CONGRESSIONAL BUDGET OFFICE
U.S. Congress
Washington, DC 20515

Douglas Holtz-Eakin, Director

July 29, 2003

The Honorable Ted Stevens
Chairman
Committee on Appropriations
United States Senate
S-128, The Capitol
Washington, DC 20510-6025

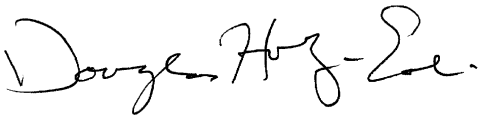
Dear Mr. Chairman:

In response to your request, the Congressional Budget Office (CBO) has reviewed the past and current use of contractors by the National Aeronautics and Space Administration (NASA) to operate and maintain the Space Shuttle. CBO has also examined other cases in which the United States government uses contractors to perform technologically complex activities. CBO's examination focuses on selected activities that it judges to be of interest based on their content. While informative, these examples do not constitute a comprehensive review of technologically complex activities conducted by the government. Nor has CBO audited the performance of the government sponsors or contractors involved in these activities.

The activities CBO examines span a broad range and include maintaining and upgrading weapons systems, designing and producing weapon systems, operating and maintaining government nuclear facilities, and designing nuclear weapons. The nature of the work contractors perform varies among these activities. In some cases contractors are designing and producing complete multi-element systems; in other cases the contractors maintain or install upgrades to specific government-owned hardware or operate facilities for the government. How the government defines the work that the contractors perform also varies—in some cases the government provides a set of detailed, comprehensive specifications; in others the government uses top-level performance measures, leaving some or many details to be defined by the contractors. The cost of the work varies from annual expenditures of tens of millions of dollars to billions of dollars. The contracts used are in some cases sole-source and in others competitively awarded; some contracts are cost plus fee, and some are firm-fixed price. The size of the government workforce performing oversight of the contractors varies from less than one hundred to more than a thousand people, and how that oversight is conducted also varies. Thus, many of the elements of the examples CBO has examined differ from the ways NASA uses contractors to operate the Shuttle. Nonetheless, all of the examples considered by CBO involve the government's use of contractors to perform demanding, technologically complex tasks, a situation that is not unique to NASA.

The attachment to this letter describes CBO's review, which was prepared by Adebayo Adedeji, David Arthur, Eric Labs, Fran Lussier, and Robie Samanta-Roy of CBO's National Security Division. CBO's staff point of contact for this effort is J. Michael Gilmore, who can be reached at 202-226-2900.

Sincerely,



Douglas Holtz-Eakin
Director

Attachment

cc: Honorable Robert Byrd
Ranking Member

NASA's Space Flight Operations Contract and Other Technologically Complex Government Activities Conducted by Contractors

July 29, 2003

Congress of the United States
Congressional Budget Office

Contents

Summary and Introduction

The space shuttle, formally known as the Space Transportation System (STS), was developed during the 1970s. The first operational shuttle, *Columbia*, was delivered to the National Aeronautics and Space Administration (NASA) in 1979 and first flew in 1981. The shuttle consists of a reusable orbiter manned vehicle, two reusable solid rocket boosters (SRBs), and an expendable external tank that holds the propellants used by the orbiter's three space shuttle main engines (SSMEs) during launch. The shuttle fleet initially consisted of four orbiter vehicles, and NASA initially planned for the STS to fly up to 60 missions per year; however, at most, it has flown only eight missions annually. In 1986, the *Challenger* exploded on its ascent to orbit, and subsequently, the Congress authorized funds for a replacement vehicle. On February 1, 2003, the *Columbia* disintegrated as it reentered Earth's atmosphere. Currently, there are three remaining orbiters in the fleet—*Atlantis*, *Discovery*, and *Endeavour*—which have about 75 percent of their design life remaining, based on a goal of 100 missions per orbiter.

The space shuttle program continues to be one of the most significant individual portions of NASA's budget. In the President's budget for 2004, the space shuttle accounted for about 26 percent of NASA's total proposed funding.

In 1995, NASA began planning to consolidate the numerous individual contracts it was using to operate the shuttle into a single contract let to a single contractor. In 1997, NASA initiated the first phase of that consolidation by contracting with United Space Alliance (USA), a limited liability company owned jointly by Boeing and Lockheed Martin.[1] Under the Space Flight Operations Contract (SFOC), USA was to perform some—but not all—of the tasks associated with shuttle operations. Not all of the originally planned consolidation has occurred, although additional activities were subsequently incorporated under the SFOC in Phase II, which began in 1998. In particular, the propulsion elements, such as the external tank, SSMEs, and propellant portions of the SRBs, have not been incorporated under the contract. NASA still uses multiple contractors, albeit a lesser number than it used originally, to operate and maintain the shuttle.

At the request of the Chairman of the Senate Appropriations Committee, the Congressional Budget Office (CBO) has reviewed NASA's past and current use of contractors to operate the shuttle. CBO's review also describes other cases in which the U.S. government uses contractors to undertake technologically complex endeavors like the shuttle's operation and maintenance (see Table 1). CBO's examination focuses on selected illustrative activities that it judges to be of interest on the

1. Limited liability companies (LLCs) have characteristics of both regular corporations and partnerships. Like the stockholders of regular corporations, the owners of LLCs are not personally liable for the debts and liabilities of the organization. However, an LLC can be taxed as a pass-through entity, like a partnership, so there is no corporate tax on its net income. The profits of the LLC are automatically included in the owners' income for tax purposes.

basis of their content. Although selected to be informative, the examples do not constitute a comprehensive review of the government's technologically complex activities. Nor has CBO audited the performance of the associated contractors or government agencies.

The activities that CBO examined span a broad range and include maintaining, upgrading, designing, and producing weapon systems; operating and maintaining the government's nuclear facilities; and designing nuclear weapons. The type of work that contractors perform varies among those activities. For example, in some cases, the contractors may design and produce complete multielement systems; in other cases, they may maintain or install upgrades to specific government-owned hardware or operate government facilities.

How the government defines the work that the contractors perform also varies—in some instances, the government may provide a set of detailed, comprehensive specifications; in others, it may use less specific performance measures, leaving some or many of the details to be defined by the contractors. The cost of the work ranges

Table 1.
Examples of Selected Technologically Complex Government Activities Conducted by Contractors

Activity	Government Department
Coast Guard Deepwater Project	Department of Homeland Security
Evolved Expendable Launch Vehicle Program	Department of the Air Force
Future Combat System	Department of the Army
Lawrence Livermore National Laboratory	Department of Energy
Logistics Support for the B-2 Bomber	Department of the Air Force
National Missile Defense—National Team	Department of Defense
Refueling/Overhauls for Aircraft Carriers	Department of the Navy
Savannah River Site Program	Department of Energy
Trident Ballistic Missile Submarine Conversions to Perform Conventional Missions	Department of the Navy

Source: Congressional Budget Office.

from annual expenditures of tens of millions of dollars to billions. The contracts used are sometimes sole-source contracts and sometimes competitively awarded; some are of the cost-plus-fee type, and others feature firm fixed prices.

The size of the government workforce that oversees the contractors for a given activity varies from less than 100 personnel to more than a thousand, and how that oversight is conducted may differ from activity to activity. For example, in some cases, the government may require contractors to prepare and submit reports according to government specifications; in other cases, it may use internal contractor-generated reports.

