilian and uniformed engineers on the Air Force's core acquisition staff has been reduced by 35 to 40 percent over the last 14 years[23]. A&D contractors face a similar shortage of experienced employees with a broad understanding of systems integration. The result? Cost overruns and schedule delays.

Figure 10: Today's A&D workers have fewer programs to learn from [22]

(Vertical bars: Military aircraft program starts. Horizontal bars: Typical 40 year career span.)



Source: RAND Study (Chart by Northrop Grunman, Aerospace Industries Association

Solutions and recommended practices

The DoD and armed services have begun to implement a number of resolutions designed to address the talent problem. Defense companies are also beginning to take action, and more success is anticipated. Key activities to continue are:

- Retaining much needed experience by creating financial incentives for "baby boomer" engineers and technicians.
- Establishing mentorship programs to accelerate development for younger workers.
- Fostering interest in math and science among middle school and high school students. Establishing programs to generate excitement, identify promising talent, develop potential, and create a recruiting pipeline for future talent. As it stands, fewer than 15 percent of U.S. high-school graduates have sufficient training in math and science to even begin pursuing an engineering degree.
- Modernizing HR programs and launching "total rewards" initiatives that provide employees with a comprehensive and balanced package that includes compensation, benefits, career development, and work environment.
- DoD should consider restoring higher allowable costs for independent research and development, enabling A&D companies to cultivate "sandbox" talent. This talent could be called upon to solve thorny development and production challenges.

Supply chain challenges

A&D supply chains have undergone a major transformation in recent years. Original equipment manufacturers (OEMs) and large platform contractors are shedding more and more of their manufacturing and subsystem assembly work. At the same time, OEMs are streamlining their base of suppliers in order to create greater economies of scale. For example, a major aircraft OEM reduced its supplier base from 350 in 1999 to only 38 in 2004. Tier one suppliers are increasingly being asked to invest in technology development in exchange for incumbent positions on platforms. Lower tier suppliers are taking on increasingly complex design and manufacturing tasks, including activities such as requirements definition, systems engineering, and configuration management.

These shifts have made OEMs and large platform contractors increasingly dependent on their suppliers – increasing overall risk. In fact, some key tier two and tier three suppliers are becoming critical bottlenecks and wielding significant power over much larger prime contractors.

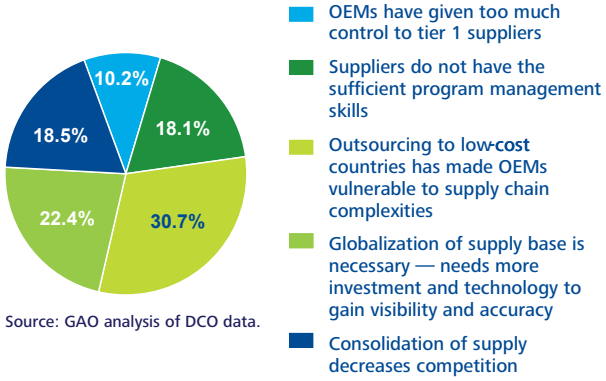
At the same time, pressure to reduce costs has shifted a significant amount of commercial aerospace work to lower cost regions. East Asia, Eastern Europe and Latin America are emerging as key growth regions for lower cost labor to support the industry. In Deloitte's survey, this outsourcing trend was cited as the biggest supply chain risk (Figure 11). For U.S. defense contractors, outsourcing for major components and subassemblies also is on the rise, although

Solutions and recommended practices

The industry is taking significant steps to streamline supply chains, boost efficiency, and better manage program performance, but could do more. Key activities:

- Assisting tier 1 suppliers to mature their supplier oversight, monitoring and performance metrics reporting processes
- Developing a supply chain strategy early in the program lifecycle which considers design, manufacturing and aftermarket requirements.
- Identifying key suppliers and building collaborative, risk sharing relationships (as opposed to the more traditional, arms-length transactional model).
- Mapping out the supply chain at multiple levels to identify key risk points and relationships that can be proactively managed to avoid failures.
- Developing leading supply chain indicators that help avoid risks, and then incorporating them into standard program management techniques.
- Building a supply chain organization that can actively monitor and manage multiple networks and linkages across the extended supply chain. Acting quickly to address problems.
- Creating a supply chain "architect" to drive integration across the supply chain's various dimensions and stakeholders.

