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Briefing Report to the Chairman, Subcommittee on Defense, Committee on Appropriations, U.S. Senate

August 1990

PROCUREMENT

Assessment of DOD's Multiyear Contract Candidates for Fiscal Year 1991

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United States
General Accounting Office
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National Security and
International Affairs Division

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August 31, 1990

The Honorable Daniel K. Inouye
Chairman, Subcommittee on Defense
Committee on Appropriations
United States Senate

Dear Mr. Chairman:

As requested, we analyzed six multiyear contract candidates in the Department of Defense's (DOD) fiscal year 1991 budget to determine whether they satisfied the legislative criteria for multiyear contract approval. The six weapon systems we analyzed were (1) the UH-60 Black Hawk helicopter, (2) the Family of Medium Tactical Vehicles (FMTV), (3) the Avenger weapon system, (4) the LHD amphibious ship, (5) the Landing Craft, Air Cushion (LCAC), and (6) the Navstar Global Positioning System (GPS). We briefed your staff on the preliminary results of our review on June 27, 1990, and on July 20, 1990, we provided additional information requested. This report summarizes the final results of our review and also provides updated information on candidates proposed between fiscal year 1986 and 1990.

Background

Multiyear procurement is a method of acquiring up to 5 years' requirements of systems, subsystems, or other items with a single contract. In 1981, the Congress authorized DOD to use multiyear procurement for major weapon systems. Since that time, DOD has annually proposed various weapon systems as multiyear contract candidates for congressional approval.

Although multiyear procurement can benefit the government by saving money and improving contractor productivity, it can also entail certain risks, such as increased costs to the government, should a multiyear contract be changed or terminated. A particular disadvantage of multiyear contracts is that they decrease annual budget flexibility because the Congress and DOD commit themselves to fund such contracts through completion or pay any contract cancellation charges, which may be substantial. If DOD's procurement budget is reduced significantly and multiyear contracts are maintained, programs not under multiyear contracts would have to be cut disproportionately.

Section 909(b) of the DOD Authorization Act of 1982 (P.L. 97-86, 10 U.S.C. 2306(h)) established criteria to ensure that multiyear contract

candidates achieve a reasonable balance of benefits and risks. The criteria require that (1) the estimated contract costs and projected savings be realistic, (2) the minimum requirement (total quantity, production rate, and procurement rate) for the system be expected to remain substantially unchanged, (3) there is a reasonable expectation that sufficient funding will be requested by DOD to carry out the contract, and (4) the design be stable. Failing to meet one or more of the criteria may not necessarily mean that a system is an inappropriate candidate, but indicates areas of increased risk that must be weighed against the potential savings to determine whether multiyear procurement approval should be granted.

Results in Brief

Our evaluation of six weapon systems proposed for multiyear contracting authority showed that these systems did not clearly meet one or more of the legislative criteria.

Table 1 summarizes our views of whether each candidate satisfied the criteria. Each "?" identifies an instance where a candidate does not clearly meet one of the criteria.

Table 1: Fiscal Year 1991 Multiyear Contract Candidates Not Clearly in Conformance With Legislative Criteria

System	DOD's Estimated multiyear percent savings	Realism of savings	Stability		
			Requirement	Funding	Design
Army:					
Black Hawk	12.4	?	?	?	•
FMTV	12.9	?	•	•	?
Avenger	9.3	?	•	?	?
Navy:					
LHD	7.6	?	?	?	•
LCAC	7.7	•	?	•	•
Air Force:					
GPS	19.8	•	?	•	?

From fiscal years 1986 through 1990, DOD proposed 68 major candidates for multiyear contracts and the Congress approved 32.

Estimated Savings

To calculate an amount of savings for a candidate, the estimated costs of procurement on a multiyear contracting basis must be compared to the

estimated costs of the same procurement through a series of annual contracts. For the six systems we reviewed, DOD estimated that it would require about $7.1 billion in then-year dollars[1] to complete the planned multiyear procurements. DOD estimated that multiyear procurement of these six systems would save $0.875 billion, or about 11 percent, compared to annual contract estimates.

Our review indicated that four of the systems' savings projections were unrealistic because of questionable assumptions. We found questionable savings projected for the Navy's LHD amphibious assault ship, questionable estimating techniques for the Army's Black Hawk helicopter and FMTV, and outdated information used to estimate the Army's Avenger weapon system costs.