In sum, many of the features of the activities that CBO has examined differ from the elements that characterize NASA's use of contractors to operate the space shuttle. As is the case with the shuttle's operation, however, all of the examples involve the government's use of contractors to perform demanding, technologically complex tasks, a situation that is not unique to NASA.

History of NASA's Use of Contractors to Operate the Shuttle

As noted earlier, from the early 1980s through 1996, NASA used numerous contracts with individual contractors to operate and maintain the space shuttle. In late 1994, NASA Administrator Daniel Goldin formed an independent team to propose approaches to improve the shuttle's management. The team was led by Christopher Kraft, the flight director during the early Mercury and Gemini missions; its membership was drawn from the aerospace industry and former NASA leaders. NASA stated that the panel's objective, set within the context of flat NASA budgets and initiatives to reduce the civil service workforce, was to maintain safety while significantly decreasing total operating costs.

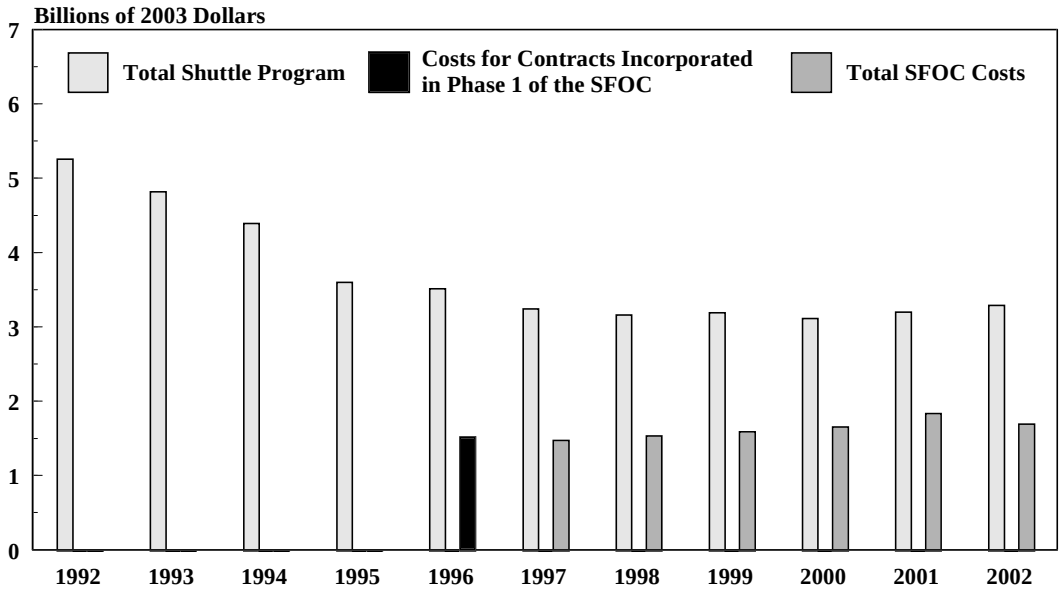
The *Report of the Space Shuttle Management Independent Review*, also known as the Kraft report, was released in February 1995, and its key recommendation was to place the shuttle's operations under a single prime contractor. In addition, the review team recommended that NASA reduce its involvement in and oversight of the operation of the space shuttle, transferring responsibility for daily operations to the contractor; and that various elements of the shuttle program, such as its processing before flight and its flight operations, be consolidated and reduced, along with the minimizing of NASA-contractor interaction. The Kraft report stated (p. 8): "Many inefficiencies and difficulties in the current Shuttle Program can be attributed to the diffuse and fragmented NASA and contractor structure. Numerous contractors exist supporting various program elements, resulting in ambiguous lines of communication and diffused responsibility. This type of fragmented structure and contract management provides little promise for significant cost reductions."

In September 1995, NASA held a competitive bidder's conference for the Space Flight Operations Contract, which was attended by Boeing, McDonnell Douglas, Rockwell/Lockheed Martin/United Space Alliance, and a small business (BAMSI International). USA was to be a limited liability company, with ownership split equally between Rockwell and Lockheed Martin—which at the time together accounted for approximately 69 percent of the dollar value of all shuttle-related prime contracts. In November 1995, the NASA administrator submitted a so-called Determination and Findings to the Congress, which concluded that it was in the public interest to award a sole-source contract for shuttle operations to USA. NASA awarded the SFOC effective October 1, 1996, and a total of 9,400 employees of Rockwell, Lockheed Martin, Unisys, and Allied Signal became employees of USA. In December 1996, Boeing acquired Rockwell and hence joined Lockheed Martin as an owner of USA.

Prior to initiation of the SFOC, NASA had taken steps to make the shuttle program more efficient. Over a period of five years starting in 1990, operational maintenance requirements and specifications decreased from 11,000 to 8,000, while the number of hours of labor devoted to processing each vehicle for a mission was cut from about 1 million to 750,000. Operating costs were reduced by about 25 percent. The majority of the reductions in NASA's overall shuttle workforce and budgets since 1992 occurred before the SFOC was initiated (see Figure 1 and Table 2).

SFOC costs have varied over time because of changes in its content (for example, the incorporation of additional activities under Phase II) and variations in annual launch rates. The reductions in the space shuttle's budget and workforce that occurred from 1990 to 1995 are due in part to changes that NASA made in its requirements for inspecting the shuttle during processing. Before 1989, preparing the shuttle for a launch required contractor and government personnel to execute about 44,000 government mandatory inspection points (GMIPSs) and 325,000 designated inspection points (DIPs). GMIPs are required by NASA in order for it to accept the work performed by its contractors on the shuttle. DIPs are inspections performed on work that if not accomplished correctly could result in the loss of life, a vehicle, or a mission or in a major schedule delay. Between 1993 and 1995, NASA introduced a "structured surveillance" program in which technicians were allowed to ensure the quality of their own work, primarily for non-single-point failure systems. That approach reduced GMIPs to around 22,000 and DIPs to around 140,000 per launch. During the 1997-1998 period, NASA made a concerted effort to further

Figure 1.
Annual Budgets for the Space Shuttle



Source: Congressional Budget Office based on data from the National Aeronautics and Space Administration.

Notes: SFOC = Space Flight Operations Contract. About 10 percent of total SFOC costs are for work related to the International Space Station.

This figure does not include salaries for NASA's civil servants or overhead.

reduce nonessential inspections, which resulted in a drop in GMIPs to around 8,500.[2] The DIP count, however, remained at 140,000.[3]

2. After wiring problems were found on *Columbia* in 1999, a few more GMIPs were added.

3. As an example, before 1997, both NASA and contractor personnel performed postflight inspections of the thermal protection system, although NASA determined which tiles to repair and replace and performed the final preflight inspection. After the reduction in inspections, USA conducted the postflight inspection and determined which tiles to repair and replace. NASA then performed the final preflight inspection. In this case, the contractor performed the same number of inspections, but NASA was able to eliminate one set of inspections.

The Space Flight Operations Contract

The SFOC (formally known as NAS 9-20000) between NASA and the United Space Alliance, is a cost-plus-fee contract. According to NASA, the SFOC is a"completion form" contract under which the contractor is responsible for performing a specific set of tasks defined in a statement of work that is part of the contract.