Figure 11: Major supply chain challenges [25]



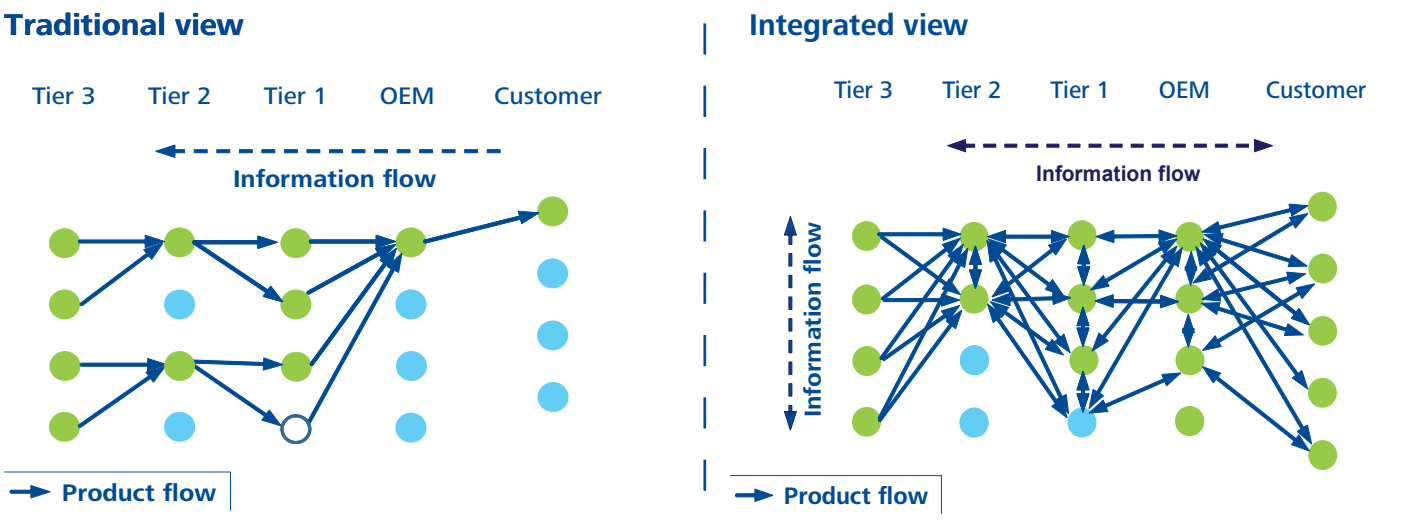
Source: GAO analysis of DCO data.

the work is contracted to U.S. suppliers due to security requirements.

Under the traditional supply chain model, the OEM was at the center of the action and every supplier had a distinct and narrowly defined role. But in today's multi-dimensional supply chain, suppliers play a much larger role and often interact directly with each other (Figure 12).

This new supply chain model has the potential to be more efficient; however, it is also more complex and harder to control. Increased reliance creates greater risk, which requires greater oversight and program management. Yet the necessary oversight and management does not always happen. Also, lower tier suppliers tend to have less robust capabilities for managing programs and risk.

Figure 12: Today's supply chains are multi-dimensional and complex



Supply Chain characteristics

- Linear
- Power concentrated within one key node (e.g., OEM)
- Distinct roles/business models for each player
- Distinctive tradeoff between cost and service levels
- Sequential/hierarchical management

Supply Network characteristics

- Multi-dimensional
- OEM has multiple chains-product, experimental and aftermarket
- Power unevenly distributed across network nodes
- Multiple roles/business models for each player
- Simultaneous service/cost improvement
- Multi-tier interaction, points of flexibility

Politics

"DoD's flawed funding process is largely driven by decision makers' willingness to accept unrealistic cost estimates and DoD's commitment to more programs than it can support." – GAO [26]

The aerospace industry is synonymous with prestige, power and politics. Nations compete hard to win manufacturing contracts in order to increase their industrial base and create high tech employment. At the same time, individual politicians lobby for factories in their local districts. Although the resulting decisions might be politically expedient, they often fail to produce the most efficient results. For example, a European next-generation fighter program has multiple locations for parts production, subassembly, and final assembly – an approach that has more to do with the politics of where jobs are located, rather than trying to optimize supply chain performance. Similarly, schedule delays for a large commercial aircraft program were at least partly caused by the fact that factories in Germany and France were using different parts design and software tools.