To achieve savings through the use of a multiyear contract, more funding is usually required in the early years of the contract term than would be needed for a series of annual contracts. For fiscal year 1991, DOD requested $90.7 million more in advance procurement funding for the six multiyear contract candidates than it estimates would have been required for advance procurement under annual contracts. This additional funding should be offset by reduced funding requirements in later years.

Requirement and Funding Stability

We identified uncertainties regarding the requirement and/or funding stability of five of the six systems. Specifically, due to impending force structure changes, the program requirements for the Army's Black Hawk helicopter and the Navy's LCAC and LHD ships may be significantly reduced. The Black Hawk and LHD systems could also face funding uncertainties. It is unclear whether the services and DOD will include them in their future funding requests. The Air Force's Navstar GPS satellite requirement is uncertain because there is not sufficient operational experience with the current Block II satellites to know how long they will last and because current Air Force estimating procedures have given conservative results in the past. If satellite design life is exceeded, the Air Force would be acquiring satellites earlier than needed, and thereby incur additional storage costs. In addition, the Army's Avenger system may require additional funding because the contractor's recent proposals and estimates indicate higher unit prices than those estimated by the Army and included in the budget.

[1]Then-year dollar expenditures include estimated inflation for the years in which the expenditures are expected to occur; constant dollar expenditures eliminate the effect of inflation.

Design Stability

Uncertainties in design stability were evident in three systems. The Avenger, while operable as a stand-alone system, has not yet been integrated with other components of the Forward Area Air Defense System. Its integration is a system requirement; therefore, until such integration is demonstrated, the successful operation of the total system will have inherent risks. Although the design for the GPS Block IIR operational replacement satellites may be stable, there is some additional risk since no production history exists for the redesigned satellite. The satellite's critical design review is not scheduled for completion until 2 months before the exercise of the multiyear procurement option. In addition, some system research and development effort will continue during early production and no production history exists for the redesigned Block IIR satellite. Design stability is also uncertain for the FMTV, which is a new system that has not yet been designed, tested, or produced.

Update on Candidates Proposed Since Fiscal Year 1986

According to an Office of the Secretary of Defense (OSD) official, during the last 5 fiscal years, 1986 through 1990:

- DOD proposed 68 major candidates for multiyear contracts and the Congress approved 32, or about 47 percent.
- Of the 32 approved candidates for multiyear contracts, DOD has awarded 24 contracts (75 percent of those approved), 3 are pending award, and 4 were awarded as annual instead of multiyear contracts. In one case, the proposed fiscal year 1990 Maverick missile system, DOD terminated the program and did not award any contract.
- Two awarded multiyear contracts were subsequently terminated; the fiscal year 1988 Hawk missile and the fiscal year 1986 MK-46 Torpedo. Estimated cancellation cost for the Hawk missile was about $13 million, but no costs were associated with the cancellation of the MK-46 Torpedo.

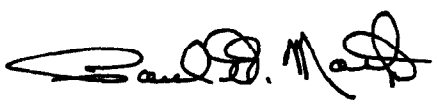
Appendix I presents DOD's multiyear contract savings projections and present value estimates of those savings. Appendix II provides our analysis of each of the six candidates we reviewed. Appendix III discusses our objective, scope, and methodology.

As requested, we did not obtain official DOD comments on this report. However, we discussed our findings with officials from OSD, the Army, Navy, Air Force, and the individual system program offices, and have included their views where appropriate.

We are sending copies of this report to the Chairmen, House Committee on Appropriations, Senate and House Committees on Armed Services, House Committee on Government Operations, and Senate Committee on Governmental Affairs. Copies are also being sent to the Secretaries of Defense, the Army, Navy, and Air Force, and other interested parties. Copies will be provided to others upon request.

Please contact me at (202) 275-8400 if you or your staff have any questions concerning this report. Major contributors to this report are listed in appendix IV.

