

Modestly-Sized Aerospace & Defense Sector Is Major National Asset

Robert H. Trice

The aerospace and defense industry may be the most misunderstood sector of the national economy. With fewer than a million employees, the industry makes a disproportionate contribution to the nation's strength and prosperity. In this fact-filled essay, former Lockheed Martin senior vice president for strategy and business development Robert H. Trice corrects some misconceptions and describes key trends in the sector.

Aerospace and Defense (A&D) is among the least understood and appreciated of America's industrial sectors. Largely because of the politically charged, acronym-laden, arcane world of government contracting within which it operates, its characteristics are much debated but seldom analyzed. And due to the size, sensitivity, and secretiveness of many of its programs, it remains a convenient target of critics seeking to uncover insidious plots hatched by the "Military-Industrial Complex" and investigators determined to ferret out "waste, fraud, and abuse" of taxpayers' dollars.

Certainly there have been spectacular examples of mismanagement, incompetence and illegal behavior over the years. But a more dispassionate view of the A&D sector reveals a set of some of America's most advanced engineering and manufacturing companies operating in a unique and dynamic governmental marketplace, competing every day against world class commercial enterprises in the private sector for financial and human capital, the lifeblood of any successful business. This paper seeks to highlight some relevant aspects of A&D as a business in the context of the larger U.S. industrial landscape.

The first thing to note about the Aerospace and Defense sector is its modest size. There are about 140 million civilians in the 2010 recession battered U.S. workplace. The Aerospace Industries Association estimates today there are about 819,000 private sector A&D workers, down from 1.2M in 1990, the end of the Cold War. Just to put matters in context, there are roughly 2.8M civilian federal government workers, 1.6M uniformed military, 1.1M lawyers, and about 2.3M people in jail in America. And while there could be some double counting in these last two numbers, by any definition A&D is a "niche" industrial player.

A&D workers are well compensated. The hourly wage of production workers is higher than any other sector (\$33), \$2 higher than auto workers, \$10 higher than government employees, and three times that of leisure workers (\$11). A&D employees are twice as likely to be represented by a union (16%) than the rest of the private sector. With annual earnings for all employees at \$79K in 2009, the average A&D worker is second only to those working for "High Tech" (\$84K) companies, and ahead of government (\$74K) and auto employees (\$73K). In contrast, the average U.S. salary in 2009 was \$38K, and the average employee in leisure and

hospitality made \$27K. Nowhere else are the implications for American standards of living so clear when we talk about transitioning from a more manufacturing-based economy to a more service-based one.

This small sector is also, year after year and by far, the leading positive contributor to the U.S. balance of trade. Including commercial aircraft exports, A&D's net exports in 2008 were about \$58B. The second leading sector was semiconductors at roughly \$22B, followed by foods, feeds and beverages at about \$20B. In contrast, pharmaceuticals contributed a net negative \$40B and computers and accessories a minus \$60B to the overall trade balance. What this tells us is that A&D remains one area of engineering and manufacturing excellence for the United States, and one where we can more than hold our own with global competitors.