One of the biggest problems is a flawed funding process based on unrealistic cost estimates. Most programs are funded and launched while there is still significant uncertainty about everything from systems and technologies to integration, interoperability, and supply chain requirements. This lack of certainty and knowledge makes it difficult or impossible to make informed funding decisions, which often leads to cost overruns and schedule delays.

Figure 13: Quantity reductions lead to sharply higher unit costs [27]

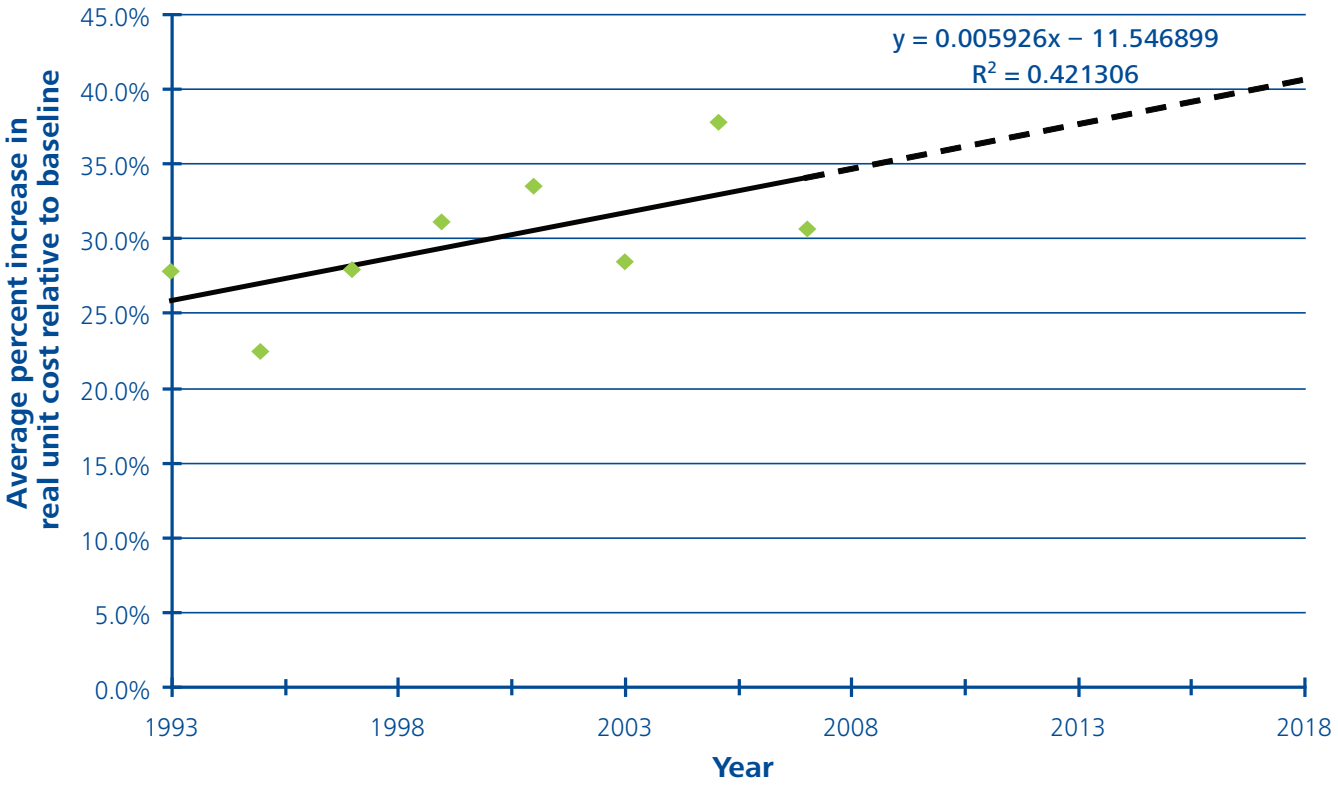
	Baseline # units	Adjusted # units	% Change	Baseline unit cost ($M)	Adjusted unit cost ($M)	Unit cost increase ($M)	Unit cost increase %
1980's							
Strategic missile	845	561	(34)	31.4	47.0	15.6	50
Helicopter	578	382	(34)	2.9	5.8	2.9	100
1990s							
Launch vehicle	181	138	(24)	72.5	186.0	113.5	157
Helicopter	758	671	(11)	7.5	14.6	7.1	95
2000s							
Satellite	6	4	(33)	923.0	2,340.8	1,471.8	154
Transport aircraft modernization	519	222	(57)	6.4	20.3	13.9	217

(All $ figures are in constant baseline year dollars. Program status based on most recent or final reports as published in "Selected Acquisition Reports.")