Sincerely yours,



Paul F. Math
Director for Research, Development,
Acquisition, and Procurement Issues

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Abbreviations

CBO	Congressional Budget Office
DOD	Department of Defense
FAADS	Forward Area Air Defense System
FMTV	Family of Medium Tactical Vehicles
GPS	Global Positioning System
LCAC	Landing Craft, Air Cushion
NAVSEA	Naval Sea Systems Command
OSD	Office of the Secretary of Defense
POM	Program Objective Memorandum
RDT&E	Research, Development, Test, and Evaluation

Estimated Savings for Fiscal Year 1991 Multiyear Contract Candidates

We reviewed six of the seven multiyear contract candidates in DOD's fiscal year 1991 budget. DOD estimated that multiyear procurement of these six candidates could save $874.7 million in then-year dollars, or about 11 percent of the estimated cost of procurement based on annual contracts for the six candidates. (See table I.1.)

Table I.1: DOD Cost and Savings Estimates for Fiscal Year 1991 Multiyear Contract Candidates

Then-year dollars in millions

	Estimated contract costs and savings			
System	**Annual**	**Multiyear**	**Savings**	**Percent[a]**
Army:				
Black Hawk	$1,508.0	$1,320.8	$187.2	12.4
FMTV	1,946.2	1,694.3	251.9	12.9
Avenger	362.5	328.7	33.8	9.3
Navy:				
LHD	2,288.9	2,115.3	173.6	7.6
LCAC	1,170.9	1,080.4	90.5	7.7
Air Force:				
GPS	694.6	556.9	137.7	19.8
Total	**$7,971.1**	**$7,096,4**	**$874.7**	**11.0**

[a]Savings divided by annual contract costs.

Present Value Analysis

Present value analysis is used to put annual and multiyear procurement estimates on a comparable basis because the rates of government expenditures differ under annual and multiyear procurement methods. It can be used to compare the two procurement alternatives to reflect the time value of money. Although present value analysis is a generally accepted practice, selecting an appropriate interest rate has been a subject of controversy. Because most government funding requirements are met by the Department of the Treasury, we believe its estimated cost to borrow is a reasonable basis for establishing the interest rate to be used in present value analysis.

Accordingly, for our analysis, we used the average yield on outstanding marketable Treasury obligations that have remaining maturities similar to the period involved in the analysis and applied that rate to then-year dollars. DOD uses the Office of Management and Budget Circular A-94's prescribed present value method, which applies a flat 10-percent discount rate to constant dollars.

Despite the difference in the two methodologies, the end results are very similar. Our present value analysis of the six multiyear contract candidates, as shown in table I.2, shows projected savings of about 10 percent. DOD's present value analysis shows savings of about 9.7 percent. Therefore, distortions in projected savings rates caused by the time value of money are not a significant factor for these candidates.

Table I.2: Our Estimated Present Value Savings as Compared to DOD's for Fiscal Year 1991 Multiyear Contract Candidates

Dollars in millions

	DOD present value savings		Our present value savings	
System	**Amount**	**Percent[a]**	**Amount**	**Percent[b]**
Army:				
Black Hawk	$75.2	8.9	$96.1	10.1
FMTV	139.8	13.4	158.3	13.2
Avenger	5.3	2.6	11.9	5.0
Navy:				
LHD	52.1	4.5	79.8	5.4
LCAC	76.9	12.3	83.7	10.8
Air Force:				
GPS	67.9	16.1	80.9	17.5
Total	**$417.2**	9.7	**$510.7**	10.0

[a]Savings divided by DOD's estimated present value annual contracts cost.

[b]Savings divided by our estimated present value annual contracts cost.

DOD's Estimated Source of Savings

Just as the estimated savings for each candidate varies, so does the source of the savings. The majority of the savings for DOD's multiyear contract candidates has been associated with procurement of vendor and subcontracted items on a more economical basis than is possible with a series of annual procurements. Multiyear contracting allows economic order quantity procurement. Rather than procuring subcontracted parts and materials in annual lots of limited sizes, the prime contractor can procure parts in larger lots, thereby obtaining lower prices from subcontractors. However, the government must make a contractual commitment to the prime contractor to either procure the total multiyear contract quantity or pay termination costs if the quantity is later reduced. The commitment to larger advance procurement usually requires additional funding in the early years of a multiyear contract.

Another significant source of savings is attributed to manufacturing savings at the prime and major subcontractor levels. These savings result from such factors as improved fabrication, assembly, inspection,

and test processes; reduced labor hours and spare part and repair requirements; and improved quality and reliability of the product. Table I.3 shows the sources of savings for the six multiyear contract candidates, as estimated by DOD.