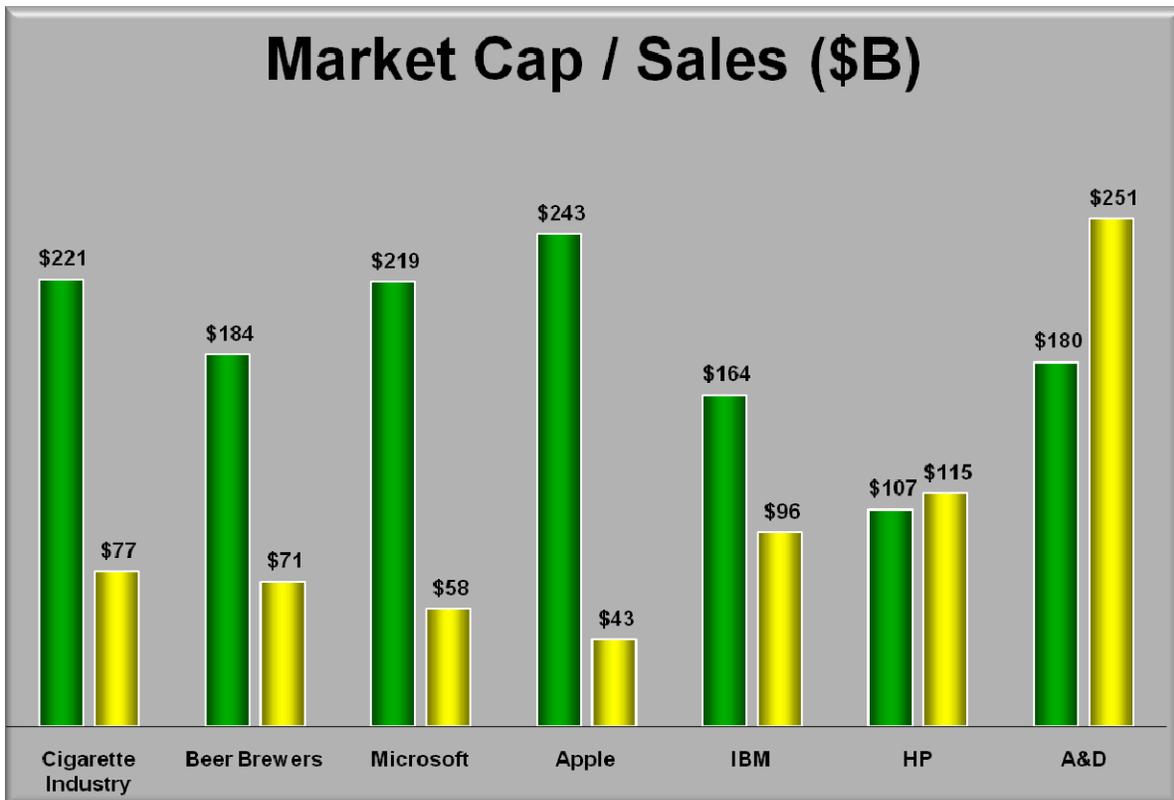
A&D is also a driving national engine for research and development. While the average U.S. company spends less than three percent of net sales on R&D, aerospace and defense companies average over 13 percent. And while the bulk of these funds come from the Department of Defense and other federal agencies, many of the technologies and innovations spawned by these investments find wide commercial applications and generate substantial public benefits. Al Gore did not invent the internet, the Defense Advanced Research Project Agency (DARPA) supported by industry, did. Examples of commercialization of defense technologies are legion: From hydraulic brakes, cordless power tools, pagers, smoke detectors and airbags to GPS, EZPass, air traffic control systems, satellite communications and climate monitoring.

But in the end, the industry and the DOD acquisition community exist to develop, produce and field the most militarily effective systems possible for the men and women who protect this nation and its freedoms, its interests and its allies. And when the U.S. Government and the A&D sector get it right – which is most but certainly not all of the time – together they can generate genuinely eye-watering capabilities. From nuclear aircraft carriers and submarines to stealth bombers and fighters to satellites to precision munitions to unmanned vehicles to integrated air and missile defense systems to communications, command and control systems to training and logistics, this government and industry partnership has largely achieved its mission of producing the world's most powerful military force. Could this have been accomplished more cost effectively? Have some of the threats these systems were designed to thwart dissipated? Are the threats, and therefore the requirements, changing? And must the government and the A&D sector adapt to the new realities to remain relevant? To each the answer is a resounding “absolutely.” But unless the alternative is to try to reconstruct the government owned and run arsenal system that was in place until World War II, it's most likely in our nation's and its allies' best interests to see that this A&D industry remains vibrant and healthy, able to effectively compete with other private sector companies for human talent and financial capital.

The so-called Military-Industrial Complex just isn't what it used to be. At the height of the Cold War in 1960, the economic value of the A&D sector as measured by market capitalization (share price x total number of shares) was about 4.2% of the total value of the Standard and Poor's (S&P) index of the 500 largest American companies. By 2000 that number had shrunk to around one percent, and at the end of 2009, in spite of the nation's engagement in two wars and a decade of steady increases in defense spending, the collective worth of Lockheed Martin, Boeing, Northrop Grumman, General Dynamics, Raytheon, L3 and Honeywell – the

“Big 7” – was around \$180B, or about 2% of the S&P 500’s total value of \$9.3 trillion. And while FY2010 total defense spending, including the cost of the wars in Iraq and Afghanistan, approached five percent of Gross Domestic Product (GDP), the Research and Development (R&D) and Procurement accounts that feed the defense industrial base were at about two percent of GDP. So, to those who claim we could solve this nation’s sovereign debt woes by simply eliminating weapons production and dismantling the A&D sector, think again.

