Budgeting for National Priorities

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Pruning the Defense Budget

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PAPER SUMMARY

This paper prunes superfluous expenditures from the defense budget by identifying cost-saving measures that trim defense spending without sacrificing essential capabilities. These measures include the elimination of programs no longer relevant to the current threat landscape, the termination of weapons programs with limited technical feasibility, the restructuring of overambitious acquisition strategies, and the curtailment of strategically provocative weapon systems. This paper also contains recommendations for limiting the wasteful practice of earmarking and for constraining cost growth. Relative to a baseline of current administration plans estimated by the Congressional Budget Office, the proposed expenditure reductions approach $35 billion per year. Only through thoughtful reprioritization of our finite fiscal resources will the U.S. government be able to improve its ability to secure the nation while retaining the financial flexibility to address unforeseen threats in the future.

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Introduction

Since September 2001, the Department of Defense (DoD) budget has increased 179 billion in FY 2006 dollars, or 56 percent.[1] Annual spending for national defense now exceeds the totals at the peak of the Korean War and approaches a real level of resource expenditure not witnessed since the Second World War (figure 1). It is well known that the emerging threat of terrorism necessitated much of this historic rise in defense spending. Supplemental appropriations for the Global War on Terror (GWOT) have totaled in excess of $507 billion.[2] Indeed, war-related spending accounts for about two-thirds of the overall increase in the national defense budget since fiscal year 2001.[3]

However, the substantial sums spent on the GWOT conceal another critical trend within the defense budget. Excluding direct war-related spending, the defense budget has grown nearly one-fifth since September 2001, even after adjusting for inflation.[4] This dramatic increase, which equates to close to $60 billion in additional spending each year, has been facilitated by dismal levels of congressional scrutiny. Both the quantity and quality of congressional oversight hearings related to national security have plunged in recent years.[5] The recently concluded 109th Congress now holds the dubious distinction of having logged fewer days in session than even the "Do-Nothing Congress" of 1948.[6] The result of this neglect is a national security budget that is fraught with inefficiencies. As Kori Schake, Director of Defense Strategy and Requirements at the National Security Council from 2002 to 2005, recently noted, this unchecked rise in defense spending has prevented the Department of Defense "from making hard trade-offs between what it prefers to do (continue existing weapon systems) and what the nation most needs (an agile force that can quickly defend us against terrorists)."[7]

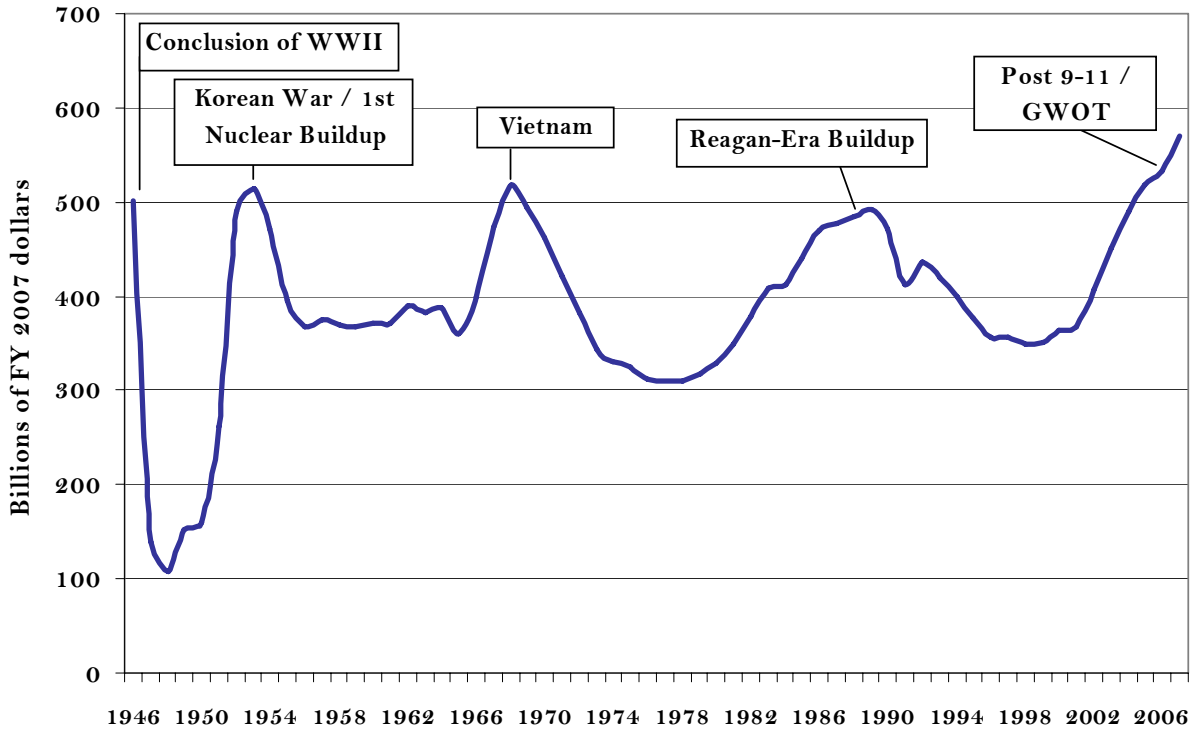
This paper prunes superfluous expenditures from the defense budget by identifying cost-saving measures that trim defense spending without sacrificing essential capabilities. These measures include the elimination of programs with limited technical feasibility, the adoption of cost-effective alternatives to failing weapons programs, the restructuring of overambitious acquisition strategies, and the curtailment of strategically provocative weapon systems that fail to enhance national security. Given this emphasis on enhancing efficiency, political actors on both sides of the aisle should find these proposals sensible.

Moreover, these measures neither require nor preclude a substantial revision of American foreign policy. The proposals contained herein presume an approach to defense budgeting that is broadly similar to the vision articulated in the 2006 *Quadrennial Defense Review*: A U.S. military that retains its dominance in terms of conventional warfare while preparing for the exigencies of asymmetric combat against mobile, loosely connected terrorist cells.[8] The proposals are also consistent with an expansive vision for American foreign policy that recognizes the importance of integrating the soft tools of diplomacy and rigorous foreign aid with the traditional instrument of military might.[9] In similar fashion, the recommendations endorsed in this paper do not conflict with efforts to improve the execution of stabilization and reconstruction missions.[10]

Recasting the contours of American foreign policy stands outside the scope of this effort. Instead, this paper focuses on eliminating the dead-weight losses imposed by poorly-performing, cost-ineffective programs in order to lower the trajectory of defense spending in preparation for an impending period of profound fiscal strain expected from the major

entitlement programs (Social Security, Medicare, and Medicaid). Adoption of the proposal contained herein should strengthen the ability of the U.S. government to secure its citizens and enhance its flexibility to address unforeseen threats in the future. Relative to a baseline of current administration plans estimated by the Congressional Budget Office (CBO), the expenditure reductions advocated in this paper approach $35 billion per year (table 1).[11] However, even if all the recommendations are adopted, total defense spending will still rise 6 percent over the next decade after adjusting for inflation.

Figure 1. Long Term Trends in National Defense Outlays
(fiscal years 1946 to 2007)



Note: Fiscal year 2006 total calculated with supplemental information from CBO 2006a. Fiscal year 2007 expected values calculated from George Cahlink, "2006 Legislative Summary: Defense Appropriations," *Congressional Quarterly Weekly*, December 18, 2006 and Leslie Wayne, "Heady Days for Makers of Weapons," *New York Times*, December 26, 2006, p. C1. Figure assumes that an additional $100 billion supplemental appropriation will pass in fiscal year 2007 in addition to the $70 billion bridge fund enacted with the fiscal year 2007 Defense Appropriations Act.

Source: *Fiscal Year 2007 Budget of the United States Government* (Table 3.1. "Outlays by Superfunction and Function: 1940-2011" and Table 10.1. "Gross Domestic Product and Deflators Used in the Historical Tables, 1940-2011").

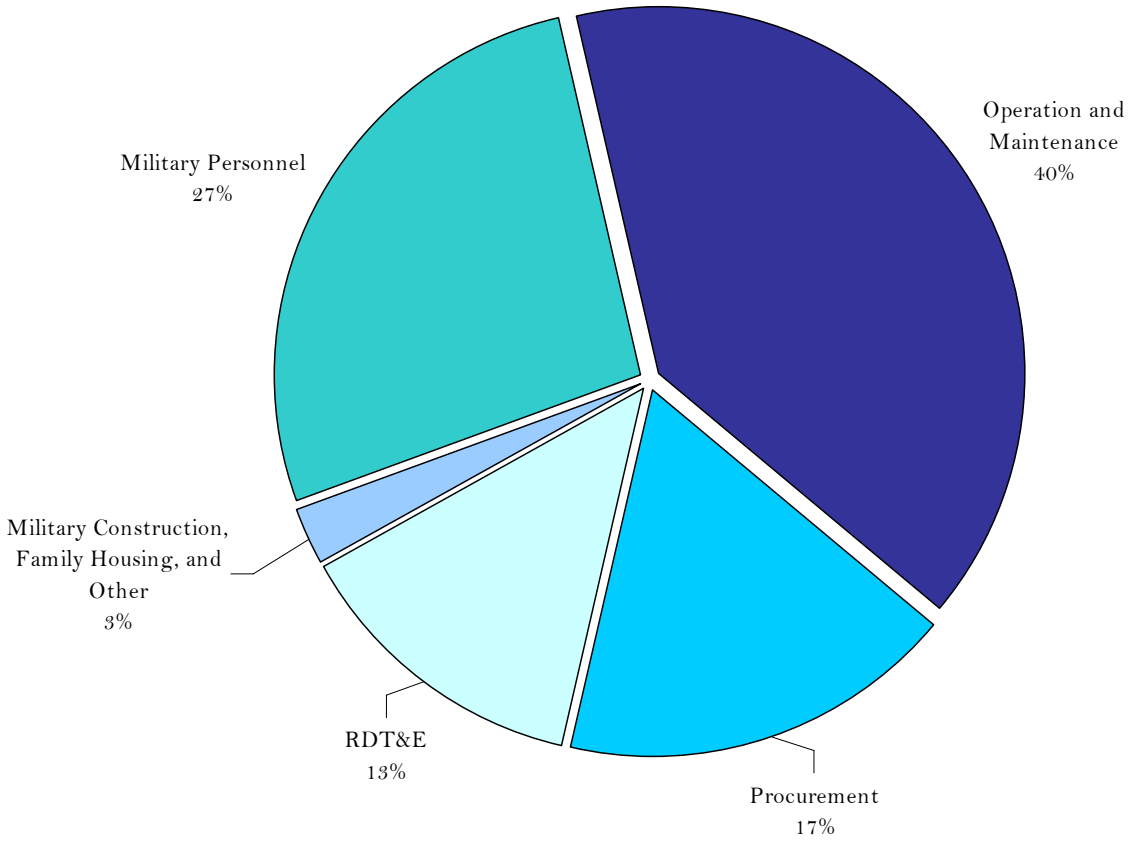
Defense Budget Drivers

Before proceeding to a discussion of specific cuts, it is worth pausing to consider which segments of DoD's budget are responsible for the recent rise in spending. Figure 2 decomposes the overall defense budget into its major constituent parts: military personnel (27 percent); operation and maintenance (40 percent); procurement (17 percent); research, development, testing and evaluation (13 percent); and all other spending (3 percent).

As stated earlier, close to two-thirds of the increase in the defense budget from fiscal year 2001 to fiscal year 2006 is attributable to supplemental appropriations for the GWOT. It is generally accepted that the majority of war-related funding is directed toward operations and support activities (military personnel, operations and maintenance), which involve running units, maintaining equipment, and providing pay and benefits. Operations in Iraq and Afghanistan have also led to accelerated rates of depreciation for ground vehicles and other equipment, which, in turn, have precipitated increased levels of procurement spending. This paper does not address war-related spending, other than to urge Congress to disallow the use of "emergency" supplemental appropriations to fund long-term military conflicts. Bypassing normal channels to fund predictable costs erodes the integrity of the budget process. Supplemental

Figure 2. Defense Spending Components

(fiscal years 2000 to 2005)

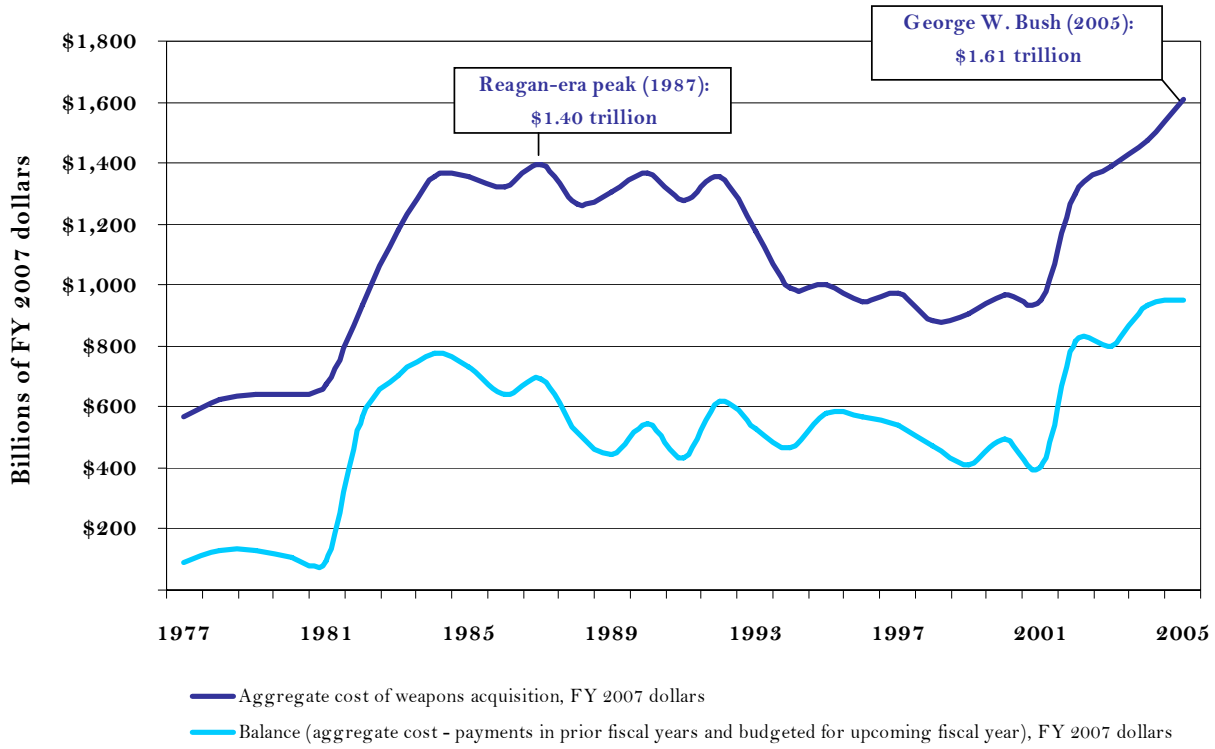


Source: *Fiscal Year 2007 Budget of the United States Government* (Table 3.2. "Outlays By Function and Subfunction: 1962-2011, Function 051, Department of Defense").

appropriations are not subject to discretionary spending caps, nor are they subject to the same rigor of documentation.[12] Although supplemental appropriations have been utilized to finance the early stages of combat in prior conflicts, the Congressional Research Service finds that "past Administrations have requested, and Congress has provided, funding for ongoing military operations in regular appropriations bills as soon as even a limited and partial projection of costs could be made."[13] This historical norm held true in both the Korean and Vietnam Wars. For all these reasons, the public must demand heightened scrutiny of federal spending in Iraq and Afghanistan.