The value of the original contract was $6.94 billion and the period of performance was from October 1, 1996, through September 30, 2002, with two two-year options. The first of the two options has been exercised, for a cost of $2.9 billion, and will expire in September 2004. The second option would extend the contract through September 2006. NASA also has two other shorter-term options under consideration that would extend the contract through December 2004 or March 2005. The total value of the contract to date, including shuttle upgrades and other annual authorizations, is $12.8 billion.

Table 2.
The Space Shuttle's Workforce, 1992 to 2002

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
NASA Employees											
Associated with the shuttle program	4,000	3,800	3,300	3,066	2,650	2,196	1,954	1,777	1,786	1,759	1,724
Associated with the SFOC[a]	n.a.	n.a.	n.a.	n.a.	n.a.	1,604	1,252	1,260	1,251	1,219	1,191
SFOC Contractor Personnel[a]	n.a.	n.a.	n.a.	n.a.	n.a.	12,207	11,989	11,820	12,859	13,478	12,958

Source: Congressional Budget Office based on data provided by the National Aeronautics and Space Administration.

Notes: Not all personnel who work on the shuttle program do so full-time. The numbers of government personnel in the table denote full-time equivalents assigned to the program.

SFOC = Space Flight Operations Contract; n.a. = not available.

a. The SFOC was initiated in 1997. CBO was unable to obtain comprehensive data on the numbers of NASA civil servants and of contractor personnel associated with overseeing and executing the individual contracts that NASA used to operate the space shuttle before the SFOC's initiation.

United Space Alliance
Under the SFOC, USA has overall responsibility for processing selected shuttle hardware, which includes:

- Performing inspections and modifications of the orbiter,
- Recovering the expended solid rocket boosters,
- Assembling the sections that compose the SRBs,[4]
- Attaching the external tank to the orbiter, and
- Installing the space shuttle main engines within the orbiter.

In addition to processing shuttle hardware, USA is responsible for mission design and planning, astronaut and flight controller training, design and integration of flight software, payload integration, flight operations, launch and recovery operations, vehicle-sustaining engineering, flight crew equipment processing, and operation and maintenance of shuttle-specific facilities such as the Vertical Assembly Building, the Orbiter Processing Facility, and the launch pads. USA also provides spare parts for the orbiters, maintains shuttle flight simulators, and provides tools and supplies, including food, for shuttle missions. About 10 percent of the value of the SFOC pays for shuttle-related activities that support the International Space Station, including training, mission planning, mission operations, and flight equipment and supplies.

SFOC Implementation
In 1995, prior to the SFOC's initiation, NASA had 85 separately managed contracts with 56 contractors. Those contracts were either fully or partially funded by the shuttle program and were used to operate and maintain the shuttle fleet. In 1996, spending on those separate contracts totaled about $3.14 billion. Phase I of the SFOC, begun in 1997, consolidated 12 of the contracts (plus two smaller subcontracts), which had a total cost of about $1.36 billion in 1996. In July 1998, Phase II of the SFOC was initiated to incorporate the activities associated with 15 additional contracts and subcontracts. Those activities included processing of the SRB and maintenance of flight software and equipment used by the flight crew. As a result of Phase II, 1,375 employees of United Space Boosters Inc., Lockheed Martin, and Boeing became employees of USA.

Originally, Phase II was planned to incorporate contracts for maintaining and upgrading the shuttle's main engines, the external tank, and the propellant sections of the SRBs. However, responsibility for those activities has not been added to the SFOC. According to NASA, part of the rationale for excluding those activities was

4. USA does not manufacture the SRB propellant sections (or the external tank or SSMEs). Rather, the contractor receives the SRB sections at the Kennedy Space Center, assembles them to form two boosters, and attaches the boosters to the shuttle's external tank.

the agency's philosophy that it should continue to separately manage contracts that involved significant development activities. To support the separate-management approach, some NASA officials also cite the results of a study of military space-launch programs, called the Broad Area Review (BAR), which was conducted by the Air Force in 1999. The Air Force commissioned the BAR after a number of launch vehicle failures and near failures. The review's key finding was that the Air Force had been exercising insufficient management and engineering oversight of its contracts for space launch vehicles.

SFOC Fees

The overall fee that USA has earned to date amounts to about 9 percent of the contract's cost measured on an annual basis. The contract establishes several categories of fees that USA can earn, which are based on a variety of criteria, both objective and subjective. The criteria include meeting specific schedules for performing key activities associated with preparing the shuttle for launch; executing a safe, successful mission; and reducing the costs of operating the shuttle.

NASA states that the fee system is structured to meet the program's goals, which are, in order of priority, (1) flying safely; (2) meeting the launch manifest—that is, launching the shuttle and its payloads on schedule; (3) ensuring that the shuttle can be operated and supported throughout its expected design life; and (4) improving the overall shuttle system. Under the contract, USA can earn no fee for cost reduction unless it exceeds expectations for safety. And if NASA determines that USA is responsible, through its acts or omissions, for the loss of an orbiter or for loss of life during the period from the beginning of final launch preparations through the return of the orbiter, USA will lose all fees for the six-month performance period in which the loss occurs.

NASA's Oversight of the SFOC

Under the SFOC, NASA has the following responsibilities and roles:

- Maintaining ownership of the shuttles and all other assets of the shuttle program;
- Managing the overall process for ensuring the shuttle's safety;
- Developing requirements for major upgrades to all assets;
- Participating in planning shuttle missions and in directing launches and executing flights;
- Performing surveillance and audits and obtaining technical insight into contractor activities;
- Deciding whether to "commit to flight" for each mission; and
- Managing government-to-government relations, including international interactions.

NASA divides management and oversight of the shuttle program among three major centers:

- *The Johnson Space Center* (JSC) houses the Shuttle Program Office and is the primary site for the astronauts' activities, including the selection of flight crews, training and support (under the SFOC), and extravehicular activity. In addition, JSC has primary responsibility for such SFOC-related activities as shuttle flight operations, software, and equipment processing; shuttle integration; and the orbiter.

- *The Kennedy Space Center* has primary responsibility for processing, launch, and landing operations, all of which are conducted under the SFOC.

- *The Marshall Space Flight Center* is primarily responsible for all of the shuttle's propulsion elements, including the external tank, the shuttle's main engines, and the SRBs. The boosters actually have two components: the propellant portions (the reusable solid rocket motor) and the nonpropellant portions, which are also referred to as the SRB. Of those elements, only the nonpropellant portion is currently under the SFOC.

Within NASA and located at the three centers described above are technical management representatives (TMRs), also referred to as subsystem managers, who are responsible for executing the tasks associated with NASA's roles and responsibilities. Within USA, there are associate program managers, each of whom has a counterpart TMR within NASA.

As a result of the SFOC, some of NASA's tasks and positions associated with shuttle oversight and management were moved to USA. They include 425 tasks and 25 positions associated with flight operations; 305 tasks (no positions) associated with ground operations; and 38 tasks (no positions) associated with integrated logistics.

Before the SFOC, NASA's subsystem managers were the primary focal point for all technical issues relating to a shuttle subsystem. Those managers were aware of and took part in day-to-day decisionmaking regarding any technical problems that arose with the shuttle subsystems for which they were responsible. Under the SFOC, the NASA TMRs participate less in daily decisionmaking. They are responsible primarily for overseeing changes in the design of shuttle subsystems and processing, and for resolving anomalies that occur during shuttle flights.