Table I.3: Sources of Estimated Multiyear Contract Savings for Fiscal Year 1991 Candidates

Then-year dollars in millions

	Total savings	Percent savings
Vendor procurement	$398.7	45.6
Manufacturing	343.3	39.2
Inflation	100.3	11.5
Other	32.4	3.7
Total	**$874.7**	**100.0**

Our Assessments of the Fiscal Year 1991 Multiyear Contract Candidates

This appendix summarizes our assessments of six multiyear contract candidates proposed in the fiscal year 1991 budget. We also provide background information on each system, including the proposed multiyear contract period.

We reviewed DOD's multiyear contract justification materials submitted to the Congress in January 1990 for the six candidates. Candidates were reviewed to assess their conformance with the legislative criteria for multiyear procurement (P.L. 97-86).

UH-60 Black Hawk

The Army's UH-60 Black Hawk, manufactured by Sikorsky Aircraft, is a squad carrying assault helicopter. Its mission is to transport infantry into combat, resupply units in combat, perform aeromedical evacuation and reposition reserves. The UH-60A Black Hawk is a twin-engine, single rotor helicopter designed to carry a crew of 3 and up to 14 combat equipped troops or the equivalent cargo load.

In October 1989, the engines for the UH-60A Black Hawk were upgraded from the General Electric T700 engine to the General Electric T701C, requiring a change in the designation of the aircraft to the L model. The new T701C engine includes various enhancements, such as a 12 to 14-percent increase in horsepower and a digital electronic control. In addition, the UH-60L model also has an improved main transmission.

Proposed Multiyear Contract

Term: Fiscal years 1992-96 (Advanced procurement in fiscal years 1991-95).

Type: Firm fixed-price, sole-source contract, with a variable business base option clause.

Estimated cost: $1,320.8 million.

Estimated savings: $187.2 million (12.4 percent) compared to estimated annual contract costs.

Quantity: 300 aircraft (60 aircraft per year for 5 years).

Procurement objective: 2,253 (Multiyear procurement would provide units 1,108 through 1,407).

Unfunded cancellation ceiling:[1] $0.

Fiscal year 1991 funding: $149.5 million — all advance procurement.

Review Results

Savings Realism

- The UH-60 Black Hawk Program Office calculated both multiyear and annual cost estimates using prior procurement history, contractor's cost data, and DOD inflation indexes. It developed a computer program which uses historical contract data and the most recent cost information from the current multiyear procurement contract, then converted the costs to constant fiscal year 1989 dollars for its cost estimates.
- The same method was used for the annual contract estimates. The annual and multiyear estimates for labor and overhead are the same. The primary difference between the two estimates is in material cost.
- Annual contract material costs were projected to be about 15 to 17 percent higher than multiyear contracts costs. The Army applied price/quantity adjustments factors, developed for a 1984 multiyear contract, which resulted in a $136 million savings. The Army assumed that this same price/quantity relationship still existed. No data were available to support the $136 million savings in materials the Army attributed to the multiyear contract. Because proposals have not yet been requested, the program office believes the historical data derived from prior multiyear procurements are a good indicator of what to expect for the proposed multiyear procurement.
- The information submitted in the multiyear justification package has not been comprehensively and independently verified by the Army. The supporting data for the figures and underlying assumptions were not reviewed or analyzed for reliability or validity. The Army submitted the package after a cursory review by program officials.

Requirement and Funding Stability

- The requirement for the UH-60 Black Hawk has fluctuated in the last year and a half and the future of the program is uncertain. On February 15, 1989, the procurement objective was increased from 1,107 to 2,253 aircraft, representing about a 100-percent increase in the program baseline.

[1] Unfunded cancellation ceiling is the total amount of DOD's liability for which funds have not been budgeted or appropriated in the case of multiyear contract cancellation.