However, this paper focuses on the investment portion of the budget (the procurement and research, development, testing and evaluation [RDT&E] categories), which has witnessed unchecked growth during the Bush administration. In the short span of five years, procurement expenditures are estimated to have increased 45.5 percent, while RDT&E spending for nascent weapons programs are projected to have increased an astonishing 57.3 percent in real terms. Rapid expansion in weapons development and acquisition accounts for nearly 55 billion fiscal year 2006 dollars of the increase in the overall defense budget.[14] As a consequence, the weapons acquisition portfolio has swelled, rising from $951 billion in September 2001 to $1,609 billion in September 2005, of which only $658 billion has been paid for.[15] This exceeds even the inflation-adjusted Reagan-era peak in fiscal year 1987 (figure 3).[16]

Figure 3. Weapons Acquisition Budget (1977 to 2005)



Source: Author's calculations using DoD *Selected Acquisition Reports Summary Tables* from 1977 to 2005, available at: www.acq.osd.mil/ara/am/sar/index.html. Inflation adjustments calculated using "Defense Composite Outlay Deflator" contained in *Fiscal Year 2007 Budget of the United States Government* (Table 10.1. "Gross Domestic Product and Deflators Used in the Historical Tables: 1940–2011").

Proponents of robust growth in defense investment tend to claim that the "procurement holiday" of the 1990s justifies the present spending binge. Several notes of caution are appropriate before entering into this firestorm. First, the reduction in defense investment during the oft-cited "procurement holiday" was not quite as dramatic as the rhetoric implies. Indeed, the decline in investment account outlays following the Reagan-era build-up was actually substantially less than the descent after other conflicts, including Korea and Vietnam.[17] Second, to the extent that a "procurement holiday" did occur, it was not imposed exclusively by the political system. For instance, the Air Force chose to sink massive sums into RDT&E for the F-22A, a tactical fighter that has been plagued by cost overruns and performance flaws throughout its twenty-year history.[18] Hypothetically, the Air Force might have procured additional F-15 and F-16 series aircraft with a lower unit cost than the next generation tactical aircraft still under development. Instead, it judged that the average age of its aircraft was sufficiently low, and it directed its investment resources elsewhere.

Regardless of whether aggregate defense investment during the 1990s was adequate, the United States is not obligated to procure bloated or irrelevant weapon systems simply because they are in the pipeline. As the specific recommendations below will show, the recent surge in weapons expenditures has not represented a cost-effective, well-planned investment. The truth is that the weapons acquisition portfolio still contains hundreds of billions of dollars of investment in weapons programs from a bygone Cold War era.[19]

There are a number of interdependent issues that have caused the weapons acquisition segment of the defense budget to diverge from its ideal path. Foremost among traditional explanations is the immense inertia of the weapons acquisition process, where the strength of the vested interests of the iron triangle (the military leadership, Congress, and defense contractors) lead to inexorable pressures to continue funding programs, with little regard for their relevance to the nature of current threats or to the performance of those systems on measures of cost-effectiveness, ability to maintain production timelines, or ability to deliver promised capabilities. This analysis proposes a host of expenditure reductions aimed at reforming the weapons acquisition budget.[20] These first proposals recognize that DoD has persistently demonstrated an inability to adjust resource allocation to feedback from external stimuli, whether those stimuli are substantial shifts in the nature of potential threats or weak results on key performance parameters for weapon systems under development.

Over time, the implications of the poor management decisions aggregate, yielding a pernicious effect on the efficiency of the acquisition system, as military contractors correctly perceive diminished incentives for meeting cost and schedule estimates. The Government Accountability Office (GAO) reports that the top five weapons programs alone have already increased in cost by 29 percent, or 122.4 billion FY 2006 dollars since their first full cost estimates.[21] Major research efforts by the GAO in 1987 and the Defense Systems Management College in 1999 reported average cost growth at 40 percent over base year estimates during the full development cycle of major weapon systems.[22] While the first set of proposals endorsed in this paper essentially perform some much-needed "spring cleaning" of the defense budget, the second set of proposals pertains to these systemic concerns regarding inefficiencies in the procurement process. Thus, sections 3 and 4 of this paper contain recommendations for limiting the wasteful practice of earmarking and for constraining cost growth. Section 5 concludes.

Reassessing an Unsustainable Weapons Acquisition Strategy

This section suggests the restructuring, curtailment, or elimination of eight defense projects whose cost and structure do not address today's realistic defense needs.

Terminate Weapon Systems No Longer Germane to Threat Landscape

The current acquisitions portfolio contains a host of gargantuan projects that persist despite their waning relevance to present threats. The F-22A Raptor and the DDG-1000 are two seemingly interminable programs that no longer deserve the priority they have enjoyed in prior budgets.

F-22A Raptor

The twenty-year investment in the F-22A is illustrative of the immense inertia of the weapons acquisition process, where congressional appropriators are generally reluctant to abandon weapon systems in which a significant investment has already been made. The F-22A Raptor was originally conceived in the mid-1980s to overcome an advanced generation of Soviet MiG jets that never materialized. Since 1992, the unit cost of the Raptor has risen nearly three times relative to the original, inflation-adjusted, estimate, and now totals 361 million FY 2006 dollars per aircraft. [23] Given these escalating costs, DoD has been forced to slash aircraft orders, from 750 at program inception, to 279, to 183 at present.[24]

In order to justify its continued development after the demise of the Soviet Union, the Air Force subsequently added a ground-attack capability, although that function is not yet fully developed. In fact, the Air Force still requires additional funding to bolster these purported ground-attack capabilities, with $4.4 billion allocated between 2005 and 2011 for additional ground attack and intelligence-gathering functionality.[25] Even assuming successful implementation, a single F-22 will carry only two thousand-pound Joint Direct Attack Munitions while costing more than 25 times the price of the A-10, which can deliver substantially larger payloads.[26]

Despite spending close to 30 billion FY 2006 dollars in research and development, the F-22A is hobbled by several shortcomings. In September 2006, a key designer of the F-16 issued a blistering critique of the F-22A, contending that the aircraft was a "liability" in air-to-air combat. The aircraft is quite large relative to other fighters and thus will be visually identified early in engagements. The immense size of the F-22A also hinders its maneuverability, and its stealth limits its ability to "exploit instantaneous opportunities." For instance, to evade enemy radar, the guns and missiles are stowed behind doors that require a non-trivial amount of time to open. Finally, the complexity of the F-22A has led to unusually high levels of maintenance downtime.[27]

In June 2006, the GAO recommended halting further investments until a convincing business case was presented.[28] The F-22A program fails almost all of the statutory criteria for initiating a multi-year procurement contract, including a durable estimate for requested quantities, a stable design, a level of funding strongly supported by agency leadership, and realistic cost estimates. Nevertheless, the F-22A was approved for multi-year procurement in the FY 2007 Defense Appropriations Act.[29] Rather than enduring immense cancellation costs, the Air Force should allow Lockheed Martin to fulfill the contract for the remaining 60 Raptors. These highly expensive jets might be used to attack a select number of targets in specialized

scenarios, in particular, if a serious air superiority threat were to emerge from a potential competitor such as China.[30] Nevertheless, the F-22A program ought to be terminated after the contracted 183 aircraft have been delivered, rather than allowing the continued procurement that the Air Force has publicly expressed its intent to pursue. If defense planners are truly worried about the average age of the tactical aircraft fleet, the Air Force should focus procurement dollars on the Joint Strike Fighter, a next generation tactical aircraft with nearly as much capability as the F-22A. Excluding research and development costs for the Joint Strike Fighter, the unit cost of its production is still nearly three times less expensive than the Raptor.[31]

DDG-1000 Zumwalt class destroyer

In much the same fashion as the F-22A Raptor, the DDG-1000 Zumwalt class destroyer is a bloated acquisition program with marginal relevance to the threat landscape.[32] Originally intended for warfare on the open seas, defense planners have repeatedly revised the role of this expensive ship.[33] The DDG-1000 is now intended to provide firepower from sea to shore, presumably for opposed amphibious landings. Despite opportunities for opposed amphibious landings over the past half century, the United States military has not conducted such an operation since 1950, during the Korean War.[34] Moreover, at more than 14,500 tons of displacement, the DDG-1000 is much better suited to its original purpose of "blue water" combat than its revised rationale of coastal combat. Indeed, the Navy is pursuing a Littoral Combat Ship (LCS) that could provide superior capabilities in this regard at substantially lower cost.[35] The stealthy LCS will travel 50 percent faster than the DDG-1000 and feature swappable "mission modules" to handle varied tasks including submarine warfare, surface warfare, and minesweeping. Individual LCS will cost less than one tenth the price of a single DDG-1000.[36]

Costs for the DDG-1000 have proven unmanageable. During the Clinton administration, the DD-21 (an earlier version of the renamed DDG-1000) was expected to cost $1.1 billion per ship in FY 2007 dollars. DoD currently estimates the cost of the DDG-1000 at $2.8 billion, and CBO projects that the ultimate cost for these destroyers will average $3.8 billion per ship.[37]

Robert Work of the Center for Strategic and Budgetary Assessments recently testified that current Navy ship-building plans for the DDG-1000 unnecessarily supplant Ticonderoga-class guided missile cruisers prior to their scheduled retirement. If fulfilled, the Navy acquisition strategy would result in the purchase of seven ships in excess of the projected requirement of 88 large surface combatants in 2021.[38] As such, I recommend that the projected purchase of seven DDG-1000 Zumwalt class destroyers be cancelled, yielding a total projected savings of 16 billion then-year dollars through fiscal year 2013 (table 1).[39]

Curtail Weapon Systems that Fail Essential Tests of Safety and Technical Feasibility

DoD consistently fails to terminate programs that encounter insurmountable obstacles in terms of safety or technical viability. Indeed, DoD often embarks upon acquisitions projects with immature technologies and only hazy development plans. The following two examples illustrate the human and financial risks that invariably follow.

National missile defense

In a world with perfect technical knowledge and unlimited financial resources, a layered system of national missile defense might merit consideration. However, despite generous levels of

funding over an elongated development cycle, missile defense has persistently failed to achieve its objectives. To date, the U.S. government has committed more than $100 billion over several decades in the pursuit of missile defense capabilities, with minimal technical success.[40] The Ground-Based Midcourse Defense (GMD) system, the centerpiece of current research and development efforts, has failed to intercept its target in five out of 11 flight tests. In two recent tests, the interceptor rocket never managed to leave its silo. The system has managed only a single successful intercept since October 2002, and all successful flight tests have involved highly unrealistic scenarios.[41] In particular, several GMD tests involved mock warheads that emit data detailing their trajectory.[42] While the most recent GMD test featured the use of operational radar to capture target information, the target missile did not employ any countermeasures (decoys).[43]

In the end, building an integrated network of missile defense interceptors, capable of defending the nation against the simultaneous launch of multiple intercontinental ballistic missiles (ICBMs) with corollary decoy units, may ultimately prove infeasible. Regardless of theoretical tractability, the United States cannot afford to continue diverting more than $9 billion per year toward a disastrous system designed to counter a low-priority threat.[44] Asymmetric techniques, including the surface detonation of nuclear weapons transported by container, pose greater risks than the launch of an ICBM with a return address that would inevitably result in crushing reprisal for its sender.

Accordingly, I advocate an adoption of the "Evolutionary Alternative" for the Missile Defense Agency explicated in CBO's Long-Term Implications of Current Defense Plans and Alternatives, saving 6 billion to 13 billion then-year dollars per year through fiscal year 2017 (table 1).[45] Under this option, DoD would pursue no further upgrades to radars, deploy no additional interceptors, and deploy no space-based interceptors, while continuing a low level of continued research on related concepts. Existing plans would be funded through fiscal year 2007, leaving twenty-three interceptors deployed at Fort Greeley and two interceptors at Vandenberg Air Force Base. Some terminal-phase ballistic missile defense would be preserved, with DoD developing and deploying two Terminal High Altitude Area Defense fire units, as well as the Patriot Advanced Capability-3. Such theater-level systems have enjoyed modest technical improvements in recent years, demonstrating a limited ability to provide protection to troops in the field of battle.