Industry Comparisons



Aerospace and Defense: Lockheed Martin, Boeing, Northrop Grumman, General Dynamics, Raytheon, L3, and Honeywell Corporation

Cigarette Industry: Lorillard, Reynolds American, Vector Group, Star Scientific, Altria Group, Philip Morris International, and British American Tobacco Industries

Beer Brewers: Anheuser-Busch InBev, Fomento Economico Mexicano, Companhia de Bebidas das Americas, Molson Coors Brewing Co, Compania Cervecerias Unidas, Boston Beer, and China New Borun Corporation

More interesting is how investors view the relative economic value of different sectors and companies (chart 1), by comparing sales to total worth (market cap). Take Apple, for example, as a high tech competitor for financial and human capital. Roughly the size of Lockheed Martin in terms of 2009 sales (\$45B versus \$43B), the value of its stock is more than a third larger than the Big 7 A&D companies combined. On the other end, investors also clearly favor beer and cigarette industries over A&D, and are prepared to pay a significant premium to buy their stock. Why? In both cases (and for IBM and Microsoft as well) investors are

convinced they'll get a bigger bang for their investment buck. All publicly traded companies are ultimately judged on how well they meet their economic raison d'être of returning value to their shareholders. Those deemed more successful in attracting financial capital through higher returns are also likely to have an advantage in attracting that other precious commodity, human capital. And in this instance, A&D companies compete directly with the likes of Hewlett Packard, IBM, Apple and Microsoft for the best and brightest software, systems, mechanical, and electrical engineers and scientists this nation produces.

Some argue that A&D companies make too much money. The question here is relative to whom? Using a standard measure of gross earnings (earnings before interest, taxes, depreciation and amortization, or EBITDA) for various sectors from 2007-09, A&D lags most of its competitors with an average gross return of around 13%. How about net earnings? In 2009 the average net income or profit of the Big 7 was around seven percent, in line with the average profit margin for the S&P 500 companies, but well below the top companies from other industries such as Merck (47%), Microsoft (28%), Cisco (17%) or IBM (14%). We won't even mention the oil companies. None of the A&D companies makes it into Fortune Magazine's annual "Top 20" lists among its 500 largest companies when measured in terms of return on revenue, return on assets, percent increase in profits, or percent increase in revenue. The picture that emerges is of a relatively small, specialized A&D sector that runs in the middle of the American industrial pack in terms of profitability.

Why, then, would investors put their hard earned money into A&D companies? There are several good reasons, most related to the lack of downside risk compared with many commercial companies. With the government shouldering much of the bill for the development of the next generation of systems, most A&D companies consistently post reasonable, if not spectacular, returns on investment. With the exception of the commercial aircraft divisions of companies like Boeing and General Dynamics, A&D companies are rarely "betting the farm" on new product development, and, unlike most private companies (think Exxon, BP and Toyota), are generally indemnified by the government from catastrophic risk in the event of a disaster. The federal government tends to pay its bills on time, producing strong cash flows that companies can share with their investors through relatively high dividends, stock buy backs, and relatively low debt levels.

Because of lengthy development and production cycles, investors can occasionally take a longer view of A&D business prospects. A classic example is the F-16 fighter aircraft developed by the U.S. Air Force and General Dynamics (GD) in the 1970s, with an initial plan to build a total of 998 aircraft. More than 30 years later, and with periodic technology updates, first GD, then Lockheed and now Lockheed Martin have delivered more than 4,400 jets to the U.S. and allies, with several hundred in backlog, and no end yet in sight.

Finally A&D is frequently seen by investors as running counter to the overall market cycle. If the total market is booming A&D may be seen as a bit stolid, with less potential to deliver high, near term returns. But when markets get skittish, value investors often find solace in a sector with a well financed customer set residing within the federal government and the central governments of its friends and allies.