Another problem is that DoD programs generally span multiple years, yet congressional budgets are approved annually. As a consequence, approved programs are forced to re-justify themselves every year. In the process, Congress often decides to cut the number of program units in order to control the program budget. This reduced order volume sends unit costs spiraling higher because upfront development costs are now spread across fewer units (Figure 13). In cases like these, if Congress had known how high the final cost-per-unit would be, it might not have funded the programs in the first place.

Based on Deloitte's analysis of DoD data (Figure 14), the average percentage increase in unit cost relative to baseline jumped from 28.4% in 1993 to the current 31.2% in 2007 and is projected to reach 41.2% by 2018.

Figure 14: Unit costs are rising [28]



(Note: analysis based on real baseline year dollars)

According to former U.S. Comptroller General David M. Walker: "At this time DoD is simply not positioned to deliver high quality products in a timely and cost-efficient fashion. DoD starts more weapons programs than it can afford and sustain, creating a competition for funding that encourages low-cost estimating, optimistic scheduling, over promising, and suppressing of bad news. Invariably, with too many programs in its portfolio, DoD and the Congress are forced to continually shift funds to and from programs – undermining well-performing programs to pay for poorly performing ones[29]."

Solutions and recommended practices

Over the past three years, Congress has enacted legislation which, if followed, could instill more discipline into the front-end of the acquisition process. One key element of this legislation requires that specific levels of knowledge be demonstrated at critical decision points early in the acquisition process – before programs enter the technology or system development phase. Another key element requires DoD to report on strategies for balancing allocation of funds and other resources among major programs, and to identify strategies for enhancing the role of program managers in carrying out programs.

GAO reports state that improved weapon program outcomes require discipline, accountability, and fundamental changes in the acquisition environment. The reports indicate that DoD does not commit full funding to develop major weapon systems when the programs are initiated, despite a policy to do so. The GAO believes that a knowledge-based approach could improve major weapon system program outcomes. Key activities to help improve the situation are as follows:

- Developing and implementing a strategy to bring DoD's current portfolio into balance by aligning the number of programs – and the cost and schedule of these programs – with available resources.
- Requiring that all new programs have manageable development cycles, realistic cost estimates, and planned and programmed full funding for the entire development cycle.
- Requiring all program cost estimates at key funding milestones be reported as a range of likely costs that include the associated levels of risk and uncertainty.