The V-22 Osprey

The V-22 Osprey tilt-rotor aircraft is a flawless example of the immense strength of the iron triangle. The development of the V-22 has resulted in thirty deaths, the unit cost of the aircraft has tripled, and the system continues to struggle with major concerns over safety, survivability, and maintainability. Nevertheless, the program has escaped termination for twenty-five years, enduring several cessations of flight testing and repeated attempts at cancellation by former Secretary of Defense Richard Cheney.[46] The source of the V-22's resilience is readily apparent: the two lead contractors, Bell Helicopter and the Boeing Corporation, have carefully distributed subcontracts for the V-22 Osprey across more than 40 states and 200 congressional districts, with former Representative Curt Weldon, the most recent chairman of the Tactical Air and Land Forces Subcommittee, representing the Pennsylvania district that includes Boeing's helicopter division.[47] Weldon and others have fought vociferously for the V-22's survival and then-Governor Bill Clinton seized upon the V-22 as an attractive campaign promise in the lead up to the 1992 presidential election.

The V-22 Osprey is a unique aircraft, coupling the ability to take off and land vertically with the ability to rotate its rotors forward to operate as a traditional airplane in forward flight. Proponents note that this novel tilt-rotor technology allows the V-22 to travel further and faster than legacy helicopters, such as the CH-46D Sea Knight. Supporters also note that since the V-22 is designed for aerial refueling, it is capable of self-deploying to remote regions ('over the horizon') rather than requiring time-intensive deployment by sea vessel. This increased radius of action, V-22 advocates argue, enhances the Osprey's mission-capabilities, allowing the aircraft to complete complex missions in a single period of darkness. Concurrently, the increased speed of the V-22 supposedly reduces the aircraft's vulnerability to enemy attack.

Careful examination of these claims, however, reveals that each of the purported benefits of the V-22 has either been overstated or misrepresented. Moreover, the substandard track record of the V-22 on measures of safety and survivability effectively precludes consideration of the aircraft's potential merits. Finally, the V-22's dramatic escalation in cost over the course of its quarter-century development forecloses the possibility that the aircraft will ever be affordable in a world with cost-effective alternatives and other, more pressing, defense requirements.

It is certainly true that the V-22, should it ever reach fruition, is designed to exceed the specifications of the legacy aircraft it is poised to supplant. Indeed, the Bell Helicopter company frequently boasts that the V-22 will have "twice the speed, three times the payload and five times the range of the legacy helicopters that it replaces."[48] However, judging the V-22 against 1970s technology egregiously commits the logical fallacy of the "straw man." Several modern rotorcraft have been developed in the interim, and each of these newer helicopters also exceeds the capabilities of the legacy helicopters, at costs far less than that of the V-22 and with higher rates of survivability and maintainability than the V-22. For instance, the range of the European-designed EH-101 exceeds the range of the CH-46E Sea Stallion by more than a factor of three. [49] The CH-53E Super Stallion Helicopter features aerial refueling, effectively lifting all constraints on range.[50] Adjusted for inflation, the V-22 is at least four times more expensive per rotorcraft than the CH-53E.[51]

Perhaps what is most disingenuous about the comparison of the V-22 with the legacy aircraft is the unstated assumption that multiplicative advances in range and payload are high priorities for the military. In evaluating the V-22, we must remember that "the fundamental Marine mission is a short flight of 25 to 70 miles from ship to shore, flown at 30 to 300 feet."[52] As former Navy Secretary Sean O'Keefe commented, the V-22 is essentially "a bus to bring 20 people from ship to shore."[53] Thus, in the vast majority of potential military scenarios, it will not be necessary for the Marine Corps medium-lift helicopters to self-deploy to remote regions. Moreover, the Congressional Research Service reports that "Marine assault missions in an opposed landing would involve ship-to-shore movement of troops and equipment, which would require coordination with aircraft having less speed and range than the V-22," thereby rendering the ability to self-deploy worthless.[54] In those cases where it will be appropriate to execute the Marine Corps' new "Ship to Objective Maneuver," modern helicopter can ably serve in place of the V-22.

Procurement decisions should involve the careful matching of program design to military necessity, with scrupulous attention to issues of survivability, maintainability, and relative cost. The Marine Corps and the Air Force require medium-lift helicopters with ample maneuverability under hostile fire, the ability to effortlessly land on unprepared surfaces, and

the ability to operate seamlessly at night. When the V-22 is judged by the relevant criteria, the program fails spectacularly.

A brief review of the program's history reveals a rotorcraft fraught with issues of safety and survivability. The V-22 has suffered no fewer than three fatal crashes since development started in 1986. In July 1992, an engine fire caused a V-22 prototype to crash into the Potomac River near Quantico, Virginia, killing seven. In April 2000, a V-22 flying over Marana, Arizona entered an aerodynamic phenomenon known as Vortex Ring State and crashed, killing all four crew and fifteen passengers aboard. Finally, in December 2000, four Marines died in Jacksonville, North Carolina, when a V-22 suffered a burst hydraulic line, which subsequently triggered a software malfunction.

The Marana accident occurred when the pilot directed the V-22 to descend at a relatively rapid rate. If a helicopter descends swiftly, without forward motion, it can become enveloped in its own downwash, entering a situation known as Vortex Ring State (VRS). In this case, the rotors experienced sharp updrafts of turbulence, leading one of the rotors to lose lift, which caused the V-22 to crash. Accordingly, the Marana crash was officially attributed to pilot error. In an effort to avoid future encounters with VRS, program officials subsequently narrowed the recommended "flight envelope" available to pilots.

While all helicopters are vulnerable to VRS, numerous military experts and scholars have concluded that tilt-rotor aircraft have substantially greater susceptibility to rotor flow instabilities. A computational fluid dynamic study conducted at the University of Maryland demonstrated that tilt-rotor aircraft have a tendency to generate powerful lift asymmetries when descending at rates far short of what ordinarily induces VRS.[55] Those differences in lift can induce an uncontrollable rolling movement. Indeed, Philip Coyle III, former director of the Pentagon's Office of Operational Test and Evaluation, reported eight separate incidents of lateral instability during testing to the 2001 Blue Ribbon Commission that reviewed the V-22.[56] In order to prevent the V-22 from experiencing VRS or some similar phenomenon, pilots are now restricted from descending faster than 800 feet per minute (800 fpm), which is far slower than the mandated descent rates for legacy helicopters.[57] Indeed, the V-22 must land at rates 47 percent slower than the CH-53A/C/D/G and 60 percent slower than the CH-46.[58] This leaves the aircraft acutely vulnerable to enemy fire from the ground.[59] The continued absence of the required defensive gun in the nose of the rotorcraft exacerbates this critical weakness. The V-22 also lacks a personnel hoist necessary for swift insertion or extraction of soldiers.[60]

In spite of these serious deficiencies, the V-22 has never been tested in a high-threat environment. In an official DoD report from the Office of Operational Test and Evaluation, David Duma emphasized that "the concept of operations for medium lift aircraft, such as the MV-22 carrying Marines, is not to intentionally use these assets in a known high-threat environment." However, he also acknowledged that "a medium-threat, or even a low-threat environment, can change suddenly to a high-threat because enemy movements are not always known."[61]

In the Jacksonville incident, several pilots involved in the official investigation claimed that contractors were aware of the design flaw in the hydraulic line several months prior to the accident, but left the issue unaddressed in an effort to hold down costs prior to the Pentagon

decision regarding full-rate production.[62] The Marine Corps has explicitly acknowledged cutting corners in the course of the V-22 project. Immediately prior to the Jacksonville accident, Lt. Gen. Fred McCorkle, chief of Marine aviation, reportedly said: "When we built that airplane, we built it on the cheap… we cut every ounce of fat that we could cut."[63] This included the use of plastic fasteners and other inexpensive parts on earlier aircraft.

Accidents continue to occur at an alarming rate. Two V-22's conducted emergency landings in June 2004, including one Class B mishap (incidents resulting in $200,000 to $1,000,000 in damage). In November 2005 a V-22 was forced to conduct a precautionary landing when its engines malfunctioned after ingesting pieces of ice during a storm.[64] In early 2006, a V-22 suffered another software failure, yielding an unintended 3.1 second flight and crash landing that severed the right wing from the aircraft, causing more than $1 million in damage (a Class A mishap).[65] Most recently, the Marine Corps attempted to demonstrate the long-range capability of the V-22 by flying two of the aircraft across the Atlantic Ocean to an international air show. In a turn of events all too fitting for the beleaguered program, one of the V-22 aircraft encountered serious engine problems and was forced to land in Iceland for multi-million dollar repairs.[66]

Concerns over the V-22's notoriously poor safety record are not alleviated by a review of the flight testing regimen to date. Due to an unseasonably wet spring in 2005, the V-22 was not tested in conditions of severe visibility degradation, such as the extreme blowing of sand and dust.[67] The ability of medium-lift transport helicopters to swiftly land on unprepared surfaces, including blowing desert sand, is a critical parameter for program success. Program officials are aware that the V-22 produces an unusually strong downwash, particularly in "more severely degraded environments." Adjusting flight patterns to mitigate this hindrance imposes the "cost of potentially increasing the time required to execute an approach and landing."[68] As in the case of VRS, V-22 pilots will be restricted in their ability to maneuver, leaving the V-22 vulnerable to enemy attack for longer durations of time.

The V-22 has also been subject to less operational testing at night than originally planned.[69] Concerns persist that cumbersome seating will impede troop egress, particularly in the event of emergency.[70] Finally, the V-22 is no longer required to feature "autorotation," the ability to land powerlessly in helicopter mode. While all legacy helicopters are capable of autorotation, the V-22 will not be survivable if both engines fail at an altitude below 1,600 feet.[71]

The GAO reported in March 2006 that "production aircraft continue to be accepted with numerous deviations and waivers." In spite of all these shortcomings, the V-22 was approved for full-rate production in September 2005.[72]

At 39 million FY 2006 dollars per aircraft, the V-22 was an expensive project at the time of its conception. The project has since escalated to a unit cost of 110 million FY 2006 dollars per aircraft, nearly three times more expensive than the original estimate.[73] Research and development costs have spiraled from 3.8 billion to 11.7 billion FY 2006 dollars. The program is fourteen and a half years behind schedule.

V-22 aircraft have also proven resource-intensive to maintain. In September 2001, two senior Marines were found guilty of misconduct for instructing their squadron to falsify maintenance records in order to have the V-22 appear less costly to maintain.[74] In the most recent round of

program testing, the V-22 breached the acceptable threshold for "mean repair time for aborts."[75]

Since the V-22 entered full rate production in September 2005, the opportunity for significant budgetary savings is modest. Nevertheless, Congress and the president must cancel this program in light of grave concerns regarding rotorcraft safety and survivability. The Marine Corps and Navy ought to replace planned V-22 purchases with an equivalent number of H-92 and CH-53X aircraft, generating a net savings of approximately $4 billion by FY 2016 (table 1).[76] Existing V-22 Osprey ought to be reduced to scrap metal.

Employ Realistic Acquisition Strategies for Ambitious Technologies

In the pursuit of scarce appropriations dollars, defense planners and contractors frequently project wildly optimistic timelines for program completion and promise unattainable technological breakthroughs during program development. The Joint Strike Fighter program and the Future Combat System are prime examples of this tendency. The Future Combat System (FCS), the Army's chief initiative for transforming its forces into lightly armored, rapidly deployable brigades, escalated in cost by 44.9 billion FY 2006 dollars (54.4 percent) in the short span of two years (May 2003 to September 2005).[77] The FCS schedule has also been extended by four years, and recent reports indicate that core capabilities that potentially justify this substantial delay may ultimately prove infeasible. Similarly, the Joint Strike Fighter (JSF) experienced unit cost increases of 26.7 percent between October 2001 and December 2004.[78] This upward trend may well continue, with Representative Neil Abercrombie of the House Tactical Air and Land Forces Subcommittee recently exclaiming "I'll eat this microphone if it [the Joint Strike Fighter Program] stays at $244 billion, and I don't think I'm going to lose on that bet.[79] Congress and the president must act to restructure the acquisition strategies for these two flagship programs, while implementing systematic reforms to preclude these developments in future acquisition programs. These longer-term reforms are analyzed in section 4.

Joint Strike Fighter

The Joint Strike Fighter (JSF) program consists of a family of joint-service tactical aircraft that are intended to replace a substantial portion of existing DoD fighter and attack aircraft. The program will produce a conventional-takeoff plane for the Air Force and Navy, as well as a short-takeoff/vertical-landing version for the Marines Corps and the U.K. Royal Navy. With 2,458 aircraft slated for purchase, the JSF program is the flagship component of DoD's aircraft recapitalization effort, supplanting aging F-16s, A-10s, AV-8Bs, and F/A-18 A/C/Ds. [80]

The fundamental motivation for the concept of the JSF is sound. The use of common parts across aircraft, with shared, large-scale production lines should yield lower-cost tactical aircraft than would be expected from multiple, smaller-scale development processes by the individual military services. Moreover, significant participation from allied nations further lowers unit costs and reduces barriers to coordination in future allied military operations.[81] Despite the strong conceptual underpinning for this valuable project, the development process for the JSF is overly aggressive and unnecessarily infused with serious risks to overall cost and schedule. DoD plans to allow low-rate initial production to proceed in 2007 with less than one percent of flight testing completed. From 2007 to 2013, 424 aircraft are scheduled for procurement at a cost of $49.3 billion. However, no production representative prototypes will have been completed at the start of low-rate procurement, and a host of critical components, including

"low observable and highly common airframe, advanced mission systems, and maintenance prognostics systems," will remain untested at that juncture.[82]

Program officials admit that the current procurement structure allows little, if any, flexibility in the event of unanticipated technical changes. Concurrent testing and production also preclude the use of fixed-price contracts, forcing the Pentagon to proceed with fixed cost procurement contracts that shift cost risk from the contractor to the government (and ultimately, the taxpayer).[83]

I recommend that Congress delay initial low-rate production of the JSF by two years, while continuing to provide RDT&E funding at fiscal year 2007 levels (adjusted for inflation). In the intervening period, DoD must heed its own procurement policy and restructure JSF along an evolutionary acquisition strategy. Relative to the baseline, this measure saves 13 billion then-year dollars through fiscal year 2017 (table 1). More importantly, it should avert probable cost growth not included in baseline projections. Unit costs have already increased 28 percent ($23 million per aircraft) with the overambitious, single-phase, twelve-year development program. Development costs have increased an astonishing 84 percent.[84] DoD should heed the lessons of history and restructure the JSF program into smaller, realistic segments. Separating JSF development into reasonable increments will allow the near-term production of aircraft with capabilities equal to or greater than those of legacy aircraft, thereby enabling DoD to retire aging tactical aircraft that are nearing the close of their service lives and are thus particularly expensive to maintain and refurbish.