- In a March 1990 testimony, the Army's Deputy Assistant Secretary for Research, Development, and Acquisition said there would be cuts in the 2,253 procurement objective of up to 632 aircraft. Moreover, in a May 1990 interview, the Secretary of Defense said the UH-60 Black Hawk Program may be terminated.
- The current reduction in the Army force structure, coupled with continuing efforts to develop a new Army Aviation Modernization Plan reflecting lower numbers of aircraft, will affect the requirement for UH-60 Black Hawk helicopters. The Army's Deputy Program Executive Officer for Aviation told us that the service cannot rationally review the procurement objective until its modernization plan is revised because the size and needs of the force structure will determine the size of all Army aviation programs. Another Army official told us the number of UH-60 Black Hawks needed will be based on the modernization plan and a smaller force structure will almost certainly require fewer UH-60 Black Hawks.
- Whether DOD or the Army will request sufficient funding for the multiyear contract is highly questionable. The Army did not request funding for UH-60 Black Hawk helicopter procurement beyond fiscal year 1992 in its Program Objective Memorandum (POM).
- Several Army Aviation System Command officials believe that, if there is a multiyear procurement, it will most likely be for 36 aircraft per year rather than the 60 annual production rate estimated in the multiyear procurement proposal. At 36 aircraft per year, based on the estimating method used by the UH-60 Black Hawk Program Office, estimated savings would decrease by at least $86 million, from $187.2 million (12.4 percent) to a saving of $101.2 million (10.4 percent).

Design Stability

- The basic UH-60 Black Hawk is in its 13th year of full production, thus, indicating a stable design. Even with the upgrade to the L model, program officials said it is considered a nondevelopmental item.[2]
- Army officials told us about the UH-60 Black Hawk's water integrity problems which could lead to accelerated aircraft corrosion and operational problems. When the contractor was notified of the leakage problem, it anticipated that the new UH-60 model design would solve the water problem. However, in April 1990 when a UH-60A and a new L model were subjected to a water integrity test, both models leaked in the nose and cabin compartments and under the transmission. Several

[2]Items that are either available in the commercial market place or otherwise already developed and in use by a governmental entity, including items that require only minor modifications.

Army officials told us they were concerned that this deficiency has not been corrected.

Conclusions

UH-60 Black Hawk requirements and funding are uncertain because of the expectation that the reduction in the Army force structure and the new Army Aviation Modernization Plan will reduce aircraft requirements. In addition, the Army has not requested funding for the UH-60 Black Hawk procurement beyond 1992, and the Secretary of Defense has indicated that the program may be terminated.

We question the $187 million savings estimate claimed for the multiyear contract in the justification package because over 70 percent of it is based on a relationship between quantity and price estimated to exist for a different contract 6 years ago. In addition, if annual production is 36 aircraft per year, instead of the 60 proposed, savings are likely to be less.

Although the UH-60 Black Hawk's design has been stable, the water integrity problems identified could lead to accelerated aircraft corrosion and other operational problems.

FMTV

The FMTV program is designed to replace DOD's present 2-1/2-ton and 5-ton truck fleets with new vehicles that will satisfy the operational needs of the Army. FMTV will consist of new 2-1/2-ton and 5-ton trucks, utility trailers, and "kits". The Army can use the trucks, trailers, and kits in various configurations for different purposes, such as operating in arctic weather, carrying troops under a canvas cover, or using a crane to unload bulk cargo.

FMTV has no prior production history and is being procured as a nondevelopmental item. The program began with the competitive award of three prototype contracts in October 1988 to Tactical Truck Corporation, Teledyne Continental Motors, and Stewart and Stevenson. Prototype testing is scheduled for completion in December 1990. Production is scheduled to begin with a March 1991 award of a competitive 5-year multiyear production contract.

Proposed Multiyear Contract

Term: Fiscal years 1991-95 (No advanced procurement).

Type: Competitive, fixed price, with an economic price adjustment clause.

Estimated cost: $1,694.3 million.

Estimated savings: $251.9 million (12.9 percent) compared to estimated annual contract costs.

Quantity: 18,657 FMTV trucks, 259 trailers and 39,756 kits.

Procurement objective: Currently authorized at 79,512; however, program quantities are being revised. (Multiyear procurement would provide units 1 through 18,657.)

Unfunded cancellation ceiling: $0.