Other Technologically Complex Government Activities

The remainder of this paper examines examples of other activities that the government undertakes by using contractors. The activities span a broad range of effort,

and they vary in their annual costs, the types of contracts used, the incentives the contracts contain, how work to be done under the contracts is defined, and how the government oversees the contractors' work. Thus, many of these activities have features that differ from those characterizing NASA's use of contractors to operate the space shuttle. However, all of the subsequent examples involve the government's use of contractors to perform technologically complex tasks.

The Coast Guard's Deepwater Project

The Coast Guard is undertaking a project, which it calls Deepwater, to redesign the way it performs its missions in deepwater regions—that is, regions that are 50 or more nautical miles from the U.S. coastline. That effort involves determining the numbers and types of ships, fixed-wing aircraft, helicopters, and surveillance sensors that the service will need for such missions for the next 30 years.

The first phase of the Deepwater project was a competition conducted in 1997 in which three contractor teams were each awarded a $21 million contract to design a Deepwater "system" for the Coast Guard. After judging the results, the Coast Guard selected Integrated Coast Guard Systems—a joint-venture limited liability company formed by Northrup Grumman and Lockheed Martin—to build the Deepwater system. That single contractor is to provide the Coast Guard with all of the elements that compose the Deepwater system—ships, aircraft, helicopters, and sensors—over a 30-year period. The contractor will also provide whatever other systems are needed to ensure that the system is integrated—that is, that all Deepwater elements can communicate with each other and exchange needed information.

According to the Coast Guard, no other government agency has ever attempted to replace its entire set of core mission systems by using a single contractor instead of a piecemeal approach. Moreover, in contrast to past projects in which detailed specifications were provided to a contractor that then supplied equipment that matched them, the Coast Guard conducted the Deepwater design competition by employing a set of less detailed measures of performance.

After Integrated Coast Guard Systems delivers the ships, aircraft, and other assets that compose the Deepwater system and following a period of transition, the Coast Guard will use its personnel to operate the equipment and perform minor maintenance. Currently, the service employs contractors to perform major maintenance on selected equipment, and it plans to continue that practice. In general, the Coast Guard has not yet determined the role that Integrated Coast Guard Systems will play in maintaining the Deepwater elements. However, it has decided not to purchase the high-altitude unmanned aerial vehicle that is part of the Deepwater system and that will be used to perform surveillance missions but rather to lease it from, and have it maintained by, the contractor.

The Coast Guard has divided the remainder of the Deepwater project into six five-year contracts characterized as indefinite-delivery, indefinite-quantity contracts.[5] Their total potential value is $14 billion to $15 billion. The first five-year contract period has a potential value of $3 billion to $5 billion.

Under the terms of those contracts, the Coast Guard will develop a set of task and delivery orders each year that describe the work that Integrated Coast Guard Systems should accomplish and the equipment that it should deliver. Those task and delivery orders can be structured as either cost-plus-fee or firm-fixed-price arrangements. The contractor may also receive an additional annual award fee if the work performed on all task and delivery orders is deemed satisfactory by the Coast Guard.

At the end of the five-year period of each contract, the Coast Guard will evaluate the contractor's performance. The most important determinants of the service's overall satisfaction with the contractor's efforts will be whether operational effectiveness has been increased and total ownership costs have been reduced. Although the Coast Guard has a once-a-year opportunity to "walk away" from the contract, the contractor is bound to fulfill its contract responsibilities for the full five-year term so long as the Coast Guard wants it to continue doing the work. If, at the end of the five years, either side no longer wants to work with the other, either party can terminate the relationship.

The Evolved Expendable Launch Vehicle

According to the Air Force, the Evolved Expendable Launch Vehicle (EELV) program is a new approach to obtaining the capability to launch satellites into orbit. With the EELV contract, the Air Force states that it is purchasing, for a firm fixed price, not actual launch vehicles but commercial launch services supplied by a contractor that is responsible for ensuring that the services are provided successfully. In a further departure from traditional practices, the Air Force will not pay all of the contractors' costs to design and test the new EELVs. Instead, the service has required the contractor to share in those development costs because of the potential commercial market for the launch vehicles developed under the EELV program. (However, the originally anticipated market has not as yet materialized.)

To initiate the EELV program, the Air Force executed two "other transaction" authority agreements with Boeing and Lockheed Martin in October 1998.[6] Under

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5. The contracts do not specify the exact numbers and types of items that the contractor must provide to the Coast Guard during each five-year period. Those details will be decided yearly and will depend on a number of factors, including available budgetary resources.

6. "Other transaction" agreements are financial assistance or acquisition arrangements other than procurement contracts, grants, or cooperative agreements. The "other transaction" authority contained in title 10, section 2371, of the U.S. Code permits the military to enter into such arrangements to carry out basic, applied, and advance research projects without regard to statutes or regulations that constrain the use of contracts, grants, or cooperative agreements.

those agreements, the government provided $500 million to each contractor to develop a family of EELVs. According to the Air Force, each contractor has also spent from $1.5 billion to $2 billion of its own funds on EELV development.

Currently, the EELV program comprises two families of launch vehicles, the Delta IV and the Atlas V; there are multiple versions of each vehicle to meet the demand for medium-, intermediate-, and heavy-weight payloads. The first Lockheed Martin vehicle, the Atlas V, flew on August 21, 2002, and the first Boeing vehicle, the Delta IV, flew on November 20, 2002. Both flights were successful but carried commercial payloads. The first Air Force payload was successfully launched by a Delta IV on March 10, 2003.

Rather than eventually selecting a single contractor, the Air Force expects to engage continually in competitions between Boeing and Lockheed Martin to procure launch services using EELVs. The Air Force states that this continual competition is needed to ensure that the United States always has the means available to launch spacecraft.

In 1998, the Air Force awarded initial launch services contracts for 26 EELV launches: 19 Boeing Delta IV launches, for a total of $1.5 billion, and seven Lockheed Martin Atlas V launches, for a total of $506 million. The Air Force anticipates awarding a second set of contracts in the summer of 2003 for up to four launches and a third set of contracts in the fall of 2003 for up to 18 launches. Recently, as a penalty for Boeing's unlawful possession of a competitor's proprietary information, the Air Force reduced the initial Boeing contract to 12 launches and increased the initial Lockheed Martin contract to 14 launches. In addition, the Air Force also disqualified Boeing from competing for three additional launches and awarded them to Lockheed Martin.

The Air Force's EELV program office is located in Los Angeles, with additional personnel located at both the eastern (Cape Canaveral) and western (Vandenberg Air Force Base) launch ranges. The program office currently employs 76 Air Force personnel to manage the EELV program. Lockheed Martin and Boeing together have approximately 3,600 employees to manufacture and launch their respective versions of the EELV.