The GAO consistently reiterates the panoply of additional benefits derived from an evolutionary strategy, including greater predictability of costs, more reliable delivery of capabilities to the warfighter, and the ability to employ fixed-price contracts for production. Segmenting the program into shorter phases also allows DoD to align the tenure of the program manager, the chief engineer, and the chief logistician with the completion of an increment, thereby promoting continuity and enhancing professional accountability. The immediate predecessor of the JSF, the F-16, is an ideal archetype for an evolutionary acquisition structure. The F-16 successfully released five increments over thirty years, delivering its first installment a scant four years after the start of development.[85]

The Future Combat System

The Future Combat Systems (FCS) program represents the focal point of the Army's long-term modernization efforts. This highly-complex, 130 billion FY 2006 dollar endeavor is structured to produce eighteen major systems, including eight new types of armored vehicles, four classes of unmanned air vehicles (UAVs), three types of unmanned ground vehicles, unattended ground sensors, a missile launcher, and improved munitions, all of which will be linked within a "system-of-systems architecture" through an advanced, mobile communications network. Originally conceived by then-Army Chief of Staff General Eric Shinseki, the FCS is intended to transform the nature of ground warfare, dramatically increasing the agility of U.S. forces while maintaining the same levels of lethality and survivability.[86]

All components of the FCS would be light enough for airlift transport (rather than transport by sea), which the Army believes will reduce the amount of time required for deployment to sites of conflict. The dramatic weight reduction of ground vehicles should also yield improvements in fuel efficiency that mitigate the need for extensive supply lines.[87] Moreover, all new ground

vehicles would share the same chassis and engine, thereby facilitating easier repair and maintenance in the field of battle.

The trade-off necessitated by the lighter vehicles, however, is a reduction in the level of armor. In spite of this lower level of armament, survivability will theoretically be sustained through an increase in battlefield awareness or battlefield "transparency," facilitated by the planned advances in sensors and communications equipment. That is, the concept of operations envisioned for FCS is predicated upon the development of technology that will allow soldiers to avoid being attacked, rather than developing armament that allows soldiers to better endure an attack. The Army expects to procure equipment for fifteen brigade combat teams by fiscal year 2025.[88]

The fundamental goals of the FCS program are certainly compelling. Increasing the ability of Army forces to rapidly deploy to any location on the globe would improve the nation's ability to address the highly mobile threats encountered in the Global War on Terror. Planned interoperability of communications equipment, as opposed to post hoc retrofitting of existing equipment, is farsighted and should lead to enhanced fighting capability. However, despite these laudable aims, both the acquisition strategy and the conceptual design for FCS suffer from critical flaws.

Over the past several years, the GAO has issued several reports indicating that the FCS lacks the fundamental elements of a sound business case, which include "firm requirements, mature technologies, a knowledge-based acquisition strategy, a realistic cost estimate, and sufficient funding."[89] On the issue of requirements, FCS was approved for Milestone B (the beginning of system development and demonstration) in March 2003, but is not slated to reach the level of stability in program requirements typically necessary for Milestone B approval until 2008.[90] The result is that the acquisition schedule is plagued with periods of concurrent development and multiple design reviews will occur much later than recommended.

In terms of technological maturity, the FCS flagrantly violates "best practice" standards. The new concept of operations envisioned for FCS depends upon a series of technological advances that are nowhere near fruition. Former House Armed Services Committee Chairman Duncan Hunter, who led an attempt to cut $400 million in funding from FCS during the fiscal year 2006 budget authorization, described the acquisition strategy for FCS as "inventing on a schedule."[91]

Paul Francis, Director of Acquisition and Sourcing Management at the GAO, recently reported that under DoD standards, only one-third of the relevant technologies were "mature" in 2005, whereas nearly 90 percent of the FCS technologies were slated to have reached maturity by that time.[92] Moreover, FCS has registered this abysmal performance under DoD standards, which are lower than the best practice standards recommended by GAO. GAO standards for success are for critical technologies to attain a technology readiness level of 7—where prototypes are tested in a *realistic* environment—whereas DoD only requires a technology readiness level of 6—where prototypes are demonstrated in a *relevant* environment.[93]

Failure to follow the best practice standards tends to precipitate major cost overruns, extensive schedule delays, and an increased likelihood of program failure. It should thus come as little surprise that, following a major restructuring in July 2004, four years were added to the

acquisition schedule for FCS. As a product of that restructuring, the FCS has now increased in cost by 54 percent, rising from 82.5 billion to 127.5 billion FY 2006 dollars.[94] Even if the FCS manages to avoid future cost increases, the program is estimated to dominate 60 to 70 percent of the Army procurement budget from 2014 to 2022. Continued escalation in cost would impose untenable budgetary pressures on core priorities in the Army procurement budget. Such escalation, however, is probable. CBO reports that the historical cost risk for the Army's major weapons programs is quite high, measuring 30 to 71 percent for research and development and 13 to 74 percent for procurement relative to the estimated baseline at Milestone B. Given the fresh baseline established after FCS restructuring in 2004, CBO estimates further potential cost risk on the order of 60 percent.[95] Independent estimates from the Office of the Secretary of Defense's Cost Analysis Improvement Group cohere with this assessment, with FCS acquisition costs projected to rise still further, to between160 billion and 173 billion FY 2006 dollars. That revision was the product of a mandatory review required by the fiscal year 2006 Defense Authorization Act.[96]

The potential for FCS to crowd out other important investments has already drawn the attention of a small set of lawmakers. Representative Abercrombie, Chairman of the House Armed Services Subcommittee on Air and Land Forces, has expressed concern that with the FCS and the related modularity initiative consuming most of the investment budget, "there is no fall back if these programs don't work or are substantially delayed."[97] Thus, the FCS acquisition strategy has the potential to impede the preservation of long-term national security.

Lawmakers might believe that the transformational capabilities expected from this new platform warrant the acceptance of substantial risk. However, it is not clear that the FCS has even been properly conceived to satisfy the original motivations for creating the program, which were increasing the agility of ground forces while maintaining equivalent survivability.

In many cases, the current structure for the FCS program will not increase the speed with which Army units can deploy. CBO released analysis in April 2006 that concluded that in spite of projected improvements in the weight of equipment, deploying an FCS division will still be much faster by sea (23 days) than deployment via airlift (115 days). Although brigade-sized units are rarely deployed alone, even deploying a lone FCS-equipped brigade by airlift rather than by sealift would save only three to four days. Untangling this paradox is surprisingly simple: Aside from major U.S. military facilities such as those in Germany and South Korea, few regions of the world have adequate paved surfaces for the receiving and unloading of hundreds of aircraft. This, in turn, "limits the number of daily sorties by Air Force transport aircraft that those airfields can support." In contrast, most coastal regions possess at least one port capable of unloading the ships of the U.S. Military Sealift Command. Given that soldiers are rarely deployed in units smaller than a division, FCS units will be deployed by sea in most cases.[98]

The likelihood of this outcome is bolstered by recent obstacles encountered during technological development. Thus far, contractors have encountered difficulty in reducing the weight of the FCS tanks. FCS planners have resorted to an interim, 24-ton vehicle, rather than the requisite 19 tons.[99] Of course, a 24-ton tank is dramatically lighter than a 35-ton Bradley Fighting Vehicle or a 70-ton Abrams Tank. This weight reduction requires substantial sacrifice in terms of armament. In order to maintain survivability, FCS depends on the tenuous assumption that soldiers will utilize near perfect information to avoid unplanned engagement with the enemy. There is little evidence that our military is close to reaching a level of

situational awareness that would permit this reduction in physical protection. The assumption of a "transparent" battlefield ignores the inevitable vagaries of urban warfare, where soldiers are unable to fight at a distance and are fundamentally hindered from discerning the location, movement, or intentions of their enemies. In these situations, heavily armored tanks have performed admirably. As Brookings Senior Fellow Michael O'Hanlon writes, FCS "discounts the utility of heavy tanks too quickly. For all their downsides, they have continued to perform impressively in modern war, and they provide protection in settings, such as the streets of post-Saddam Iraq, that may continue to be of critical importance."[100]

Even if the new suite of sensors, robots, and unmanned vehicles proves remarkably adept at gathering information, substantial concern persists about the linchpin of the entire FCS: the communications network that distributes that information to all of the relevant devices. At best, technological development of that network has been halting. Cluster 1 of the Joint Tactical Radio System (JTRS), a primary component of the communications system, was substantially restructured in March 2006 after significant cost increases and delays.[101] In the end, a completed network might still be vulnerable to jamming or even to complete immobilization by an electromagnetic pulse (EMP).[102] An EMP is destructive within a radius of several hundred miles. If an EMP were released, all electronic equipment that has not been hardened could be immediately disabled, essentially eliminating the main line of defense for troops utilizing FCS equipment.[103]

In summary, the FCS represents a well-intentioned, but overambitious endeavor. Attempting to develop eighteen major systems in such a short time frame, with immature technologies and overlapping development schedules, is a prescription for disaster. Congress and the president must act immediately to dismantle the FCS into manageable segments, emphasizing technological components that are feasible in a time horizon of moderate length.

In this vein, I recommend that the FCS program be reformed according to the parameters laid out in "Alternative I" of CBO's August 2006 analysis, The Army's Future Combat Systems Program and Alternatives. Under this alternative, the Army would emphasize the development of those technologies carrying the least risk. The Army would develop and procure the unattended ground sensors and all four classes of unmanned aerial vehicles that were part of the original FCS program. The Army would also develop a less extensive version of the FCS network that could be installed within existing armored vehicles. All other FCS systems would be cancelled, although existing armored vehicles would be converted to the latest model of the current system, thus preventing their average age from rising. Costs would total 99 billion FY 2006 dollars from 2007 to 2025, versus 139 billion FY 2006 dollars for the full FCS program over the same time period, translating into savings of roughly 22 billion then-year dollars through fiscal year 2017 (table 1). Potential cost risk would likewise fall precipitously, from 60 percent under the current FCS program to a mere 33 percent.

Given the lower technological risk, the Army could start introducing the new equipment as early as 2010. The systems could also be procured at a much higher rate, with an estimated thirty-three brigades equipped by 2025. Since the heavy armor of the older vehicles would be maintained, this system would not depend as centrally upon the network for survivability. Concomitantly, the implementation of an enhanced network within the context of existing vehicles would provide the Army with the opportunity to test the extent to which improved informational awareness reduces the necessity for armor. These developments would not

preclude the ultimate implementation of the full-scale vision of the FCS program. On the contrary, the alternative represents a prudent set of acquisition choices that facilitate a smooth path toward a new concept of operations.

It should be noted that FCS is emblematic of two dangerous trends in the acquisition process: first, a growing reliance on "skip-a-generation" technology, rather than evolutionary advances and second, an increased emphasis on the development of "super-platforms." With regard to the first issue, throughout the second half of the twentieth century evolutionary acquisition strategies proved far more capable of delivering new equipment to the warfighter in a timely and cost-effective fashion. In the future, the president should direct DoD to avoid acquisition strategies that require implausible leaps forward. With regard to the second issue, all-encompassing weapons platforms, by their very design, usually become all-or-nothing propositions for congressional appropriators. Over time, as large sums of cash have been poured into system development, it becomes "increasingly difficult … to conclude that program progress is anything less than acceptable."[104] So much money has already been spent that the system simply must work. These situations reduce incentives for sterling contractor performance and unnecessarily reduce flexibility for military planning.

Halt Acquisition and Maintenance of Strategically Provocative Weapons

While the preceding two recommendations involved the reform of flagship programs that ultimately ought to be retained, the following two recommendations relate to broad categories of weapons activity that ought to be curtailed. These programs fail to provide essential capabilities, while unnecessarily destabilizing the international community. Moreover, superior alternatives with higher levels of cost-effectiveness are available.

Offensive space-based weaponry

Sensible military space policy requires diligent consideration of diplomatic sensitivities, technological barriers, cost concerns, and potential strategic consequences. The available evidence uniformly indicates that the pursuit of offensive, space-based weapon systems by the current administration represents an imprudent rejection of each of these stated criteria.[105] The deployment of space-based weapons would prove needlessly provocative, offering only marginal gains in global strike capabilities, while hastening the demise of the favorable status quo situation of U.S. space dominance. Defense analysts widely agree that the predictable orbits required by space-based weaponry would render these tools highly susceptible to low-cost, asymmetric countermeasures.[106] Even assuming such vulnerabilities could be surmounted, current and foreseeable technological capabilities do not permit the cost-effective deployment of space weaponry. Each of the space weapons programs currently under development are demonstrably cost excessive relative to viable terrestrial alternatives. As such, DoD ought to immediately curtail the majority of funding directed toward such weaponry.

In the early 1990s, President Clinton reportedly cancelled every Pentagon program related to offensive weapons in space.[107] Heeding the alarmist warnings of a potential "space Pearl Harbor" predicted by the Rumsfeld Space Commission in early 2001, the Bush administration has reversed the posture of the prior administration, adopting a somewhat aggressive agenda to weaponize space.[108]

Among unclassified programs, several major systems are under development, including a system of space-based lasers, an unmanned, orbiting common aero vehicle that could deliver

conventional munitions to virtually any destination on the globe at hypersonic speeds, and the hypervelocity rod bundle, affectionately known as "Rods from God," which consists of tungsten (or titanium) rods projected at terrestrial targets at velocities in excess of 7,000 miles per hour, potentially striking with the force of a small nuclear weapon.[109] The Air Force also fielded the XSS-10 microsatellite in January 2003, which maneuvered within 35 meters of an orbiting target on multiple occasions to capture photographs of that target.[110] Many analysts presume this technology will be developed (or has already been developed) to yield anti-satellite (ASAT) capabilities.