Fiscal year 1991 funding: $63.2 million—	
RDT&E[3]	$6.9
Procurement	56.3
Total	**$63.2**

Review Results

Savings Realism

- No price history exists for the FMTV, and the contractors' price proposals will not be submitted until October 1990.
- The multiyear contract cost estimates for the 2-1/2-ton and 5-ton trucks are based on cost estimates from previous contracts. The estimate for 5-ton trucks was based on a 1986 multiyear contract. The estimate for 2-1/2-ton trucks was based on a 1981 contract price which, with options, was extended through 1984. The Army adjusted its estimates to reflect the physical differences between the trucks previously procured and the FMTV.
- The cost of FMTV trailers was based on an Army cost estimating formula using historical contractual data on payload and contract costs for four-wheel flatbed trailers.
- Over half of the Army's estimated multiyear savings were based on calculations using the estimated cost penalties of annual contracting over multiyear contracting derived from the Army's December 1988 vehicle

[3]Research, development, test, and evaluation.

manufacturers' survey. The Army then increased the estimated savings on the assumption that, under annual contracts, a new contractor would be selected to build the vehicle in each of the 5 years. In doing so, the Army (1) added an average of $17.8 million per year to annual contract costs for production line start-up costs and (2) added or increased testing, training, and data costs by $50.3 million for the 5-year period.

- OSD's Cost Analysis Improvement Group reviewed and generally agreed with the Army's estimate for the FMTV's life-cycle costs, including development, production, and operations and support. These cost estimators found the total program estimates to be low risk because of the nondevelopmental nature and the competitive environment of the FMTV procurement. However, they did not specifically review the multiyear and annual cost estimates for the proposed fiscal year 1991 through fiscal year 1995 buy. The Cost Analysis Improvement Group did note that if the Army changed the present procurement mix of the FMTV configurations, the cost could change substantially because of the wide cost range for the various configurations.

Requirement and Funding Stability

- In May 1990, the procurement objective for the FMTV was reduced from about 150,000 to 79,512 vehicles and may be reduced further due to planned force reductions. Army officials said that the proposed multiyear contract will not be affected by this reduction because (1) the need to replace the aging 2-1/2 and 5-ton trucks still exists and (2) the contract is only for 18,657 vehicles, which is significantly less than the 79,512 required.
- Army officials told us that the Army requested funding for the proposed multiyear contract in the 1990 POM. However, we noted that in 1989 the Army withdrew funding for the final year of its 1986 multiyear contract for 5-ton trucks because of higher priority programs. The Program Executive Officer said the FMTV system is a very high priority for the Army.
- According to program officials, "ramp up" planning for the FMTV allows for low-rate initial production until vehicles are certified as having met initial product testing requirements. Once these requirements are met, the Army expects the contractor to build vehicles at an economically advantageous rate. The contractor expects to produce about 90 vehicles a month for 4 months in fiscal year 1991; 150 vehicles a month for the first 2 months in fiscal year 1992, then 200 a month for the remaining 10 months. In fiscal year 1993, the contractor is expected to produce 200 a month for the first 5 months. At that time, the test results from the first fiscal year 1991 vehicles are expected and, if satisfactory, production will gradually increase to 550 vehicles a month. The Army expects to buy 550 vehicles a month during fiscal years 1994 and 1995.

Design Stability

- Although the FMTV has no production history, program office officials believe that the FMTV development is low risk because (1) the vehicle will be composed of commercial components available in the marketplace, (2) the manufacturing processes are not new, and (3) each vehicle configuration is being subjected to prototype hardware testing. However, design stability is uncertain because the components have not been integrated and functioned together before and prototype testing has not been completed.
- A program official told us that as of April 1990 no major design problems had been identified during these tests. We did not verify the test data. The Army expects to complete testing in December 1990, after the scheduled October 1990 receipt of contractor proposals, but before the scheduled January 1991 completion of negotiations or the March 1991 contract award.

Conclusions

Although force reductions could affect the overall FMTV requirement, the multiyear contract quantity of 18,657 will be needed to replace the aging truck fleet.

However, we question the Army's cost estimate because there is no prior price history for the FMTV, and contractor price proposals will not be submitted until October 1990. In addition, the Army's assumption that a new contractor would be selected for each annual contract during the 5-year period is highly unlikely because there are only three interested bidders. Further, the original production contractor, who will have already received payment for production line start-up costs, will have an advantage over any competitor.

When the Army's estimate of $17.8 million average annual start-up costs is deducted from all but the first year of production, the savings estimate is reduced to a maximum of 9.6 percent (rather than the projected 12.9 percent). Finally, when the proportional share of the $50.3 million in added testing, data, and training costs is deducted from all but the first year of production, the savings estimate is reduced further to 7.1 percent.