Four key performance parameters have been established for the EELV program: mass-to-orbit specifications, reliability, standard payload interface, and a standard launch interface.[7] Under the launch services contracts, a launch service is deemed

7. There are seven mass-to-orbit standards that specify given masses to given orbits—for example, the launch vehicle must get 17,000 pounds of payload into a low Earth orbit with a certain inclination. The vehicle's design reliability must be at least 98 percent. The Air Force has specified a standard interface for accommodating payloads that each vehicle must be capable of providing. The launch interface requirement states that medium, intermediate, and heavy versions of a launch vehicle must be able to be launched from the same pad.

complete and accepted with the intentional ignition of the first-stage engine and the first intentional detonation of the first-stage tie-down of the launch vehicle. In other words, the contractors are responsible for ensuring that an EELV successfully ignites and begins to lift off the launch pad—but not for ensuring that the Air Force spacecraft it carries successfully reaches orbit.

There are no incentive or award fees in any EELV program contract. According to the Air Force, the contractors are expected to launch successfully in order to increase their competitiveness in the marketplace. Consequently, the government does not have penalty clauses associated with the EELV contract in the event of the loss of a vehicle. (Rather, the penalty to the contractor would be the potential loss of future business from government sources and commercial firms as a result of the failure.) Both contractors, in what is known as the "best-customer clause," guarantee that they will not sell a commercial launch service using an EELV for less than the cost that the government has negotiated for a similar launch service.

The Air Force states that it has relied heavily on "insight" rather than "oversight" in conducting the EELV program. For example, the service notes that it has not required the contractors to provide the government with special or unique documentation or data. Instead, the government has relied on the same documentation that the contractors use to manage their respective programs.

The Future Combat System

Traditionally, in developing battlefield weapon systems, the Army has established separate programs for each system—such as the Abrams tank or Comanche helicopter—relying on a prime contractor to develop each one. But in the case of the Future Combat System (FCS), the Army's next generation of weapons, the service is using a nontraditional approach that assigns substantial authority to a single contractor. That contractor, referred to as the lead system integrator (LSI), will develop and integrate 18 different systems—new families of manned and unmanned ground vehicles and unmanned aerial vehicles—to replace the service's current fleet of tanks, armored vehicles, self-propelled howitzers, and various other systems.[8] The Army has contracted with Boeing—which has teamed with Science Applications International Corporation—to act as the LSI and to coordinate the development, testing, and production of all 18 systems, their associated sensors, and the communications networks to connect them all.

According to the Army, the LSI will "develop, manage, and execute all aspects" of the program, acting as the government's industry partner.[9] In that role, the LSI will

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8. The total cost for equipping all of the Army's maneuver brigades with FCS could be as high as $300 billion.

9. Department of the Army, "The Lead System Integrator (LSI) Agreement for the Future Combat System (FCS) Program," Army Information Paper (June 18, 2003), provided to the Congressional Budget Office.

undertake many of the activities that the Army would have performed under a more traditional approach. Those activities include issuing requests for proposals (RFPs); developing performance requirements for FCS as a whole as well as for individual systems and subsystems; evaluating responses to the RFPs; and, with the Army's concurrence, awarding the contracts to develop the individual systems. The LSI will also design tests, analyze system performance trade-offs, and manage production. The Army has used "other transaction" authority agreements in executing contracts for FCS and states that it believes that "FCS is larger and more complex than traditional developments, and thus requires an alternative procurement approach." As a consequence, the Army chose to rely on an LSI "after studying lessons learned by the National Aeronautics and Space Administration's (NASA) space station and the Missile Defense Agency's (MDA) Ballistic Missile Defense Systems approaches to designing and developing extremely large and complex systems of systems projects."[10]

During the concept and technology development stage from March 2002 through June 2003, Boeing was responsible for developing, delivering, updating, and maintaining an overarching architecture for all of the systems included in FCS; supporting the Army's Training and Doctrine Command in refining operational concepts and requirements; identifying and evaluating potential concepts and technologies; conducting demonstrations; and developing performance specifications and the documentation to support a successful transition to the system development and demonstration (SDD) phase of the project. As part of that effort, Boeing issued 23 RFPs for development tasks to be performed during SDD and evaluated the responses in preparation for awarding the contracts in the fall of 2003. For work performed during the concept and technology development stage, the government agreed to pay Boeing a total of $154 million.

The government recently exercised its option under the concept and technology development contract to extend its agreement with Boeing to include the system development and demonstration phase. Activities to be performed by the LSI during that phase include managing the design, manufacture, and testing of prototypes; evaluating whether the systems are ready for production; identifying and performing the tests and producing the documentation needed to enter the next phase of the acquisition process; providing detailed cost estimates and cost reports; and supporting Army personnel who will use the equipment once it is fielded. Boeing, in conjunction with government representatives, is also responsible for awarding contracts for the 23 systems and subsystems that were defined in the concept and technology development phase. The SDD phase of the FCS program is estimated to extend through December 2011, with the total value of the contract currently set at $14.9 billion and annual funding levels ranging from $1.3 billion to $4.3 billion.

10. Ibid.

Although the Army signed a contract with the LSI on May 30, 2003, to perform the work described above, the final details have yet to be settled. In fact, one of the tasks to be completed during the first seven months of the contract is to establish the fee structure and criteria that will apply to the remainder of the contract (that is, from early 2004 until December 2011) and to reconcile Boeing's projected expenditures with the government's projected funding and the program's scope of work.[11] Other tasks that Boeing must perform include updating the technical specifications; demonstrating command-and-control software; evaluating or negotiating all 23 subcontracts for which RFPs were let and fully defining at least 85 percent of them; and reaching agreement on the staffing of integrated product teams (IPTs), which include both contractor and government personnel.

A total of $130 million has been allocated to this effort for 2003, with an additional $60 million planned for 2004. Of that total $190 million, a base fee of $10 million has been set aside for Boeing with an additional $15 million available in incentive fees. The incentive is structured to motivate Boeing to complete the tasks described above—and in particular to establish the final details of the contract—before the end of December 2003.[12]

Although the government will retain ultimate control of the FCS effort, the program's management structure—in which the LSI and the Army form integrated product teams—gives the contractor extraordinary responsibility and authority. The agreement signed in May 2003 envisions IPTs at several levels. The highest would be the program management team cochaired by the LSI program manager and the Army's FCS program manager. Below that would be 14 second-tier IPTs, each of which would also be cochaired by representatives of both the LSI and the government.

Decisions by IPTs are expected to be reached by consensus between the cochairs, but the contract also includes a mechanism for settling disputes. In cases in which consensus cannot be reached, the decision of the LSI cochair will prevail. Government cochairs can initiate a request for review of decisions with which they do not concur but must do so in writing to the next-higher-level IPT and propose an alternative approach to the disputed decision as well. The same hierarchical rules apply to the higher-level IPTs—that is, the LSI cochair has the final say. The highest decisionmaking authority for an issue raised through this process is the LSI program manager. However, any appeal that the LSI program manager does not support must be reported to the Army's FCS program manager. Ultimately, it is the Army's

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11. Department of the Army, *Agreement Between the Boeing Company and US Army Tank-Automotive and Armaments Command Concerning Future Combat System (FCS) System Development and Demonstration (SDD) Phase*, DAAE07-03-09-F001 (May 30, 2003).

12. Starting on December 30, 2003, and every 30 days thereafter, the $5 million incentive fee for working out the final details of the contract will be reduced by $800,000. If the contract is not fully defined by the end of May 2004, Boeing will not receive any of the $5 million incentive fee.

FCS program manager who has not only the final word but also the authority to override the LSI program manager's decision and direct that changes be made to the program.