Each of these programs suffers from the same serious strategic flaw: the introduction of space weapons of this sort will imperil the United States' ability to continue to reap the benefits of a space frontier that has been "militarized" but not yet "weaponized." As of 2003, the United States operated roughly 60 military satellites, which offered the military real-time communications, mapping, targeting, and reconnaissance capabilities unparalleled by any other nation.[111] These military support assets have been allowed to operate without obstruction, as the world community has generally accepted these assets as non-provocative. Given the overwhelming dependence of the U.S. military on space assets relative to potential adversaries, the United States stands to lose the most by encouraging the population of the heavens with destructive weaponry.

In *Neither Star Wars Nor Sanctuary: Constraining the Military Uses of Space*, O'Hanlon advocates a hedging strategy for U.S. space activity in the near to intermediate term. Rather than permanently abstaining from the introduction of weapons into space, O'Hanlon recommends that the United States refrain from vigorous development of offensive space-based weapons in the near-term, while focusing efforts on defensive countermeasures to protect the force enhancement capabilities offered by U.S. military satellites. O'Hanlon rejects the near-term deployment of offensive space-based weapons because, "Militarily, it would legitimate a faster space arms race than is otherwise likely—something that can only hurt a country that effectively monopolizes military space activities today. Second, it would reinforce the current prevalent image of a unilateralist United States, too quick to reach for the gun and impervious to the stated will of other countries."[112]

Numerous experts and defense policy organizations concur with O'Hanlon's assessment. Notably, the Federation of American Scientists released an in-depth study in late 2004 that convincingly advocated the rejection of space weapons by the United States for at least the next five years.[113] Bruce M. DeBlois, director of systems integration at BAE Systems, and Richard L. Garwin, an IBM fellow emeritus, caution that introducing space weapons has the "potential for uncontrolled escalation and increased quantities of hazardous space debris."[114] In particular, the introduction of anti-satellite capabilities could have a critically destabilizing effect. Recent space war-game simulations found that preemptively destroying an opponent's space-based information assets could rapidly escalate into full-scale war, in some cases triggering the use of nuclear weapons, as the loss of mutual transparency engenders an environment of tremendous mistrust. DeBlois and Garwin concluded that "it is the space-based military support capabilities that are essential and that must be preserved by force, by political and diplomatic means, and by non-space redundancy. Space weapons, paradoxically, seem more likely to imperil than to protect these important systems and undermine overall U.S. military capability."[115]

Proponents of offensive space-based weapons often point toward the purported ability of space weapons to fulfill the mandate of "Prompt Global Strike," the ability to swiftly respond to any crisis through the direct attack of any target on the globe (typically within sixty or ninety minutes). These arguments, however, ignore the fact that the United States is already a global military power capable of rapid intercontinental strike. In the most recent war in Iraq, commanders required a mere 11 minutes from the identification of a target to the striking of that target. When the U.S. military is not deployed at the site of a conflict, or when access to forward air bases is limited, ICBMs are capable of striking targets anywhere on the globe within 45 minutes, although these missiles currently carry only nuclear warheads.[116] Thus, without space weapons, the U.S. military has already reached the point where the primary time constraint prior to the destruction of a target is the period necessary for reasonable deliberation.

Given the current state of technological development, space-based weapons fail any measure of cost-effectiveness conceivable and will continue to do so for the foreseeable future. In particular, the slow pace of improvement in launch vehicles for delivering payloads into space precludes the financial viability of almost all space-based weaponry. For instance, launch costs for a single 100-kilogram long-rod penetrator (part of the hypervelocity rod bundle), would total some $66 million. The U.S. Space Command would require a constellation of some forty orbiting rods to consistently cover the globe, yielding a total system launch cost of some $8 billion. Compare this to hundreds of surplus ICBMs, Tomahawk cruise missiles that cost a relatively inexpensive $600,000 per unit, or precision-guided Joint Direct Attack Munitions (JDAMs) priced at an economical $15,000 per bomb, and the "Rods from God" is suddenly recognizable as a grossly over-priced adolescent fantasy.[117]

Space-based lasers would similarly require a constellation of several dozen lasers to continuously cover strategically important regions. These lasers could effectively attack only a restricted set of targets (e.g., combustibles, aircraft canopies, and thin-skinned storage tanks). The lasers could not penetrate cloud cover and potential targets could successfully shield themselves from attack through myriad inexpensive measures, including smoke screens, pools of water, and thin coatings of cork. Space-based lasers are preposterously expensive, costing $240 million per target to send the necessary fuel for an individual laser into orbit.[118] DeBlois and Garwin remind us, "a single Tomahawk cruise missile . . . could attack heavily armored and nonflammable targets, would not be affected by clouds, and would be expended only when needed."

Finally, orbital common aero vehicles (CAVs) suffer from the same magnitude of cost excess. The prohibitive cost of orbital CAVs would prevent the use of such a system in all but the most isolated cases. In its evaluation of long-range strike options, CBO concluded that "High unit costs would probably make [orbital] CAVs unsuitable for replacing aircraft in roles that require attacking large numbers of targets."[119] CBO estimates that it would cost over 200 billion FY 2006 dollars to purchase enough space-based CAVs to provide the same number of weapons as one day's delivery of 2,000-pound JDAMs by 100 supersonic cruise bombers flying missions against targets 7,000 nautical miles from their base. While the space-based CAV may be appealing for use against targets in hostile territory with strong anti-aircraft defenses, DeBlois and Garwin recommend unmanned combat aerial vehicles as viable, less-expensive alternatives.

Given these strategic, financial, and pragmatic considerations, I recommend the immediate reduction of budget allocations for offensive space-based weapons. The Task Force for a Unified Security Budget estimates that $7 billion in funding was requested by the president for offensive space-based weaponry in his FY 2007 request.[120] The exact value of current spending on space weapons is unknown, as the bulk of spending is presumably classified. Indeed, a March 2006 report by the Center for Defense Information and the Henry L. Stimson Center uncovered only about $1 billion in possible space weapons spending in the publicly available sections of the budget.[121] In the absence of more detailed information, my calculations assume that 2 billion FY 2007 dollars in annual savings is achieved in each future year. Some segment of the remaining funding ought to be directed toward a rigorous set of protective measures for current space assets.

O'Hanlon and other analysts recommend enhanced monitoring of space activity, increased fuel capacity for satellite maneuverability, the development of rapid re-launch capability for replacement satellites, antijamming measures, and the implementation of shutter control against blinding or dazzling of satellite optics. Future satellite circuitry ought to be hardened against radiation and electromagnetic pulse. The Defense Threat Reduction Agency estimates that pre-planned hardening should only increase total satellite unit costs by two to three percent.[122] Similar hardening has already been incorporated into the highest priority systems, including the MILSTAR satellites. "Confidence building measures," including advance notifications of space launches and the creation of "keep-out zones" around deployed satellites may hinder inadvertent conflicts and deter belligerent action. Finally, the military must develop alternatives to military satellites, especially for low altitude assets. Redundancy will reduce incentives for adversaries to attack space assets, and will prevent the possibility of "'single-point failures' that would bring down whole warfighting systems after the loss of a single type of asset."[123] This recommendation is particularly pertinent in light of China's recent demonstration of anti-satellite capability.[124]

The strategic nuclear arsenal

Despite the definitive close of the Cold War, as of January 2005 the United States maintained 5,966 strategic nuclear warheads, deliverable via 1,225 strategic nuclear vehicles, including Intercontinental Ballistic Missiles (ICBMs), Submarine-Launched Ballistic Missiles (SLBMs), and Bomber Aircraft.[125] Broad agreement exists that the current U.S. nuclear arsenal far exceeds the exigencies of all plausible threats. This inexplicably aggressive nuclear weapons posture forgoes valuable opportunities to further the nonproliferation regime. Moreover, the operation, maintenance, and modernization of this outsized arsenal and its complex delivery system entail billions of dollars in wasteful spending on an annual basis.

Accordingly, a host of scholars and scientists have endorsed specific proposals to markedly reduce the number of operable U.S. nuclear warheads. In April 2005 Sidney Drell, a Senior Fellow at the Hoover Institution and professor of physics emeritus at Stanford University, and Ambassador James Goodby, Nonresident Senior Fellow at the Brookings Institution, released an Arms Control Association Report advocating a force structure of 500 operationally deployed nuclear warheads, with 500 warheads in reserve as a "responsive force." The specific structure would retain "the current diversity of systems as a hedge against common failure modes."[126] Drell and Goodby contend that historical precedent rejects the contention that overwhelming stockpiles of nuclear weapons will dissuade developing nations from "strengthening their defenses," citing North Korea and nations in the Middle East and South Asia as examples.[127]

While dissuasion from development is impractical, these scholars still believe that an arsenal of one thousand nuclear warheads will prove more than sufficient for the purposes of deterrence. Drell and Goodby further contend that financial resources ought to be reallocated from maintaining unnecessarily large stockpiles of nuclear weapons, to preventing the acquisition of nuclear materials by terrorist groups.[128]

The report of the Arms Control Association followed a June 2001 joint statement issued by the Center for Defense Information, the Federation of American Scientists, the Natural Resources Defense Council, and the Union of Concerned Scientists recommending the reduction of the nation's nuclear arsenal to one thousand warheads. The statement emphasized that the current "force structure and doctrine are obsolete and jeopardize American national security."[129] The organizations noted that unilateral reduction in U.S. nuclear capacity would provide "Russia an incentive to adopt a safer nuclear posture for its own nuclear arsenal," and had the potential to prompt multilateral negotiations for "deeper, verified nuclear reductions." Most recently, Business Leaders for Sensible Priorities and the Task Force on a Unified Security Budget have separately endorsed similar proposals to reduce the number of U.S. nuclear warheads to one thousand.[130]

The proposal endorsed in this paper would reduce the U.S. strategic nuclear arsenal to one thousand operationally deployed weapons, with 50 weapons stored as spares. No additional warheads would be maintained in a responsive reserve. All three legs of the current triad of delivery systems (intercontinental ballistic missiles, submarine-launched ballistic missiles, and bomber aircraft) would be retained and modernized. However, the United States would retain substantially fewer ICBMs. Instead of developing a full-fledged successor to the Minuteman III, the United States would develop a smaller successor ICBM that could hold only one warhead rather than three. The United States would reduce the number of ballistic nuclear missile submarines (SSBNs) from fourteen to eight. A new, smaller SSBN would be procured starting in 2022, with a new submarine-launched ballistic missile produced in 2023. Finally, the Air Force would forgo the production of a new bomber in the near term, waiting until 2030 to replace the B-2A. Annual savings average 10.7 billion FY 2006 dollars.[131]

These estimates do not include the costs associated with "developing, producing, maintaining, and (eventually) dismantling and disposing of the actual nuclear warheads used to equip US nuclear offensive strategic forces." The Department of Energy is charged with these tasks and currently receives some $17 billion per year for defense-related activities (excluding $1.1 billion for non-proliferation programs). However, reducing the size of the nuclear stockpile is not expected to produce significant savings. Most spending in the Department of Energy is focused on "overhead, environmental cleanup, [research and development] and other activities that are relatively insensitive to the number of warheads in the stockpile."[132] As such, I assume only 200 million FY 2007 dollars per year in savings at the Department of Energy in connection with this recommendation (table 1).

Halt Abuse of the Budget Process and Rein in Pork-Barrel Spending

The eight expenditure reductions endorsed thus far are the product of a healthy review of the current defense budget. Reasonable analysts, armed with the same criteria, might uncover additional justifiable reductions. In addition to scouring the current budget for programs amenable to cancellation or significant reduction, the prudent defense planner must also

address systematic pressures that promote fiscal profligacy in the first place. The issue of pork-barrel spending, while seemingly intractable, offers substantial opportunities for attainable savings.

In December 2005, Senator John McCain exposed a host of preposterous earmarks in the defense appropriations bill for fiscal year 2006, highlighting millions of dollars for museums in Washington, Hawaii, and Pennsylvania, $400,000 for dairy waste remediation in Louisiana, and $600,000 for "conservation related to cranberry production" in Massachusetts and Wisconsin. The appropriations bill also contained $200,000 for the "Weed It Now – Taconic Mountains" program. While Senator McCain professed his support for the "global war on weeds," he also aptly noted that the earmark deserved no place in the defense appropriations bill.[133]

If such gratuitous earmarking were confined to minor parochial projects with negligible impact on the overall budget, the practice might be considered acceptable, perhaps even humorous. Indeed, certain scholars have contended that pork-barrel spending might promote fiscal prudence, providing political cover to legislators deliberating over unpopular structural spending decisions.[134] At present, however, these small grants represent the mere tip of the proverbial iceberg, providing only an indication of the fiscal recklessness submerged from public view.

Hundreds upon hundreds of earmarks are often listed in the Joint Explanatory Statements of conference reports that span 300 or more pages.[135] These line items aggregate to considerable sums: According to the non-profit group Citizens Against Government Waste, the fiscal year 2006 Defense Appropriations Act ultimately contained 2,822 earmarks constituting some $14.9 billion in "pork."[136] While small grants for cranberry conservation garner considerable press, and dairy waste remediation programs offer superlative fodder for pork-busting political speeches, the bulk of pork-barrel spending actually flows from the earmarks with heftier price tags. In fiscal year 2006, the top tenth of defense earmarks (those costing $6 million or more) represented more than 65 percent of the aggregate expenditures on pork. The truly egregious cases typically involve a member of Congress (or multiple members of Congress) attempting to either bolster employment within their district or prevent the loss of jobs from the cessation of an outmoded weapons program.