By definition, what sets A&D apart as an industrial sector is its unique and repeatedly demonstrated ability to produce and deliver goods and services to a frequently dysfunctional monopsony customer, the U.S. federal government, and make a modest profit in doing so. The highest barriers to entry are 1) understanding the morass of legal, bureaucratic and political processes and rules that govern how the government buys things, and 2) developing and implementing the skill sets necessary to find a way through the conflicting interests and guidance of all the players involved – the military services, Office of the Secretary of Defense, Office of Management and Budget, the rest of the White House, Congressional authorizers, appropriators, leaders and individual members, industrial competitors, the media, interest groups and public opinion – in order to actually end up with funded contracts. Those who call for reforming the acquisition system to make it “cheaper, faster, better” ignore the layers of laws and regulations that currently dictate the processes by which the government goes about its business. The Defense Acquisition University has a single chart that says it all. It’s called the “Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System,” and it attempts to pictorially depict the three major elements that drive DOD procurement: 1) The Joint Capabilities Integration and Development System (JCIDS); 2) the Defense Acquisition System; and 3) the Planning, Programming, Budgeting and Execution (PPBE) Process. The chart lays out the literally hundreds of steps that must be followed to buy and field a major weapons system. And, by the way, the three processes run separately in parallel, with minimal connectivity among them.

One reason A&D companies are sometimes charged with being costly, cumbersome, risk averse and bureaucratic is that they mirror their primary customers. And, inevitably, the periodic attempts to make the process more economical and “commercial-like” fail because this government marketplace is the antithesis of a commercial one. Commercial businesses work in generally open markets, dealing directly with multiple customers empowered to make buying decisions through individual transactions, and with growth largely constrained by anti-trust laws. A&D companies are largely dealing with a single customer set comprised of multiple, competing political constituencies, with growth and size limits often set by industrial base considerations. Commercial firms work to a price-based, closed book business model. The market determines what consumers will pay for a particular widget, irrespective of what it costs to make it. A&D companies work to a cost-based, open book business model.

Cost and price negotiations are governed by the Truth in Negotiation Act (TINA) and the Federal Acquisition Regulations (FAR) that lay out every element of contractor cost to be analyzed. To ensure A&D companies are fulfilling their DOD contractual obligations, in 2009 the Defense Contracting Auditing Agency (DCAA) employed 4,000 people with a budget of \$433M, the Defense Contract Management Agency (DCMA) had 10,000 civilians with a budget of over \$1B, and the Office of the Inspector General had 1,475 auditors and a budget of \$288M. In addition, there are military service acquisition and program management offices for every program, the Office of the Secretary of Defense acquisition community and Congress’ auditing arm, the General Accountability Office (GAO). The Department of Defense has stated that it will further increase oversight by hiring 20,000 more acquisition professionals, at a time of flattening acquisition budgets. A&D companies have to staff their program management, finance, contracts and internal audit functions to service these legally mandated government requirements.

Unless a commercial company really messes up (Enron, AIG, BP, Lehman Brothers), it is likely to face limited government oversight. By the very nature of its work, an A&D company lives with significant oversight every day. A commercial company faces very limited controls over most exports; defense exports, quite rightly, are by far the most highly regulated of any industrial sector. Each step along the way to a foreign sale of U.S. defense equipment requires its own State Department export license, and each proposed sale over \$50M is subject to Congressional review. As of 2010, there are literally tens of thousands of active licenses that govern how A&D companies approach the international marketplace.

And finally, a commercial company's product life cycles are largely driven by consumer demand. Some products go gang-busters for years while others simply go bust. For A&D companies, program life cycles are driven by the vagaries of annual budgeting and appropriations processes, changing threats, requirements, and philosophies, program performance and, in some cases, political whims. The business consequences can occasionally be surreal, and the military impacts consequential.

All business models are assumption driven, and one of the key assumptions concerns the quantities to be procured. It should come as no surprise that when, for whatever reason, original production quantities are reduced, units will cost more, in part because there will be fewer units over which to amortize the already sunk research and development costs necessary to get to the production stage. Industry does not come up with these initial "Program of Record" quantities; their customers do. Some classic examples of systems developed and produced that fall into this "cost-quantity, quantity-cost" death spiral have been the B-2 bomber (21 procured out of 132 originally planned); F-22 fighter (187 of 750); V-22 cargo aircraft (458 of 913); and the DDG-100 destroyer (3 of 32).