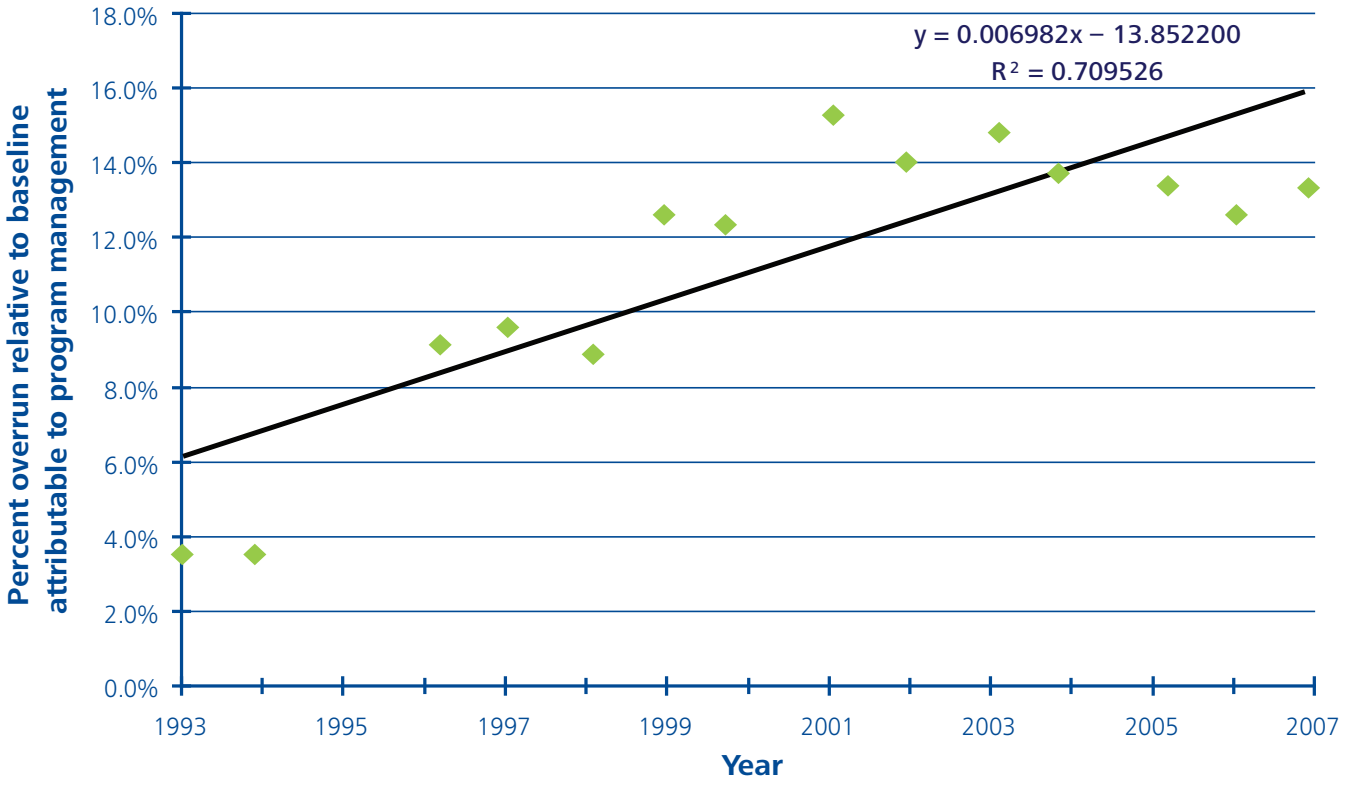
In addition to the GAO recommendations, the Acquisition Reform Working Group has provided Congress with a wish list to help guide lawmakers as they draft defense authorization legislation for fiscal years to come. One of their recommendations is to develop a "new management frame of reference" for creating "synergy rather than friction" in the blended government/ contractor workforce. They believe this frame of reference should account for the "new realities of Government procurement and the role that both contractors and civilian employees must play to achieve the Government's mission."Government's mission."

Program management challenges

The A&D industry has turned in spectacular program management performance in the past. For example, President Kennedy announced that, within a decade, the United States would land a man on the moon – a program that was able to meet its goal by July 1969. However, the aforementioned challenges – technology complexity, talent shortages, supply chain diseconomies, and political factors – make the task of managing program budgets and schedules extraordinarily difficult.

Moreover, our detailed analysis of DoD data shows that the program management problem is getting worse. Since 1989, program management activities such as planning, sourcing, assurance, staffing, finance and integration have played an increasing role in driving budget overruns (Figure 15).

Figure 15: Inadequate program management contributes to overruns [30]



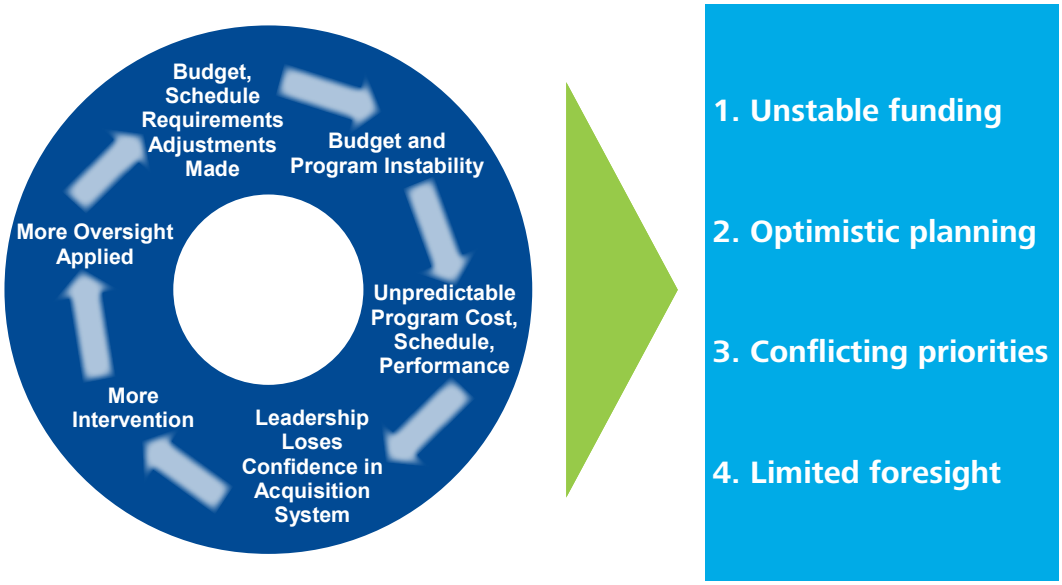
(Note: analysis based on real baseline year dollars)