Admittedly, earmarking has accompanied the legislative process since the inception of the Republic. The first case of pork-barrel spending arguably occurred as early as August 1789, when the House and Senate approved funding for the construction of a lighthouse at Cape Henry in the Chesapeake. The pursuit of parochial interests may simply constitute an irrepressible facet of representative democracy. Nevertheless, the public must act to restrain the growth of this tendency whenever possible, holding this form of spending within reasonable boundaries.

At present, legislative mores seem to have taken a marked turn for the worse. The Congressional Research Service calculates that the number of earmarks in the Defense Appropriations act has more than quadrupled since fiscal year 1994, rising from 587 in that year to 2,506 in fiscal year 2005.[137] In turn, total expenditures on earmarks have swelled from $4.2 billion in fiscal year 1994 to more than $9.0 billion in fiscal year 2005.[138] In similar fashion, the share of annual defense appropriations dominated by pork-barrel spending has risen from 1.8 percent in fiscal year 1994 to 2.3 percent in fiscal year 2005.[139]

Reasonable observers ought to be concerned that the level of pork-barrel spending has breached a pivotal threshold. At some juncture, the practice of distributing funding for innocuous pet projects has escalated to the point where decisions related to national security have become distorted in a serious, tangible fashion. In a scathing rebuke of congressional appropriators entitled *The Wastrels of Defense: How Congress Sabotages U.S. Security*, veteran former Capitol Hill staffer Winslow Wheeler notes that pork-barrel funding often displaces allocations to the operations and maintenance accounts, although this relationship is concealed by a host of obscure legislative mechanisms and disingenuous budget assumptions.[140] In these cases, funding for training, spare parts, and maintenance are directly traded for low-value projects that have not been formally evaluated on the basis of military necessity and technical merit. Invariably, the earmarked projects have not been the subject of congressional hearings. It is not altogether uncommon for the Pentagon to refuse to utilize an earmarked program.[141]

Moreover, the legislative process of securing pork-barrel projects is resource intensive. Some members of Congress dedicate several staff members exclusively to the pursuit of pork. This diversion of precious human capital translates into fewer resources available for issues of genuine oversight. Members of Congress are left with fewer staff aggressively keeping abreast of strategic issues related to the Global War on Terror, including nuclear proliferation, port security, or the domestic transport of dangerous chemicals.

The pernicious effects of pork-barrel spending extend beyond the dollars wasted and capabilities foregone. The process itself tends to undermine civilian leadership of the military. Each year, the Joint Chiefs of Staff submit a document to Congress detailing the military's "unfunded requirements."[142] These documents are wish lists, comprised of items that could not pass muster during the ordinary budget process at DoD. The lists often include VIP transport aircraft for senior military commanders, as well as additional ships or aircraft. These line items have not been subject to review by the Office of the Secretary of Defense nor the Office of Management of Budget. However, because the document comes from the military brass, the projects are rarely considered "pork." The process constitutes an end run around the Secretary of Defense, initiated by the military brass and facilitated by congressional "overseers" prone to blindly seizing upon projects that boost spending within their district.

Finally, the acceleration in pork-barrel spending fosters an appropriations environment ripe for abuse. In November 2005, former Representative Randy "Duke" Cunningham resigned after admitting to accepting $2.4 million in bribes in return for directing Pentagon contracts toward friends through the appropriations process.[143] Cunningham was later sentenced to eight years and four months in prison.[144] As pork-barrel spending proliferates, even the most egregious earmarks may escape close attention. While the infamous $223 million "Bridge to Nowhere" unleashed a spasm of national furor, Congress stubbornly included an equivalent level of general funding for Alaska, which then-Governor Frank Murkowski indicated he planned to utilize to fund construction of the bridge.[145] Moreover, despite ample press attention, few people are aware that Senator Lisa Murkowski, the daughter of the aforementioned former Governor, happens to own property on Gravina Island that might increase in value as a result of the bridge's construction.

Recommendation

For all these reasons, reformers need additional tools to combat the further proliferation of pork-barrel spending and Congress must implement rules that will reduce its own incentive to

engage in this wasteful practice. Although no set of proposals will prove a panacea, the recommendations endorsed by Citizens Against Government Waste deserve consideration.[146] Those reform options entail a combination of tools for enhancing public transparency of the appropriations process while strengthening institutional barriers that block frivolous spending. Those recommendations include limiting the number of projects that each member can request, requiring that conference reports are available at least forty-eight hours prior to floor consideration, and allowing points of order to be raised against unauthorized earmarks and policy riders which could then be stricken from appropriations bills and conference reports.

The merits of certain provisions of this reform package are marginal. For instance, requiring disclosure of earmark sponsorship may restrain members from seeking truly ludicrous projects, but on average, members of Congress seek to trumpet rather than conceal their ability to retain funds for their constituency. Hence the naming of Ted Stevens Anchorage International Airport after former Senate Appropriations Chairman Ted Stevens and the designation of more than thirty public works projects after the ranking member of the Senate Appropriations Committee, Robert C. Byrd.[147] To this end, Wheeler emphasizes that institutional tools already exist to shame members into curtailing their feeding at the federal trough, especially in the Senate. Wheeler notes a host of parliamentary tools available to potential reformers, including Budget Act points of order, the filibuster, quorum calls, and requiring the clerk to read the full text of a bill aloud. In addition to existing tools, Wheeler also recommends that C-SPAN cameras be allowed to display members of Congress delivering speeches to empty chambers, that revolving door provisions be strengthened, and that additions to professional committee staff are made while partisan personal staff are reduced.

Potential savings

While pork-barrel spending will never be eliminated, it can certainly be limited. I project that implementing the preceding reform measures will allow pork-barrel spending to decline as a share of the annual defense budget to its recent historical nadir. Since FY 2000, 2.3 percent of defense appropriations have been earmarked. The minimum share reported by the Congressional Research Service over the preceding twelve-year period is 1.2 percent of aggregate defense appropriations.[148] Shaving 1.1 percent from annual defense spending (falling from 2.3 to 1.2 percent) should translate to an average of $5 billion to $7 billion in savings per year (table 1).[149]

Table 1. Cost Savings Relative to Baseline Projection of Administration Plans for Defense Spending

(billions of then-year dollars)

	Fiscal year										
	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2008-2017**
Terminate F-22A Raptor	0	0	0	0	0	0	0	0	0	0	**0**
Cancel DDG-1000 Zumwalt class destroyer	5	-4	-4	-4	-4	-4	0	0	0	0	**-16**
Scale down national missile defense	-6	-6	-7	-7	-11	-13	-12	-12	-10	-10	**-95**
Cancel V-22 Osprey	0	0	0	0	0	0	0	0	0	-1	**-5**
Slow the Joint Strike Fighter	-4	-6	-1	2	-3	-4	1	2	0	1	**-13**
Restructure the Future Combat Systems	-1	-1	1	1	-1	-2	-4	-6	-5	-5	**-22**
Curtail development of offensive space weapons	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	**-23**
Reduce the size of the strategic nuclear arsenal	-11	-11	-12	-12	-12	-12	-13	-13	-13	-13	**-123**
Rein in pork-barrel spending	-5	-5	-5	-6	-6	-6	-6	-7	-7	-7	**-60**
Total	**-24**	**-36**	**-31**	**-29**	**-40**	**-45**	**-37**	**-39**	**-37**	**-37**	**-356**

Note: Columns and rows may not sum to totals due to rounding. A value of zero indicates that the estimated savings for the given year are between -$500 million and +$500 million. Inflation adjustments calculated using either Congressional Budget Office deflators (CBO, 2005) or official DoD Deflators (Office of the Undersecretary of Defense (Comptroller), *National Defense Budget Estimates for Fiscal Year 2007*, March 2006, p. 46, Table 5-4. Department of Defense Deflators-TOA Calculations assume that 35 percent of remaining procurement funding must be paid to the contractor in the event of cancellation of a program in low-rate initial production. A technical appendix documenting the methodology employed to produce the above estimates is available upon request from the author.

Constraining Cost Growth

Reducing congressional earmarks will yield tangible budgetary gains relative to the baseline estimates of future defense expenditures. However, the key to fiscal balance within the defense budget requires confronting a more significant budget driver: the persistent tendency of weapons acquisitions to exceed their original cost estimates. While we have reviewed the most egregious cases of cost growth with the program cancellations proposed thus far, cost growth is an issue that plagues nearly all major defense acquisitions.

In an April 2006 report the GAO noted that, "historically, DoD's programs for acquiring major weapon systems have taken longer, cost more, and often delivered fewer quantities and other capabilities than planned."[150] David M. Walker, Comptroller General of the United States and head of the GAO, recently testified before the House Armed Services Committee that "it is not unusual to see cost increases that add up to tens or hundreds of millions of dollars, schedule delays that add up to years, and large and expensive programs frequently rebaselined or even scrapped after years of failing to achieve promised capability."[151] CBO estimates that under current plans, annual defense outlays from 2012 to 2024 will average 497 billion FY 2006 dollars. That figure rises to $563 billion when cost risks are acknowledged, a difference of $66 billion per year.[152] While this $66 billion in potential cost growth is not included in the standard baseline, it is nonetheless imperative that the root causes of cost growth receive attention. Failure to address cost growth will preclude the delivery of adequate quantities of technologically mature, well-tested weapon systems to the warfighter on a timely basis.[153]

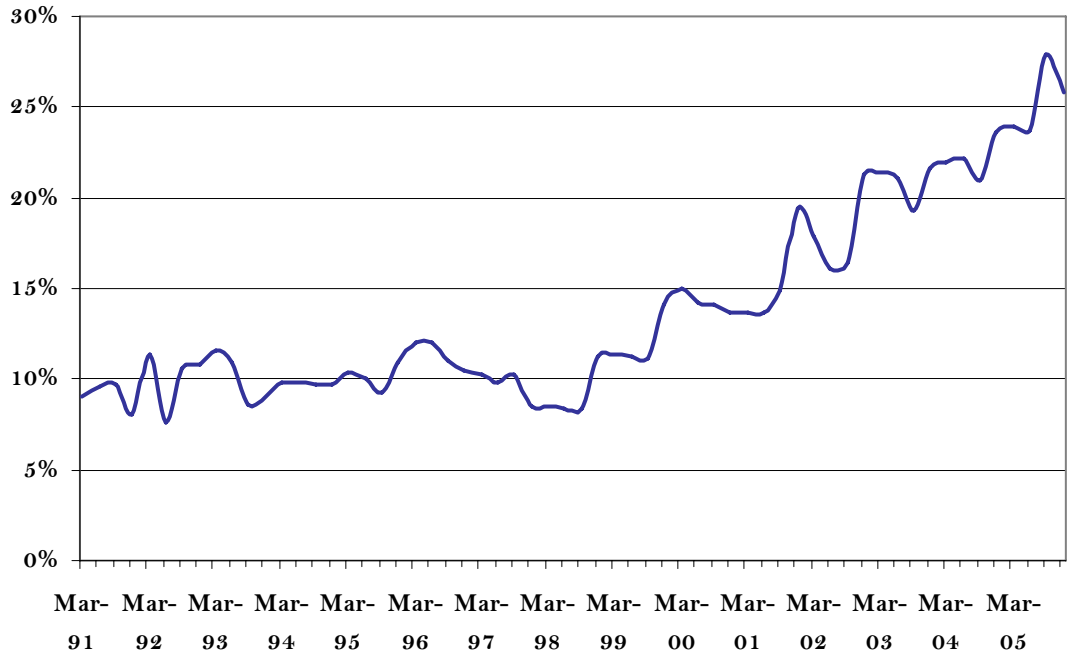
Current Trends in Cost Growth

At present, the system appears to be spiraling out of control. Aggregate statistics by quarter indicate that cost growth for the full weapons acquisition portfolio is exhibiting a stark upward trend, rising from 9.1 percent in March 1991 to 25.8 percent in December 2005 (figure 4).[154] Coalescing with the fact that the overall weapons acquisition portfolio has increased in size, this translates into cost growth totaling $303.4 billion, compared to $88.4 billion fifteen years earlier.

Rising cost growth is a mounting problem at each stage of development, as evidenced by increases in the growth of planning estimates, development estimates, and production estimates, which typically correspond to Milestones A, B, and C in the acquisition process. This implies that cost growth has been substantially higher across the board, not simply for programs inherited from prior administrations. Preliminary comparisons of the development cycle of weapon systems during the current administration relative to completed programs that commenced development from 1991 to 2000 indicate that the cost growth pattern during the current administration is equal to, if not worse than, the prior period.

The acquisitions process has been the subject of considerable scrutiny since the mid-twentieth century. Between 1971 and 2005, DoD has revised its acquisition policy eleven times, and the defense acquisition process has been the subject of no fewer than seven studies and commissions over the same time frame.[155] In January 2006, the Defense Acquisition Performance Assessment Project (DAPAP), commissioned by Deputy Secretary of Defense Gordon England, concluded the most recent study of the acquisitions process, finding little evidence of improvement. The panel stated "it is clear that, despite frequent reform and some isolated successes, the overall performance of the Acquisition System remains problematic."[156]

Figure 4. Percent Unit Cost Growth of Major Defense Acquisition Programs
(by quarter)



Source: Author's calculations using DoD *Selected Acquisition Reports Summary Tables* from 1977 to 2005, available at: www.acq.osd.mil/ara/am/sar/index.html.

Root Causes of Cost Growth

Most major flaws in the acquisitions process are both well-defined and generally accepted by the majority of analysts, including the need for adequate congressional oversight and political leadership. While certain cost-growth drivers (such as a limited supplier base) are not particularly amenable to policy response, others are self-induced and amenable to reform.[157] These drivers include flawed cost estimates, inconsistent application of DoD acquisition policy, discontinuous program management, corruption and abuse, and the growth of the classified budget.

Flawed cost estimates

The GAO has found that "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."[158] That is, overambitious portfolio decisions consistently raise pressure on program officials and defense contractors to release unrealistic cost estimates. To counter this pressure, Deputy Secretary of Defense David Packard started the Cost Analysis Improvement Group (CAIG) in late 1971.