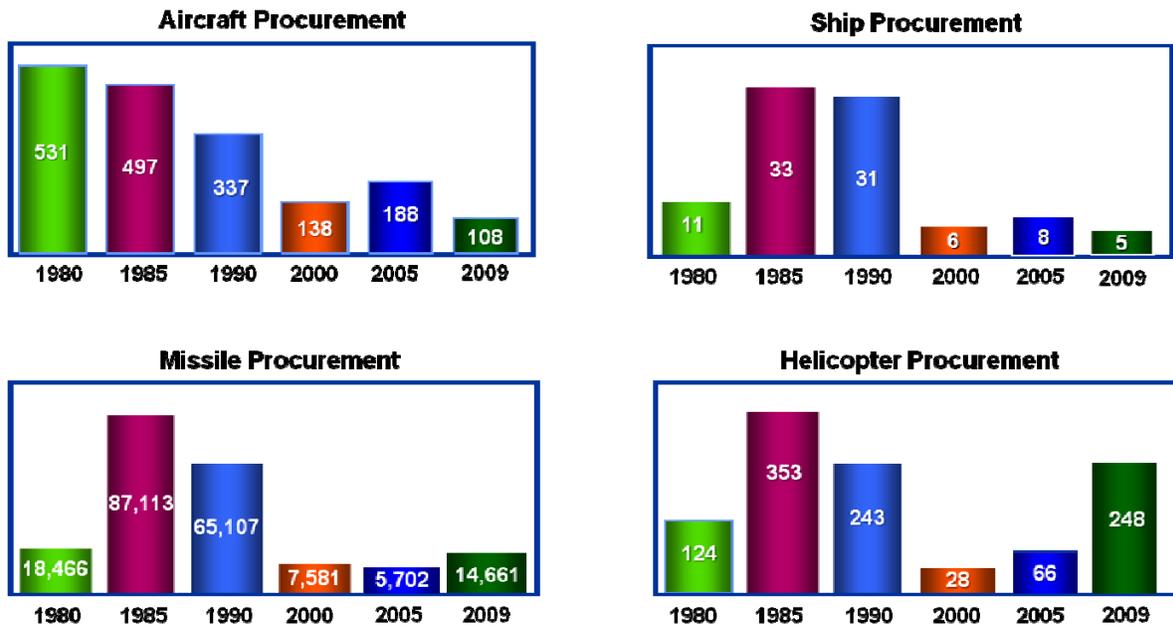
Then there are "Terminations for Convenience," where again, for any number of reasons, the Government decides that it will end development and not proceed into production. After spending \$24B, the Army's Future Combat System was abandoned; the Air Force's Airborne Laser was killed after \$7B had been spent; the Army's Comanche helicopter program spent \$9B before being terminated; the Navy invested \$5B in the next generation presidential helicopter before cancelling it; the Air Force ended its transformational satellite (TSAT) and ground systems (TMOS) after investing more than \$10B, and the Marines have been informed that it's expeditionary fighting vehicle (EFV) will be canceled after more than \$3B has been expended. By his own calculation, Secretary Gates says he cancelled about \$330B in future DOD acquisitions on a single day, April 9, 2009, and another \$78B on another, January 6, 2010.

Only governments, and only rich ones at that, can behave in such economically irrational ways, and A&D firms have had to adapt periodically to a dynamic and ever-changing environment in order to survive. The biggest challenges occurred in the 1990s, after the collapse of the Soviet Union, when the DOD Procurement and R&D accounts that undergird the industrial base were slashed by about two-thirds. In 1993, then Deputy Secretary of Defense Bill Perry assembled the CEOs of the major A&D companies for what is now famously called "The Last Supper." Over dinner, Perry explained that because of the "peace dividend" DOD could no longer afford the infrastructure costs of such a fragmented set of industries. He encouraged

consolidation, rationalization and increased efficiencies in order to meet the sudden and significantly lower demand for military products.

The core of the A&D industry as it looks today emerged from that mid-1990s period. At the top sit a relatively few global “prime” contractors – the Big 7, BAE Systems, Finmeccanica, EADS, Thales -- who hold the ultimate responsibility for delivering goods and services to the government, supported by well known sub-primes and systems partners like Rockwell Collins, ITT, ATK, Pratt & Whitney, General Electric and Textron. What gets less attention are the 30,000+ lower tier suppliers that produce and deliver subsystems and materials on up the chain. On average, between 60 and 75% of every dollar that goes to a prime is subcontracted out for work performed by others, including more than 20,000 small, minority-owned and disadvantaged businesses. Successfully managing those complex and incredibly diverse global supply chains is central to ensuring program performance and affordability. Recent examples from both the commercial (Airbus A380, Boeing 787, Toyota accelerators) and military (Airbus A400) worlds demonstrate the consequences of failure.