Because the multiyear contract costs are included in the Army's current POM and the FMTV seems to be a high priority, funding support appears to be adequate.

Design stability is uncertain because the FMTV components have not been integrated and functioned together before and prototype testing is not scheduled to be completed until December 1990.

Avenger Weapon System

In late 1985, the Army Chief of Staff convened a group of experts who concluded that no single weapon system could provide adequate forward area air defense. It recommended a concept referred to as the "Forward Area Air Defense System" (FAADS). To field FAADS quickly, the Army decided to rely on available systems, or "off-the-shelf" technology, to the extent possible.

FAADS consists of five elements or components: (1) the Air Defense Antitank System, (2) the Fiber Optic Guided Missile, (3) the Pedestal Mounted Stinger, or Avenger, (4) a command, control, communication, and intelligence system, and (5) improvements to certain existing systems, which the Army calls the "Combined Arms Initiative."

The Avenger is the initial component of FAADS to be procured and fielded by the Army. It provides defense against both fixed-wing aircraft and helicopters, and uses passive sensors for day/night/adverse weather detection.

The Avenger consists of Stinger missiles, a 0.50-caliber machine gun, passive sensors, the Stinger Identification Friend or Foe system, and a fire control system integrated in a stabilized turret and mounted on a High Mobility Multipurpose Wheeled Vehicle. The Avenger will replace selected man-portable Stinger teams.

In 1986, three contractors submitted proposals for the Avenger as a nondevelopmental item. Boeing won the candidate evaluation test and was awarded a production contract in August 1987. To date, the total quantity under this contract, including a fiscal year 1991 option for 72 units not yet exercised, is 325 Avenger systems. This includes 52 units covered in a May 1990 contract amendment.

Proposed Multiyear Contract

Term: Fiscal years 1991-95 (Advanced procurement in fiscal years 1991-93).

Type: Firm fixed-price, sole-source contract to Boeing Aerospace.

Estimated cost: $328.7 million.

Estimated savings: $33.8 million (9.3 percent) compared to estimated annual contract costs.

Quantity: 660 systems.

Procurement objective: 1,207 (Multiyear procurement would provide units 254 through 913).

Unfunded cancellation ceiling: $0.

Fiscal year 1991 funding: $76.9 million—Procurement	$51.2
Advance procurement	25.7
Total	**$76.9**

Review Results

Savings Realism

- The initial cost estimates for the proposed multiyear and annual contracts were made in late 1988 by Boeing and an independent contractor to the Army, based on cost estimates and option prices generated for the initial production contract awarded in 1987. Both Boeing and Stinger project officials stated that the cost history since that time indicates these estimates were too low. In addition, the project office has revised the estimated cost of the total program twice because of rescheduled procurement quantities and other changes. The Army has not revised the estimated cost of the proposed multiyear contract to reflect these changes.
- Boeing proposed a not-to-exceed price of $651,000 per unit for 52 units in May 1990, or about $75,000 per unit more than the fiscal year 1991 option prices included in the 1987 production contract. Boeing officials said Boeing's price would decrease as more detailed data were received from subcontractors, but Boeing's price would not be as low as the option prices.
- In July 1990, the project office prepared a new estimate of the multiyear procurement cost, based on Boeing's proposal for the 52 additional units and other preliminary data provided by Boeing. This new estimate is $373.3 million, or about $44.6 million more than the estimate submitted to the Congress in the justification package. It is unclear how this change would affect the estimated multiyear contract savings because the project office did not prepare a new savings estimate.

- Boeing officials told us they were preparing detailed estimates for the proposed multiyear and annual contracts but the estimates were not available at the time of our review. Stinger project officials said these proposals will provide a basis for estimating costs and multiyear contract savings, before a multiyear contract is awarded. Both Boeing and project officials said they expect multiyear contract savings to be more than 10 percent compared to annual procurement.
- The advanced funding estimates included in the justification package were prepared by Boeing in 1988 as part of its initial estimates. These estimates were based on an assumed economic order quantity of 240 units per year for major components at an average cost of $245,000 per unit. Boeing officials said they have not yet established a firm economic order quantity, but will do so as part of the proposal prepared for the multiyear contract.