Lawrence Livermore National Laboratory

Since 1952, the Department of Energy (DOE) and its predecessors have contracted with the University of California for management and operations (M&O) of the Lawrence Livermore National Laboratory (LLNL). Under the contract, the university is responsible for managing, operating, and staffing the lab; accomplishing the missions assigned to it; and administering the M&O contract with DOE.

LLNL was established in 1952 as a facility dedicated to research on and development of nuclear weapons designs. The lab encompasses two sites covering a total of almost 8,000 acres; it has 600 buildings and employs about 5,400 personnel. Its current missions include ensuring that the nation's nuclear weapons remain safe, secure, and reliable; acting as a steward of U.S. nuclear weapons through activities ranging from dismantling weapons to remanufacturing the enduring stockpile; ensuring the availability and safe disposition of plutonium, highly enriched uranium, and tritium; assisting in remediation and reduction of wastes from the nuclear weapons complex; and helping to deter, detect, and respond to the proliferation of unconventional weapons. DOE's total obligation to the university in 2002 for managing and operating LLNL was $1.6 billion.

The ultimate responsibility for executing the contract lies with the regents of the University of California, who have delegated management and oversight authority to the university system's president. The president, in turn, appoints the director of the lab (subject to the regents' and DOE's approval). The university oversees the three national labs that it manages for DOE (the other two are Los Alamos National Lab and Lawrence Berkeley National Lab) through the office of the vice president for laboratory management as well as through a regents' committee, a president's council, and two additional senior-level councils and committees.

DOE oversees operations at LLNL through its Oakland Field Office, which maintains about 140 personnel at the LLNL site. The assistant manager for National Nuclear Security Administration (NNSA) operations in the Oakland Field Office heads the LLNL site office and reports to the manager of the Oakland office. DOE's representatives at the LLNL site office are responsible for ensuring that nuclear activities at LLNL are carried out safely and in accordance with current laws and regulations. In particular, the NNSA staff at the site office oversee nuclear research, nuclear safety, and related matters, and the environmental management staff at the field office oversee environmental restoration and waste management activities, including the construction of a new waste treatment facility. Thus, the lab must gain approval from its DOE overseers before proceeding with new construction or operations.

The existing contract between DOE and the University of California was signed in January 2001 and extends through September 2005. Because LLNL is a federally funded research and development center, the contract for its management and operation is exempt from competition and is merely an extension of the original 1952 contract between DOE and the university. However, the current version of the contract incorporates revisions that reflect DOE's updated acquisition requirements. The contract also includes performance objectives and measures that DOE began to include in its contracts in the mid-1990s in response to widespread calls for reform.

The LLNL contract, as revised for 2003, includes nine performance objectives, each of which is supported by as many as eight performance measures.[13] Performance objectives are negotiated annually, before the start of the fiscal year, with performance tracking and reporting carried out by the contractor throughout the year. Evaluations and assessments of the university's progress based on the performance objectives and measures are conducted annually by the university and by DOE, and part of the compensation that the university receives for managing LLNL is an adjustable fee based on those evaluations. In 2003, for example, an adjustable fee based on performance could account for $4.3 million of the $7.1 million that the university may receive in compensation unrelated to the direct costs of managing and operating LLNL. (The remaining $2.8 million is fixed and covers the university's indirect costs.)

Logistics Support for the B-2 Bomber

Contractors are significantly involved in certain support activities for B-2 bombers, specifically aircraft maintenance, aircraft modifications, and training. In comparison, Air Force units perform mission planning and payload preparation. Contractors provide some assistance in those latter two activities (for example, by helping keep automated mission planning tools up to date and functioning), but the Air Force considers the planning of strikes and the loading of munitions on the bombers to be inherently military tasks that should be performed by Air Force support squadrons and by the Air Force personnel who compose the bomber squadrons.

B-2 maintenance is performed both by contractors and by Air Force personnel. In general, the Air Force handles maintenance when the aircraft are with the 509th Bomb Wing; it uses a contractor to perform the bombers' periodic and much more

13. Those standards are spelled out in Modification No. M456, Supplemental Agreement to DOE Contract No. W-7405-ENG (revised March 4, 2003)—specifically, in Appendix F, Standards of Performance. One example is the performance objective to use the university's strengths to recruit, retain, and develop the workforce. The university's progress in meeting that objective is to be judged on the basis of two performance measures: first, providing the skills necessary to enhance the science base by implementing recruiting and retention strategies; and second, implementing leadership and management development programs aligned with workforce planning and diversity objectives. Another example of a performance objective is the one for maintaining a secure, safe, environmentally sound, effective and efficient basis for operations and infrastructure. That objective is supported by eight performance measures, of which developing a long-term plan with DOE to reduce inventories of surplus and excess special nuclear material and onsite waste is an example.

extensive programmed depot maintenance (PDM). There is, however, some contractor support on the flight line. For example, a few contractors work at Whiteman Air Force Base, where the B-2s are based, to help with issues that might arise with the special low-observable surfaces on the aircraft or with its engines.

Much of the PDM work that is done under contract involves replacing the bombers' exterior low-observable coatings, a very specialized task on the B-2. A study of PDM alternatives conducted by the Air Force in the mid-1990s determined that the facilities and skills needed for that special coating maintenance as well as for maintenance activities associated with other unique aspects of the B-2 could best be provided by Northrop Grumman, the B-2's original manufacturer. As a result, the overhauls are conducted at Northrop Grumman's Plant 42 facility in Palmdale, California.

Much of the contract work for the B-2 is consolidated under an umbrella flexible acquisition sustainment team (FAST) contract with Northrop Grumman. The FAST contract does not itself define the work to be performed. Rather, it serves as a vehicle by which individual work orders tailored to the specific maintenance needs of individual aircraft can be executed.

Since the B-2 program is relatively young and the PDM cycle is seven years, the PDM arrangement has been in place only since 2000. A so-called delivery order for PDM is executed annually under the FAST contract, whose yearly value is about $60 million and typically includes work on two aircraft. According to the Air Force, the initial annual contracts were set up as cost-plus-award-fee arrangements because the specific nature and extent of the maintenance that would be required was not well understood. With the experience gained under the work conducted over the period from 2000 to 2002, the Air Force has begun to execute PDM contracts as firm-fixed-price agreements.

The PDM contracts also have incentive aspects (notwithstanding the firm-fixed-price feature), which include a program for reduction in total ownership costs (RTOC). The goal of the program is to reduce the Air Force's overall costs for maintaining the B-2 without impairing essential system functions or performance characteristics. Savings from RTOC initiatives are shared with the contractor.

As with maintenance, B-2 training is split between Air Force and contractor personnel—who are provided by the Link Simulation and Training Division of L3 Communications, Inc. (formerly Raytheon and before that, Hughes). Contractor personnel are involved in operating, maintaining, and modifying the B-2 training systems. Link operates and maintains the aircrew and maintenance training devices and also develops and modifies maintenance training courses. Course development and academic instruction for the B-2's aircrews are provided by Northrop-Grumman under a subcontract to Link, with Air Force instructors supplementing that instruction. In addition, Link operates and maintains the Weapons Loading Trainer.

Those contractor-performed training activities are covered under the Training System Contractor Logistics Support Contract, for which Link is the prime contractor. The period of performance on the $325 million contract is eight years.