Defense Systems Procured



Source: DoD Procurement Programs P-1

Few analysts appreciate just how much the major primes’ business models have evolved since the mergers of the 1990s. That’s because it is getting harder and harder to survive as a “pure play” defense company. For though expenditures are significantly higher than a decade ago, the quantities of military systems that are actually developed and delivered cannot sustain even the remaining, downsized industrial infrastructure. Chart 2 tracks the number of various types of systems procured over time. Aircraft procurement, for example, covers all fixed wing aircraft bought by the U. S. DOD -- fighters, trainers and cargo – and shows that America is buying about two-thirds fewer aircraft in Fiscal Year 2009 than at the end of the Cold War.

Similarly, in 2009 the U.S. Navy bought five ships. Unfortunately, we have at least six major ship yards. The recent upticks in missiles and helicopters reflect demands arising from Iraq and Afghanistan.

A&D companies have reacted in at least two non-exclusive ways to persistently low demand for defense products. Several, most notably Boeing and General Dynamics (GD), diversified within the aerospace industry. In Boeing's case, a commercial airplane company bought a largely defense company in McDonnell Douglas and promptly killed its commercial arm, Douglas Aircraft. For GD the target was a commercial company, Gulfstream. The trick has been operating and competing in the two vastly different worlds of the commercial and government marketplaces simultaneously, while generating savings and synergies at the corporate level. The obvious strategic advantage is less dependence on either single aerospace market.

The other, more common approach has been to diversify within the federal government marketplace. A&D companies found that all that knowledge and experience honed over decades in doing business with DOD applied equally well in competing for work from other federal government agencies. For example, many are surprised to learn that Lockheed Martin, DOD's largest contractor, is also the largest provider of Information Technology (IT) to the U.S. Government, and has been for the last 16 years. From NASA to Commerce, Health and Human Services, FBI, and across the entire galaxy of agencies, the Big 7 find themselves competing with one another and literally thousands of other companies for federal dollars in domains as wide-ranging as logistics and sustainment, training, space exploration, support for peacekeeping operations, disaster response, energy efficiency, airport screening and cyber security.

Periodic attempts by A&D companies to diversify into non-aerospace commercial markets have been, in the words of former Lockheed Martin CEO Norm Augustine, "unblemished by success." All the attributes that contribute to their ability to compete and perform in the quirky world of federal government contracting work against them in fast-moving, price driven commercial markets. Cautious, deliberate (slow) decision-making, exquisitely engineered (expensive) product solutions and aversion to financial and reputational risks and potential legal liabilities inhibit A&D companies from expanding beyond their federal comfort zone.

Penetration into state and local government contracting has also generally proved difficult for A&D primes. In particular, the challenges of trying to "de-scope" or scale down solutions that work at the national level to meet the needs of much smaller constituencies, dealing with local political dynamics and home-front industrial interests, and the frequent mismatch between program requirements and available funding combine to make state and local a less attractive target for market expansion.

The ultimate characterization of the aerospace and defense industry is that of a multi-tiered set of private sector companies translating resources into public sector solutions for the federal government. Like all other elements of the private sector, A&D companies compete for financial capital and human talent, provide returns for their shareholders and pay taxes. What differentiates this industry is that, with the exception of Boeing and to a lesser extent General

Dynamics, most of its revenue -- and oversight -- comes from the federal government, which then uses the goods and solutions produced to help provide security and services for the nation and the central governments of its allies and friends around the world.

This relatively small slice of American industry punches above its economic weight in terms of its positive contribution to the U.S. balance of trade and the quality of its jobs, and the impact of its research and development helps sustain American technological pre-eminence. Despite its middling economic returns, it's able to attract sufficient private capital because of its relatively long business cycles and relatively lower downside risks for investors. A&D companies are consistently able to hire and retain top-tier engineering and scientific talent not only because of relatively generous economic benefits, but also because of the perceived importance of the work employees are performing in support of U.S. military and foreign policy objectives and domestic priorities. The A&D industry will adapt as necessary to the current unrelenting pressures to constrain federal spending. A serious bi-partisan effort to streamline and simplify federal acquisition processes could go a long way toward ensuring we still have a healthy aerospace and defense industrial base when we emerge at the end of the coming downward budget cycle.

Mr. Trice was assisted in preparing this essay by David Potts.