Programs often run into trouble when optimistic scenarios are used as baselines in order to win approval. In addition, technical, functional and financial risks may not be identified, integrated into schedules and managed effectively. These challenges create a vicious cycle of sub-par program performance that costs shareholders and taxpayers dearly (Figure 16).

DoD program management is a complex problem with many dimensions. Specific challenges include[32]:

- DoD relies heavily on outside contractors to perform roles that have in the past been performed by government employees. This raises questions about DoD's capability to manage the affordability requirement.
- Frequent program manager turnover occurs during the system development and demonstration (SDD) phase. Since March 2001, the average program manager tenure on 39 major acquisition programs was 17 months – less than half of what is prescribed by DoD policy. This creates problems with learning curve, continuity and accountability.
- Unsettled program requirements create significant turbulence. Managers rely heavily on assumptions about system requirements, technology, and design maturity, which are consistently too optimistic.
- DoD program managers are not empowered to make go/no-go decisions. Program managers generally have little control over funding, cannot veto new requirements, and have only minimal authority over staffing.

Figure 16: A vicious cycle of budget overruns [31]



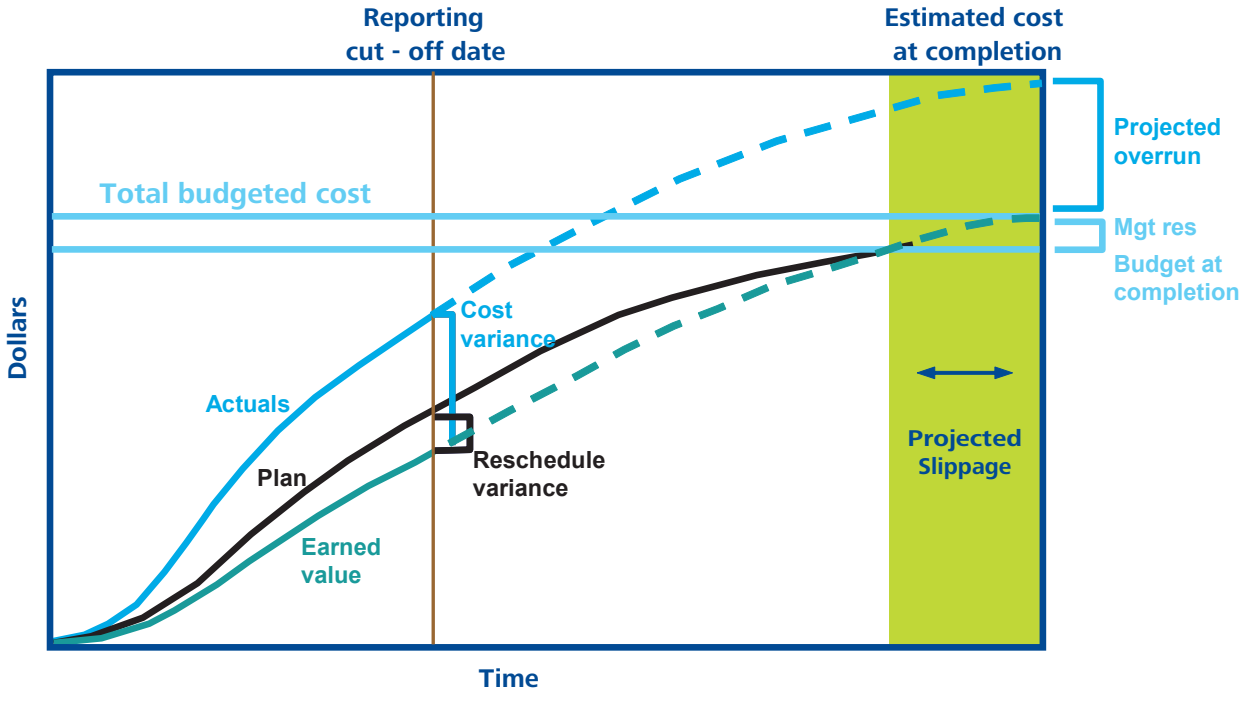
- Funding constraints contribute to cost overruns. Schedules are extended and quantities are reduced, which drives unit costs higher, as described earlier.