National Missile Defense—National Team

In order to define the elements of its "layered" missile defense concept and the manner in which those elements will interact, the Missile Defense Agency within the Department of Defense turned to a largely contractor-staffed organizational structure called the National Team. In addition to contractors, the National Team consists of employees from the Department of Defense and federally funded research and development centers (such as the Aerospace Corporation); it is divided functionally into two major components: one for systems engineering and integration (SE&I) and the other for integrating battle management, command, control, and communications (BMC2&C). Those two teams, as they are known, interact with MDA personnel in designing and developing an overall missile defense system.

According to MDA, a key feature of the National Team is that the two teams are behind a "firewall," which separates them from other contractor personnel who are developing missile defense hardware. That arrangement was necessary because the prime contractors leading the national teams are also engaged in weapon system development and production. National Team contractors must thus sign conflict-of-interest and associate contractor agreements to ensure that information—including proprietary data that team members employed by individual contractors would otherwise not be free to share—flows between the SE&I and BMC2&C teams.

The SE&I team is led by Boeing, with participation from Lockheed Martin, and the BMC2&C team is led by Lockheed Martin, with participation from Boeing. General Dynamics, Northrup Grumman/TRW, and Raytheon are also represented on both teams. The role of the SE&I team is to define a "toolbox"—consisting of weapons, sensors, and communications components—and integrate those systems to forge a single, layered ballistic missile defense system (BMDS). The SE&I team's responsibilities also include characterizing the threat environment. The role of the BMC2&C team is to develop the components for planning, control, monitoring, and execution of the BMDS.

MDA used "other transaction" authority agreements with Boeing and Lockheed Martin to form the National Team. The period of performance for both the SE&I's and the BMC2&C's agreements is divided into two parts. Part I lasts for four months; its tasks include definition of the BMDS processes and an initial assessment of the system's elements. Part II, which lasts for 10 years, covers the design, modeling and simulation, and virtual prototyping of the BMDS. Part II is structured as a two-year base contract, followed by four two-year options. Together, both Part I contracts (SE&I and BMC2&C) total about $28 million. MDA estimates that funding for Part II of the SE&I contract and Part II of the BMC2&C effort will total $953 million and about $1.7 billion, respectively.

The National Team contracts are structured as cost-plus-award-fee arrangements, with the fee amount based on a mix of subjective and objective criteria. The total award fee available through December 2003 for the SE&I contract is $34.5 million; $30.8 million is available for the BMC2&C contract.

Refueling/Overhauls for Aircraft Carriers

The Navy's nuclear-powered aircraft carriers must be refueled and overhauled periodically throughout their 40- to 50-year lifetimes. Only one shipyard in the United States—Newport News, owned by Northrup Grumman—is capable of undertaking the required work. The Navy provides Newport News with nuclear fuel and detailed specifications for refueling the carrier's reactor and overhauling the other ship's systems. The work performed by Newport News includes removing the expended nuclear fuel, installing new fuel, and delivering the expended fuel to the Navy for storage and disposal. Newport News also assists in conducting sea trials of the refueled and overhauled carrier prior to its return to operations.

The Navy uses sole-source contracts to perform the refueling overhauls and structures them as cost-plus-award-fee arrangements. Newport News and the Navy negotiate a target cost for the work and a target fee. In the most recently awarded contract, which was for refueling and overhauling the USS *Carl Vinson*, the fee component of a total $1.52 billion contract was $144 million, or about 10 percent. Under the terms of the contracts, Newport News can earn an additional fee amount (up to a preset maximum) for underrunning the cost target but will lose part of the fee (down to a preset minimum) if costs exceed the target.

Every carrier undergoing maintenance has a detailed list of specifications developed by the Navy as to how the work is to be done. Any work that cannot meet the specifications must receive a waiver from Naval Sea Systems Command (NAVSEA), which oversees work performed by Newport News.

Newport News is responsible for developing and following a quality control process and for performing quality assurance. NAVSEA personnel monitor and audit the shipyard work and perform random sampling to ensure that Newport News is following its quality control and assurance processes. That oversight is carried out by the Navy's supervisor of shipbuilding, conversion, and repair (SUPSHIP) located at Newport News. The Naval Nuclear Propulsion Program (commonly known as Naval Reactors) also has an office at the shipyard to monitor the process of refueling the carrier. All work done by the contractor must pass a final inspection by NAVSEA to ensure that the work has been done to all specifications before being accepted.

Once the ship is delivered and accepted, it goes through a series of sea trials, which the Navy performs over a three- to four-month shakedown period. Every system on the ship is tested, and the carrier is pushed to its limits to ensure that it can perform properly upon its return to operations. The ship must receive a series of certifica-

tions from the Navy to show that it passed all the tests. After that, there is an eight-month postshipyard availability during which the contractor must fix all items discovered during the trials that did not meet the specifications or pass the at-sea tests. The Navy covers the cost of resolving problems identified during the sea trials.

The Savannah River Site

The Department of Energy's Savannah River Site (SRS) was constructed during the early 1950s to produce and separate plutonium and tritium for nuclear weapons. In 1989, the Westinghouse Savannah River Company (WSRC) took over the contract with the Department of Energy to manage and operate the facility, which had been held since 1950 by the E.I. duPont de Nemours Company.

Since the mid-1990s, the bulk of the activities at Savannah River have involved managing the storage and treatment of radioactive waste from production activities, the storage of special nuclear materials such as components from dismantled weapons and spent nuclear fuel, and the recycling of tritium from surplus nuclear weapons. The site covers a total of 198,000 acres (or 310 square miles) and employs about 13,000 personnel. Under the current contract, WSRC is responsible for providing the personnel, equipment, materials, supplies, and services necessary to manage and operate the site.

Oversight of the contract is provided by about 400 DOE staff at the Savannah River Operations Office (SRO), which is located on the Savannah River site. The manager of the SRO is responsible for contract management and oversight of the site's environmental restoration and waste management activities, which represent about 80 percent of all work that DOE has contracted for there. (An assistant manager of the SRO is responsible for overseeing stewardship of the nation's stockpile of nuclear weapons and materials; those stewardship duties constitute the remainder of the activities at SRS and fall under the purview of the National Nuclear Security Administration.) WSRC is responsible for managing the work of a team of contractors and subcontractors at SRS. The team includes Bechtel Savannah River and BNFL, Inc., which together manage engineering, design, and construction activities; and BWXT, which handles shut-down, decontamination, and decommissioning of excess facilities. BNFL, Inc., also manages solid waste activities.

The existing contract between DOE and WSRC is an extension of the contract that was awarded competitively to WSRC in 1997; it was signed in early 2001 and extends through the end of September 2006. DOE's total obligation to WSRC from October 1, 2000, through September 30, 2006, is $8.4 billion, yielding average annual allotments of $1.4 billion. Under the contract, WSRC is responsible for five major groups of activities:

- Performing environmental restoration tasks such as identifying, characterizing, and assessing waste units and affected groundwater; preparing plans for closing

selected facilities; managing remediation of waste sites; monitoring inactive waste- and groundwater units; and accelerating early remediation activities;

- Decontaminating and decommissioning excess facilities, including several production reactors and chemical processing facilities;

- Developing new areas of research and development;

- Managing the site's nuclear programs, which include the processing of tritium, and supporting long-term planning to maintain the tritium supply and stabilize and store existing inventories of nuclear material; and processing high-level waste for eventual long-term storage or disposal; and

- Providing site support by protecting human health and safety and the environment in all activities; managing the design and construction of new facilities; providing operational support such as utilities, transportation, and maintenance and repairs; and supporting long-range and strategic planning for the site.