The CAIG is charged with producing parametric cost estimates, which rely upon "cost-estimating relationships" (CERs) or historical similarities in the cost growth patterns of comparable weapon systems. For reasonably similar development programs, CERs have demonstrated remarkable predictive power. Program office estimates, on the other hand, are typically compiled by simply summing an exhaustive list of expected components. As a

consequence, these latter estimates are particularly vulnerable to unplanned or unexpected program activity, including schedule slippage and additional program testing. Bolstering the credibility of CAIG estimates is its quasi-independent status. CAIG analysts do not fall under the purview of the program offices promoting particular projects, but instead reside within the Office of the Secretary of Defense, Program Analysis and Evaluation.[159]

While the production of CAIG estimates is now required in advance of milestone review decisions by the Defense Acquisition Board, the governing statute merely requires that an independent estimate be "considered" by the Secretary of Defense.[160] That is, neither DoD nor Congress are required to budget toward the CAIG estimate. Congress ought to require DoD to budget toward the independently developed CAIG estimates rather than the estimates of the individual services. This rule will ensure that Congress and DoD are forced to negotiate the inevitable trade-offs associated with a finite level of investment resources.

Inconsistent application of DoD acquisition policy

In an alarmingly high proportion of cases, DoD fails to obey its own acquisition guidelines and directives. An April 2006 GAO review of programs initiated subsequent to the most recent revision of DoD's acquisition requirements (DoD Directives 5000.1 and 5000.2), discovered that

> Acquisition officials … regularly bypass key phases of the early acquisition process, approach key decision points with limited knowledge about critical technologies and system design, and do not employ evolutionary acquisition principles. Nearly 80 percent of the programs we assessed were permitted to bypass the policy's initial major decision review and the associated systems-engineering process that are intended to ensure that a system's requirements match available resources and that a sound business case is developed prior to starting system development" (emphasis added).[161]

In December 2005, the GAO issued a report that concluded that the DoD frequently pays "most of the available award fee…regardless of whether acquisition outcomes fell far short of DoD's expectations, were satisfactory, or exceeded expectations".[162]

The DoD frequently commits to weapon systems before obtaining evidence that the capabilities it desires can reasonably be attained within available financial and schedule constraints. The GAO notes that "only 10 percent of the programs in our latest annual assessment of weapon systems had demonstrated critical technologies to best practice standards at the start of development; and only 23 percent demonstrated them to DoD's standards."[163] Finally, the DoD frequently revises or supplements program requirements at late stages of development, resulting in cost increases and schedule extensions that would have been substantially mitigated if these same requirements had been enumerated earlier in the process.

In each of these cases, DoD must act to enforce its own guidelines and policy directives. Since the rules themselves are generally sound, more forceful leadership will be required from the White House, including a willingness to dismiss members of the DoD leadership that resist application of those rules.

Discontinuous program management

The current administration has consistently relied upon revolutionary ("skip-a-generation"), rather than evolutionary, weapon system development, an approach historically prone to substantial cost growth. In addition to the associated problems already highlighted in the discussions of the Future Combat Systems and the Joint Strike Fighter, the propagation of acquisition programs that attempt to complete complex projects in one fell swoop tends to preclude the assignment of program mangers for the full duration of measurable stages of program development. This, in turn, prevents DoD from holding officials accountable when programs go awry. This problem is aggravated by an already weak delineation of responsibility within the acquisitions hierarchy. Further, program officials tend to have minimal authority for setting system funding, requirements, and staffing, and ought not to be unduly penalized for developments that, in many respects, are beyond their control. Finally, high turnover in program managers translates into a large number of program officials administering endeavors that were flawed prior to their arrival.

Corruption and abuse

News reports reveal that the weapons acquisition process may be increasingly tainted with waste, fraud, and abuse. In 2005, a former chief procurement officer for the Air Force, Darlene Druyun, was imprisoned for systematically supporting the Boeing Corporation in defense contracts in return for personal favors, including the hiring of her daughter and son-in-law. The scandal also resulted in the conviction of Boeing's chief financial officer, Michael Sears.[164] Other instances of favoritism are not quite as clear cut. In 2003, Edward Aldridge left his position as Undersecretary of Defense to sit on the board of Lockheed Martin. Prior to his departure, "Aldridge approved a $3 billion contract to build 20 Lockheed F/A-22's, after having long criticized the program as overpriced and having threatened to cancel it."[165] Congress should lengthen waiting periods between government service and employment with defense contractors and expand these revolving door provisions to include senior officials, who are currently exempt.

Growth of the classified budget

Acquisitions housed within the classified portion of the defense budget are subjected to minimal scrutiny. According to a recent report by Steven Kosiak of the Center for Strategic and Budgetary Assessments, spending for classified programs in the DoD budget now total at least 30.1 billion FY 2007 dollars, exceeding the inflation-adjusted, fiscal year 1988 peak for classified spending. In many cases, the public is not even privy to the code names for programs or their total costs. Classified spending is actually imputed from the differences between listed line items and aggregate spending. Kosiak writes, "this lower level of scrutiny, coupled with the compartmentalization of information generally associated with classified efforts has contributed to performance problems and cost growth in a number of programs, such as the Navy's ill-fated A-12 attack aircraft program."[166] Wherever possible, Congress must act to reduce the proportion of programs restricted from their oversight, perhaps through the implementations of a cap on the level of expenditures allowed in the classified portion of the budget.

Policymakers have an ample menu of systemic reform options, although the repeated failures of past efforts do not bode well for future improvements. At the very least, forceful cancellation of the unsuccessful programs discussed above would counter contractor complacency, sending the important message that the DoD and the Congress will not tolerate gross inefficiencies. Regardless of the approach pursued, it is clear that congressional overseers and DoD leadership

must strengthen their oversight of major acquisition programs. As Thomas Christie, former Director of Operation Test and Evaluation (2001-2005), the most senior position at the Department of Defense related to weapons testing, recently wrote, "unless someone is willing to stand up and point out that the emperor has no clothes, the U.S. military will continue to hemorrhage taxpayer dollars and critical years while acquiring equipment that falls short of meeting the needs of troops in the field."[167]

Conclusion

This paper recommends the cancellation or substantial reduction of funding for a number of major weapon systems, several of which have already survived considerable scrutiny at earlier stages in their development cycles. These recommendations, if enacted, would tend to increase the efficiency with which effective equipment is delivered to the warfighter, while reducing projected defense budgets by nearly $35 billion per year. Of course, these recommendations will face substantial obstacles to implementation. Even the strongest Secretaries of the Department of Defense have been held hostage in the acquisitions process, both by Congress and by the military brass. However, it is also true that the overall DoD budget has proven cyclical in nature, and the defense budget may be due for a downward correction by the time the next president enters office in 2009. If real increases in the defense budget continue to materialize through FY 2009, as defense planners have projected, we will have experienced the longest continuous expansion of the defense budget since World War II.[168]

A review of figure 1 reveals that these near-term trends in weapons acquisition spending are simply not sustainable. The most recent version of the *Quadrennial Defense Review* informs us that the Global War on Terror will be a "long war."[169] We must remember that long-term national security requires a defense budget that is not only bold, but also fiscally prudent. United States military dominance flows not simply from sheer manpower, but rather from a strong economic foundation that fosters unparalleled technological innovation and industrial production. Consistent overextension of federal resources reduces public savings, erodes the economic base, and could provoke an economic crisis that would dramatically undermine the ability of the government to consistently and effectively promote national security.

The reality of limited resources and the necessity of scaling down defense expenditures do not portend doom for the United States in its fight against terror. The United States is nowhere in the vicinity of relinquishing its technological dominance. In most cases, U.S. equipment is generations ahead of potential threats. Spending in the categories of procurement and research and development vastly outstrips that of potential adversaries. Indeed, in 2005, United States defense spending represented more than 43 percent of the world total.[170] The modest expenditure reductions advocated in this paper expunge low-priority, ineffective programs from the defense budget in favor of fiscal balance that will allow the United States to remain prepared for the security challenges that remain in the years ahead.

Endnotes

1. Here, "the Department of Defense budget" refers to expenditures under budget function 051. Figures are calculated from the close of fiscal year 2001 to the close of fiscal year 2006. See Congressional Budget Office (CBO) 2006a; *Fiscal Year 2007 Budget of the United States Government* (Table 3.2. "Outlays by Function and Subfunction"); and deflator series from CBO, 2005.
2. Belasco, 2006.
3. These estimates assume that supplemental appropriations for the GWOT are paid out during the same fiscal year in which they were appropriated. This assumption is necessitated by the fact that the Treasury Department does not distinguish war-related spending from other Department of Defense expenditures.
4. It is certainly plausible that the GWOT has imposed indirect effects on the rest of the national defense budget. For example, in order to maintain recruitment and retention levels, especially for combat troops, recruiting resources and educational benefits under the GI Bill are higher than they might have otherwise been in the absence of armed conflict. See CBO, 2006b.
5. Ornstein and Mann, 2006.
6. Jonathan Weisman and Stephen Barr, "Congress's Last Acts Include Tax Breaks" *Washington Post*, December 10, 2006, p. A5.
7. Kori Schake, "Jurassic Pork," *New York Times*, February 9, 2006, p. A27.
8. U.S. Department of Defense, 2006.
9. Such a shift would acknowledge the role of "poverty, government failure, and tribalism" in the development of international conflict. See Adams, 2005.
10. See Adams, 2006.
11. CBO, 2005.
12. Adams, 2006, pp. 157–158.
13. Daggett, 2006.
14. These calculations are based on estimates of fiscal year 2006 outlays projected in the *Fiscal Year 2007 Budget of the United States Government* (Table 3.2). Final reporting for actual outlays will be contained in the *Fiscal Year 2008 Budget of the United States Government*, to be released in February 2007. Treasury Department statements indicate that aggregate DoD spending was 2.5 percent less than originally projected, so growth in procurement and RDT&E accounts may be slightly less than the percentages reported above.
15. Here, "weapons acquisition portfolio" refers to the life-cycle estimated cost of major weapons acquisitions programs currently under development or production. Only major defense acquisition programs (MDAPs) are reported in the quarterly Selected Acquisition Reports summaries upon which I rely for this analysis. In order for a weapon system to be considered an MDAP, it must be estimated by the Secretary of Defense to "to require an eventual total expenditure for research, development, test, and evaluation of more than $300,000,000 (based on fiscal year 1990 constant dollars) or an eventual total expenditure for procurement of more than $1,800,000,000 (based on fiscal year 1990 constant dollars)." U.S. Code Title 10, Section 2430.
16. Author's calculation using DoD *Selected Acquisition Reports Summary Tables* from 1977 to 2005 (www.acq.osd.mil/ara/am/sar/index.html). Inflation adjustments calculated using "Defense Composite Outlay Deflator" contained in *Fiscal Year 2007 Budget of the United States Government* (Table 10.1. "Gross Domestic Product and Deflators Used in the Historical Tables: 1940–2011").
17. Gold, 2002.
18. CBO, 2006f.
19. For instance, the current budgetary emphasis on multiple short-range fighter programs is mystifying, given that U.S. air-to-air combat capability vastly surpasses that of any nation considered a potential threat. Moreover, our recent experience in Iraq and Afghanistan reveals that forward air bases may be difficult to secure in future conflicts. See Watts, 2005.
20. Few, if any, analysts suggest modifications to the operations and maintenance segments of the budget. The segments of the defense budget not pertaining to weapons acquisition do not appear to include major line items amenable to substantial cuts or outright cancellation. According to CBO, most future growth in spending for operations and support activities will flow from increases in the cost of personnel, including real increases in wages and in the cost of medical benefits.
21. Walker, 2006.
22. Defense Acquisition Performance Assessment Project (DAPAP), 2006.
23. Government Accountability Office (GAO), 2006d, pp. 59–60.
24. At present, the Air Force continues to request a minimum of 381 F-22A aircraft. See Wheeler, 2005.

25. GAO, 2006b.
26. Author's calculations from U.S. Air Force, "A-10/OA-10 THUNDERBOLT II" (www.af.mil/factsheets/factsheet.asp?fsID=70 [January 2007]).
27. Pierre Sprey and James Stevenson, "The F-22: Not What We Were Hoping For," *Jane's Defence Weekly*, September 20, 2006, p. 23.
28. GAO, 2006b.
29. Public Law No. 109-289, Section 8008.
30. Bolkcom, 2006, p. 8.
31. GAO, 2006d, pp. 71–72.
32. The DDG-1000 Zumwalt Class Destroyer was formerly known as the DD(X) destroyer. In fact, the program has experienced several incarnations, originally appearing as the DD-21 destroyer during the Clinton administration.
33. Korb and Pemberton, 2006, pp. 17–18.
34. CBO, 2006d, pp. 18–19.
35. Korb and Pemberton, 2006, pp. 17–18.
36. Noah Shachtman, "Defending America: The Pentagon wants to deploy a host of exotic new weapons systems. Critics say too much of this costly hardware is designed to fight the wrong war," *Popular Mechanics*, April 2006.
37. CBO, 2006d, p. 19.
38. Work, 2006, p. 5.
39. The DDG-1000 was approved for low-rate initial production on November 23, 2005. As such, I subtract 35 percent of procurement costs for fiscal year 2008 through fiscal year 2013 from the estimated savings. See "DDG-1000 History" (peos.crane.navy.mil/DDG1000/Program_status.htm [December 7, 2006]).
40. Jonathan Karp, "Politics and Economics: North Korea Missile Lapse is Break for Pentagon; U.S. Now Has More Time to Ready Two Key Trials of Costly Shield Defense," *Wall Street Journal*, July 6, 2006, p. A6.
41. Samson, 2006b; Samson and Gard, 2006.
42. Samson, 2006a.
43. Samson, 2006b.
44. Under the CBO projections, total investment in missile defense will peak in 2013 at around 15 billion FY 2006 dollars and then decrease as procurement concludes and these systems become operational. This baseline does not include historical cost risk. See CBO, 2006f, figure 3-30a.
45. CBO, 2005, pp. 41–45.
46. Barton Gellman, "Accident is Latest Twist for Troubled Program," *Washington Post*, July 21, 1992, p. A9; James Dao, "After North Carolina Crash, Marines Ground Osprey Program," *New York Times*, December 13, 2000, p. A33.
47. Leslie Wayne, "A Final Push for the Bedeviled, Beloved Osprey," *New York Times*, July 6, 2003, p. A1; Tim Weiner, "For Military Plane in Crash, History of Political Conflict," *New York Times*, April 11, 2000, p. A1.
48. Bell Helicopter, "The V-22: Transforming Aviation: Capabilities Extended, Options Multiplied, Missions Redefined," January 2007 (www.bellhelicopter.textron.com/en/aircraft/military/bellV-22.cfm).
49. The joint UK/Italian developed EH-101 has also been known as the US-101 in the United States. A modified version of the helicopter has also been selected as the successor for the president's "Marine One Squadron," carrying the new title, VH-71A. See www.agustawestland.com/dindoc/US101_PRV_%20Fact-sheets(2).pdf (January 2007) for specifications of the US-101 and U.S. Marine Corps, "CH-46E Sea Knight Helicopter" (www.hqmc.usmc.mil/factfile.nsf/0/387b12923ec35d6f8525626e0048eada?OpenDocument [January 2007]), for specifications of the CH-46E.
50. See U.S. Marine Corps, "CH-53E Super Stallion Helicopter" (www.hqmc.usmc.mil/factfile.nsf/0/8a583a9bef2c6f8d8525626e0048f5fc?OpenDocument [January 2007]).
51. Authors' calculations using DoD Selected Acquisition Reports, Summary Report September 2005 (www.acq.osd.mil/ara/am/sar/index.html) and GAO, 2006d, pp. 113–114. Unit cost calculations include both research and development and procurement costs.
52. Everest Riccioni, "Osprey or Albatross," *Defense News*, January 27, 2004.
53. Tim Weiner, "For Military Plane in Crash, History of Political Conflict," *New York Times*, April 11, 2000, p. A1.
54. Bolkcom, 2005, p. 12.
55. Leishman, Bhagwat, and Ananthan, 2002, pp. 642–671.
56. Michael A. Dornheim, "Tiltrotor Wake 'More Complex' Than Classic Vortex Ring State," *Aviation Week & Space Technology*, July 15, 2002, p. 53.