Risk management of regulatory compliance is key. Defense contractors are already subject to numerous regulatory, legal, and contractual requirements. However, Congress is providing increased oversight and requiring greater accountability in contracting. It is also increasing the disclosure requirements for overpayment and fraud. Pentagon auditors continue to increase their focus on cost and financial reporting systems, and are swift to suspend unsupported costs from billings. They are also placing increased emphasis on fraud indicators. These changes have consequences for program management throughout the entire contract life cycle.

Looking ahead, the Director of Defense Procurement recently published a memo promoting the use of earned value measurement requirements and reporting[33]. Earned Value Management (EVM) provides program managers with accurate, reliable, and timely feedback on cost and schedule performance throughout the lifecycle of their program (Figure 17). This would enable program managers to resolve issues before they become major problems.

This earned value approach is one of the defense industry's most useful program management tools, and is now mandatory for cost and incentive contracts of $20 million or more.

Figure 17: Matching costs with value received (Earned Value Management)[34]



In addition, section 853 of the Defense Authorization Act for 2007 addresses the issues of program manager empowerment and accountability. The act requires the Secretary of Defense to develop a strategy for enhancing the role of program managers in developing and carrying out defense acquisition programs. Key focus areas for improvement include: training, career development, program management resources and support, and awards for successful accomplishment of program objectives. Such improvements are essential for improving program management effectiveness.

Solutions and recommended practices

Defense contractors can create more value and manage risk more effectively by becoming "risk intelligent". Key activities include:

- Defense acquisition authorities need to understand and guard against "low bid" scenarios, where due to immature requirements specifications or lack of skill and talent, source selection awards turn out to be "change order" problems
- Budgets and schedules need to contain and be certified as "risk tolerant"; i.e., enough slack and contingency time is included to mitigate financial, operational, funding and human resource risks
- Establishing clear performance goals prior to program startup. Applying appropriate monitoring processes to report effectiveness and efficiency.
- Establishing an enterprise-wide definition of risk. Designing, implementing and maintaining an effective risk management program. Top executives set the tone, design, direction, and metrics; however, risk management should permeate all layers of the organization.
- Defining clear roles and responsibilities, accountability, and authority for managing program costs and schedules. Inside the organization, establishing close coordination between multiple supporting functions, executive management, and the board. Outside the organization, being sure to involve government customers and subcontractors.
- Implementing a common risk framework that is consistent with the organization's risk objectives and strategies.
- Owning the risk at the business unit and/or department level. Business units and functions should use the framework to decide which opportunities to pursue – and which hazards to avoid – rather than unilaterally "betting the farm".
- Providing management and governing bodies with improved transparency into the organization's risk management practices. Executives and the Board should keep risk on the agenda and require timely information from operations and other supporting functions for critical decisions.
- Ensuring the overall risk program has adequate support. Certain functions (e.g., legal, IT, HR, Finance) should not just own risk, but also help other parts of the business manage risk effectively. Some organizations are using their internal auditors and compliance functions not just for assurance, but also for anticipating future risks, identifying inefficiencies, and finding ways to use risk management to improve profitability.

Conclusion: Protecting the industry's future

Program management and execution in the A&D industry is becoming a problem that is simply too big to ignore. Business as usual will contribute to a fundamental breakdown of the integrity of the defense acquisition process that is so vital to maintaining global security. The GAO reports average cost overruns of 26 percent, and our analysis suggests that if significant action is not taken that figure could exceed 46 percent in ten years.

Acquisition problems in A&D are nothing new. Over the years, countless reports, policy studies, Congressional hearings, and legislative initiatives have tried to address the problem. But given the current economic crisis – and our nation's competing budget priorities – it is very likely that the DoD and A&D industry will be forced to set priorities and make difficult trade-offs about what they can really afford. What is needed is not more of the same, but nothing less than a transformational change.

Tackling this challenge will require a shared effort from everyone involved. As noted earlier, the DoD, armed services, defense contractors, and Congress all have specific opportunities to improve the acquisition process and keep budget overruns in check. Unless all parties work together to address the root causes of the problem, the A&D industry may be unable to afford its own future. Given our historic achievements in aerospace and defense, we are comforted that this is a challenge the industry can tackle successfully.

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Endnotes

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