The contract between WSRC and DOE includes a multiyear fee "pool" of $345 million to fund performance-based incentive awards over the contract's six-year term. Performance incentives and measures are negotiated before the beginning of each fiscal year and are used to determine annual awards. In March 2001, the Defense Nuclear Facilities Safety Board raised concerns that the incentives could encourage waste processing at the expense of safety.[14] However, an internal DOE review conducted in response to those concerns concluded that the incentive structure in place did not compromise safety and that it correctly emphasized waste processing.[15] Moreover, it concluded that the onsite DOE representatives responsible for monitoring the contract, in order to stress DOE's safety concerns, had appropriately reduced the contractor's award fee to reflect less-than-acceptable performance.

In July 2002, the assistant secretary for environmental management at DOE initiated an internal review of the incentive structure at SRS as part of an effort to ensure that incentives in DOE's major site contracts were properly linked to its overall strategic plan for environmental management and the strategic plans of the individual sites.[16] In the case of SRS, DOE's review team concluded that the site's contract incentives

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14. Defense Nuclear Facilities Safety Board, *High-Level Waste Management at the Savannah River Site*, Recommendation 2001-1 (March 23, 2001), p. 5.

15. Department of Energy, Independent Review Team, *Independent Assessment of the Savannah River Site High-Level Waste Performance Based Initiatives*, EM-INTEC-02-008 (December 2001).

16. Memorandum from Jessie Hill Roberson, Assistant Secretary of Energy for Environmental Management, to various DOE field offices, "FY2003 Contract and Performance Objectives and Incentives for Environmental Management," July 2, 2002.

were not designed to accelerate risk reduction and closure (two goals of DOE's environmental management efforts) but rather to motivate cost savings.[17] In response to that finding, WSRC and the SRO, at the direction of the assistant secretary, revised the performance objectives and incentives in the SRS contract for 2003 to better align them with DOE's environmental management goals.

Trident Ballistic Missile Submarine Conversions to Perform Conventional Missions

The Trident submarine conversion program will convert four existing Ohio class Trident submarines, which formerly performed strategic nuclear missions, to a conventional configuration that will provide special operations and conventional strike capabilities. The program comprises activities to manufacture the "kits" required to convert the four submarines, conduct engineering refueling overhaul (ERO) of the four ships' nuclear reactors, and install the conversion kits. The conversion kits consist of lock-out chambers and associated equipment for use by special operations personnel, launch tubes (multiple all-up-round canisters) for conventional Tomahawk missiles, Tomahawk missile fire-control systems, and information management and communications equipment.

The initial work on the program (such as concept and initial design studies) began in 2000, and detailed design efforts commenced in 2002. Refueling overhauls and conversion kit manufacturing and installation will take place between 2003 and 2007. The first ship in the line (USS *Ohio*) is expected to be operational in its new configuration in 2007. The four conversions are expected to cost $4 billion over the period from 2000 through 2009.

The Navy plans to carry out the conversion program by using a public/private partnership approach. The conversions begin with the installation of a new reactor core (the ERO) in each submarine. Public shipyards—the Puget Sound Naval Shipyard on the West Coast and the Norfolk Naval Shipyard on the East Coast—will each perform two refueling overhauls as part of the overall program. Those shipyards will also provide a portion of the technical labor and other services and support required to install the conversion kits in the four submarines, work that will be managed by a contractor but performed at the public shipyards. The Electric Boat (EB) division of General Dynamics Corporation will design and manufacture the conversion kits and manage their installation, including providing most of the labor needed for that task.[18] EB is designated as the conversion execution manager—the single entity responsible for the conversion kit's design, manufacture, installation, and testing.

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17. Department of Energy, *Savannah River Site Trip Report* (July 9, 2002).

18. Other contractors (Northrop Grumman Marine Systems and General Dynamics Advanced Information Systems) are also involved in the design and manufacture of the systems that go into the conversion kits. However, EB is responsible for the overall integration of the systems with those of the ship.

EB's installation of the kits and its testing activities will use the Navy's labor resources at the public shipyards. The shipyards will, in effect, operate as a subcontractor to EB under the conversion installation contract. That is, EB will receive money under the cost-plus-fee contract for the "touch labor" provided by the public shipyards and will then reimburse them for the cost of the labor that they have supplied.[19]

EB's work on the design and manufacture of the conversion kits is being done under a sole-source cost-plus-fixed-fee contract that includes performance incentives.[20] The contract has two main parts. The first, which is worth about $400 million, covers the detailed design of the conversion kits and ship modifications. The second part, totaling about $116 million, covers the procurement of materials needed for the conversion. Each portion of the contract has a total available fee of 10 percent, including incentives for timeliness and cost control.

The other major contracts in the conversion program are for the multiple all-up-round canister (MAC), designed and manufactured by Northrop Grumman Marine Systems, and the attack weapon control system (AWCS), designed and manufactured by General Dynamics Advanced Information Systems. The contracts for the MAC (totaling $155 million) and AWCS (totaling $117 million) are both of the cost-plus-incentive-fee type. For the MAC, the maximum fee is 16 percent; the maximum fee for the AWCS is 15 percent.

A Trident submarine conversion program office established within Naval Sea Systems Command is responsible for the overall management and technical oversight of the conversion program and retains approval authority for critical design elements.[21]

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19. The authority for the shipyards to undertake this type of arrangement derives from the Center of Industrial and Technical Excellence (CITE), which allows a government entity with exceptional technical capabilities to provide services to a private party if doing so benefits the government. According to the Navy's cost accounting and funding rules for its shipyards, EB will be charged the variable costs of using the labor, while the fleet, as "owners," will foot the bill for the shipyard's facility and administrative overhead.

20. The noncompetitive procurement stems from two factors: EB was the original designer and manufacturer of these Ohio class submarines, and the Navy has determined that the project's time schedule does not permit a competitive procurement.

21. In 2002, NASA and NAVSEA initiated the NASA/Navy Benchmarking Exchange to examine the Navy's submarine safety assurance program and compare its features with NASA's safety program for the space shuttle. The goal was to identify a set of lessons learned that could benefit NASA. The two organizations published an interim report in December 2002 outlining similarities in and differences between the design, test, operation, and maintenance of submarines and the shuttle. In the report, NASA identifies potential opportunities for change that it should consider, including the implementation of the NAVSEA organizational model for submarine safety compliance verification, which would establish within NASA an office independent of the shuttle program to verify compliance with safety procedures and measures; and the development of a comprehensive set of detailed and specific NASA safety requirements that its future human-operated space systems must meet.

The Navy's supervisor of shipbuilding—EB Groton Office—is the supervising authority and administrative contracting officer for all EB work (specifically, the design, manufacture, installation, and testing of the conversion kits). SUPSHIP Groton oversees and certifies the conversion work on behalf of NAVSEA. The public shipyards perform the refueling overhauls under NAVSEA's oversight.