57. Gaillard, 2006.
58. Federal Aviation Administration, 2005.
59. Bolkcom, 2005, pp. 12–13.
60. Gaillard, 2006, p. 21.
61. Duma, 2005, p. 16.
62. James Dao, "After North Carolina Crash, Marines Ground Osprey Program," *New York Times*, December 13, 2000, p. A33; Mary Pat Flaherty and Thomas E. Ricks, "Pilots Hit Osprey's Testing, Flaw Was Known But Wasn't Fixed," *Washington Post*, April 5, 2001, p. A1.
63. Mary Pat Flaherty and Thomas E. Ricks, "Pilots Hit Osprey's Testing, Flaw Was Known But Wasn't Fixed," *Washington Post*, April 5, 2001, p. A1.
64. Suzette Parmley, "New Snags Arise for the Osprey," *Philadelphia Inquirer*, November 5, 2005, p. A1.
65. Robert Wall, "More Fixed Needed; MV-22 Crash Isn't Slowing Marine Corps Planning for 2007 Iraq Deployment," *Aviation Week & Space Technology*, April 10, 2006.
66. Leslie Wayne, "For the Osprey Hybrid Aircraft, Zigzags to Cap 20 Years of Zigzags," *New York Times*, July 19, 2006, p. C4.
67. Duma, 2005, pp. 6–7.
68. Duma, 2005, p. 19.
69. Duma, 2005, p. 6.
70. Duma, 2005, p. 34. See also GAO, 2006d, pp. 113–114.
71. Duma, 2005, pp. E-4, 37.
72. GAO, 2006d, pp.113–114.
73. GAO, 2006d, pp.113–114.
74. Mary Pat Flaherty, "Three Marines Guilty in Osprey Records Case," *Washington Post*, September 15, 2001, p. A22.
75. Duma, 2005, pp. E-3, 27.
76. Depending on the size of cancellation costs, the savings might be somewhat less than the estimated $4 billion. Regardless, the rationale for cancelling the program remains salient. See CBO, 2005, pp. 34–35.
77. GAO, 2006d, pp. 61–62.
78. GAO, 2006d, pp. 71–72.
79. U.S. House of Representatives, 2005.
80. Bolkcom, 2006, pp. 3–4. See also GAO, 2006d, pp. 71–72.
81. Korb, 2006, p. 9.
82. Sullivan, 2006, p. 9.
83. Sullivan, 2006, pp. 9–10 and 12–14.
84. GAO, 2006f.
85. Sullivan, 2006, pp. 18–20.
86. CBO, 2006c, pp. xi–xxv.
87. Current Abrams tanks and Bradley fighting vehicles are capable of traveling no further than two miles per gallon of fuel.
88. Francis, 2006, p. 5.
89. Francis, 2006, p. 2.
90. Bolton, 2006, p. 3.
91. Joseph C. Anselmo, "Hunter's World," *Aviation Week & Space Technology*, September 12, 2005, p. 44.
92. Indeed, none of the technologies considered integral to the success of FCS have been fully matured at this stage. Francis, 2006, pp. 5–6.
93. Francis, 2006, pp. 9–10.
94. GAO, 2006d, pp. 61–62.
95. Gilmore, 2006, p. 8.
96. CBO, 2006c, p. xvi; "CAIG: Future Combat System Life-Cycle Costs Skyrocket to $300 Billion," *Inside the Army*, July 10, 2006.
97. U.S. House of Representatives, 2005.
98. Gilmore, 2006, pp. 10–13.
99. U.S. House of Representatives, 2005.
100. O'Hanlon, 2005, p. 89.
101. GAO, 2006a, pp. 1–2.

102. U.S. House of Representatives, 2005.
103. Foster et al., 2004.
104. GAO, 2006e, p. 40.
105. RAND defines space weapons as "things intended to cause harm that are based in space or that have an essential element based in space. The degree of harm we include in defining space weapons may range from temporary disruption to permanent destruction or death." See Preston et al., 2002, p. 23.
106. See Korb, 2006, p. 10.
107. Rupert Cornwell, "The Real Star Wars: Genesis of a New Arms Race," *The Independent* (London), May 30, 2005, pp. 20–21.
108. Commission to Assess United States National Security Space Management and Organization, 2001, p. 8.
109. James Kitfield, "Weapons in the High Heavens?" *National Journal*, September 17, 2005, pp. 2850–2853; Rupert Cornwell, "The Real Star Wars: Genesis of a New Arms Race," *The Independent* (London), May 30, 2005, pp. 20–21.
110. DeBlois et al., 2004. In addition, an XSS-11 satellite was subsequently fielded.
111. O'Hanlon, 2004, pp. 42, 54.
112. O'Hanlon, 2004, p. 121.
113. Federation of American Scientists Panel on Weapons in Space, 2004.
114. DeBlois et al., 2004, p. 64.
115. DeBlois et al., 2004, p. 68.
116. Arming ICBMs with conventional weapons poses a number of serious concerns, including possible misinterpretation by Russia or China. DeBlois et al., 2004; CBO, 2006e, p. 1.
117. All dollar figures in this paragraph are assumed to match the time of publication of the article by DeBlois et al., 2004.
118. Launch costs are reduced for space-based lasers at lower orbits (potentially $60 million per target), but a larger number of lasers would be required for a globally-encompassing constellation.
119. CBO, 2006e, p. 33.
120. The Report of the Task Force on A Unified Security Budget for the United States is a collaborative project drawing upon a set of leading security experts across a variety of institutions, sponsored by the Center for Defense Information and Foreign Policy in Focus. See Korb and Pemberton, 2006.
121. These line items are spending on capabilities that are potentially "dual-use." See Hitchens, Katz-Hyman, and Samson, 2006.
122. Federation of American Scientists Panel on Weapons in Space, 2004.
123. O'Hanlon, 2006.
124. David E. Sanger and Joseph Kahn, "U.S. Officials Try to Interpret China's Silence over Satellite," *New York Times*, January 22, 2007, p. A3.
125. Drell and Goodby, 2005, p. 32. The number of active strategic nuclear warheads has fallen somewhat since that time in accordance with the Strategic Offensive Reductions Treaty.
126. Drell and Goodby, 2005, p. v.
127. Drell and Goodby, 2005, p. 7.
128. Drell and Goodby, 2005, p. 26.
129. Center for Defense Information et al., 2001.
130. Business Leaders for Sensible Priorities is a 600 member organization of American business leaders concerned about federal government spending decisions.
131. Kosiak, 2006a, table 7. Option 4 would result in an average of 10.7 billion FY 2006 dollars in annual savings from 2006-2020, relative to option 1, which represents a reasonable interpretation of current administration plans. Estimates assume that the cost savings associated with long-range bombers are categorized under the nuclear heading, although some bombers are "dual-use" and are capable of carrying conventional weapons.
132. Kosiak, 2006a, pp. 58–63.
133. *Congressional Record*, December 20, 2005, p. S14109.
134. Ellwood and Patashnik, 1993.
135. Wheeler, 2004, p. 14.
136. CAGW categorizes projects as pork if they trigger one of seven criteria: requested by only one chamber of Congress; not specifically authorized; not awarded competitively; not requested by the president; greatly exceeds the president's budget request or the previous year's funding; not the subject of congressional hearings; or serves only a local or special interest. See CAGW, 2006, pp. 9–13.

137. The Congressional Research Service study focuses on "earmarks," rather than pork-barrel spending. CRS adopts different definitions for "earmark" depending on the nature of the appropriations bill considered. In the case of defense appropriations, CRS generally applies the term earmark to provisions that allocate funds at a "level of specificity below the normal line item level."
138. Congressional Research Service Appropriations Team, 2006, pp. 11–12. Note that the fiscal year 2005 data "does not include emergency appropriations for Iraq, Afghanistan, and other purposes provided in a separate Title in the FY 2005 bill." As such, the reported statistics understate the growth in aggregate earmarks.
139. The rapid growth of the defense budget during this time period renders this trend all the more remarkable. Note that the fiscal year 2005 figure does not reflect emergency appropriations for Iraq, Afghanistan, and other purposes in that year.
140. Wheeler, 2004, pp. 46–49.
141. For instance, in June 2006, the Washington Post reported that over the prior decade, Congress had earmarked nearly $37 million in funding for "Vibration & Sound Solutions Ltd" to develop magnetic levitation technology in which the Pentagon was not interested. See Charles R. Babcock, "The Project That Wouldn't Die," *Washington Post*, June 19, 2006, p. D1.
142. Wheeler, 2004, p. 80.
143. John M. Broder and Carl Hulse, "Republicans Denounce Ex-Lawmaker," *New York Times*, November 30, 2005, p. A29.
144. Jackie Calmes, "Politics and Economics: Pentagon's Blank Check May Be Withdrawn," *Wall Street Journal*, March 10, 2006, p. A6.
145. Michael Grunwald, "Pork by Any Other Name…" *Washington Post*, April 30, 2006, p. B1.
146. Finnigan, 2006.
147. See Citizens Against Government Waste, "Byrd Droppings" (www.cagw.org/site/PageServer?pagename=news_byrddroppings [July 11, 2006]); Michael Grunwald, "Pork by Any Other Name…" *Washington Post*, April 30, 2006, p. B1.
148. Congressional Research Service Appropriations Team, 2006, p. 12.
149. Eliminating pork-barrel items may result in a replenishment of operations and maintenance accounts that have been drained to finance wasteful expenditures. To the extent that operations and maintenance accounts rise in response, estimated budgetary savings will be overstated (although gains in military readiness will be understated).
150. GAO, 2006c, p. 4.
151. Walker, 2006, p. 1.
152. The majority of the estimated cost risk relates to weapons acquisition. CBO, 2005.
153. Given its mandate to estimate the long-term implications of current law, CBO does not assume that program quantities will be scaled downward when unit costs increase. In the cases where ordered quantities are decreased, total cost growth is mitigated somewhat, although actual buying power is still markedly diminished.
154. To be fair, the 1990s were supposedly a time during which the United States was expected to reap a "peace dividend" following the close of the Cold War. Few ambitious weapon systems were initiated during this time period, which might explain the lower levels of cost growth relative to the current period. Concomitantly, of course, the absence of major program starts during the 1990s should imply a later average stage of development for major weapon systems, which should translate to a higher level of cost growth relative to a portfolio containing programs at earlier stages of development.
155. GAO, 2006c, pp. 4–5.
156. DAPAP, 2006, p. 18.
157. A limited supplier base, combined with fewer new contracts, reduces the ability of the DoD to maximize competition. In 1985, more than twenty "fully competent prime contractors" competed for several programs on an annual basis. Today, only six firms remain, and those firms compete for "fewer and fewer programs each year." Given the highly technical nature of DoD acquisition contracts, new firms face substantial barriers to entry. The cyclical nature of funding for RDT&E and procurement also requires firms to be large enough to withstand considerable uncertainty and volatility in funding. These factors combine to dramatically limit the number of competent firms submitting bids for major contracts. See DAPAP, 2006, p. 7.
158. Walker, 2006, p. 6.
159. Srull, 1998.
160. U.S. Code Title 10, Section 2434.
161. GAO, 2006c, p. 3.

162. See GAO 2005, p. 3, emphasis added.
163. Walker, 2006, pp. 6–7.
164. Michael Hirsh, "Where's the Oversight?," *Newsweek* (Web-Exclusive), February 13, 2006.
165. Leslie Wayne, "Pentagon Brass and Military Contractors' Gold," *New York Times*, June 29, 2004, p. C1.
166. Kosiak, 2006b.
167. Christie, 2006, p. 35.
168. Work, 2006, p. 6.
169. U.S. Department of Defense, 2006, p. v.
170. See Central Intelligence Agency, "Military expenditures – dollar figure," *World Factbook 2006* (www.cia.gov/cia/publications/factbook/fields/2067.html).

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