Requirement and Funding Stability

- Requirements for the Avenger appear firm. The Five-Year Defense Program, dated January 10, 1990, included all of the units proposed for the multiyear procurement. Requirements identified in this document totaled 1,207, which is 294 more than the total multiyear procurement plus procurement through fiscal year 1990 under the initial contract. In addition, the Marine Corps has expressed an interest in procuring some yet-to-be-determined number of systems which would be included as part of this multiyear procurement.
- DOD is currently reevaluating its requirements in view of recent world events. However, Army Missile Command officials said that total Army Avenger requirements will increase to over 1,700.
- DOD funding support for the Avenger has been consistent since its inception. However, future funding will be determined after DOD reevaluates its requirements. The Five-Year Defense Program includes funding for the proposed multiyear procurement. However, if recent proposals from Boeing are a good indicator, the unit prices may be somewhat higher than the Army estimated and included in the budget. Depending on the extent of Boeing's price increases, the amount provided in the budget may not be sufficient to procure the planned number of units. Project officials said that if funding is not adequate, other program elements would be cut rather than reduce the multiyear contract quantities.

Design Stability

- The Avenger, as a stand-alone system and as currently produced, meets all operational requirements, is already being deployed, and appears relatively stable in design. This system, as a nondevelopmental item, successfully completed operational testing and evaluation. Approval for

full-scale production was granted by the Army in April 1990. As of that date, the contractor had delivered 55 fire units, 4 units ahead of schedule.

- Integration of the Avenger system with the command, control, communication, and intelligence component of FAADS is necessary to meet the requirements established for Avenger. The requirement provided that the basic Avenger system would be upgraded to interface with other FAADS components, but that is not likely to be assured until long after the scheduled award date for the proposed multiyear contract. The integration of the Avenger with other FAADS components has yet to be demonstrated.
- To fully implement FAADS (as a system), all individual weapon systems must be tied together by the command, control, communication, and intelligence component. This component consists of the software, target identification device, ground-based sensor, and masked (aerial) target sensor. These elements are scheduled to be fielded between December 1993 and September 1998, depending on the element. Therefore, it will not be known if the Avenger can be successfully integrated with the other components until long after the scheduled award date for the proposed multiyear contract. Project officials said the only element scheduled for fielding during the multiyear contract period that will affect Avenger is the software automating command and control. The expected modifications to Avenger include some wiring changes and the addition of some devices, but should not cause a major disruption in the production process.

Conclusions

The Army does not have a reliable cost estimate for the proposed multiyear contract. Both Boeing and Stinger project officials stated that the annual and multiyear contract estimates for the proposed procurement, made in late 1988 and based on data generated for the initial production contract awarded in 1987, were too low. Boeing's May 1990 proposal for additional quantities supports their statements that prices have increased.

Funding for the Avenger has been stable to date and the latest Five-Year Defense Program includes funding for the multiyear contract. However, DOD is reevaluating its requirements in view of recent world events and support for the Avenger could change. In addition, recent Boeing proposals and revised estimates indicate higher unit prices than those estimated by the Army and included in the budget. Thus, the amounts provided in the budget may not be enough to procure the number of units planned.

Since the Avenger has not been integrated with other FAADS components, design stability has not been established and it is uncertain how the total system will operate.

LHD Amphibious Ship

The Navy operates three different classes of amphibious assault ships—the LHD-1 Wasp, the LHA-1 Tarawa, and the LPH-2 Iwo Jima. The LHD, the largest of its type in the fleet, is designed primarily for amphibious warfare. LHDs can transport elements of a landing force, landing craft, and vertical/short take-off and landing aircraft and helicopters, and can also launch preloaded assault craft in support of an amphibious assault operation. LHDs can also deploy aircraft and helicopters in secondary sea control and power projection missions.

Four LHDs have been funded to date—the first ship entered the fleet in May 1989. The LHD's design is similar to that of the LHA assault ship, although modifications have been made for the operation and support of AV-8B Harrier jets, increase the number of LCAC carried, and provide increased command and control capabilities.

The LHD program started in fiscal year 1981 as part of an overall program to increase amphibious capability. In the spring of 1981, the Navy accelerated the LHD program by moving the authorization to award the contract for the lead ship from fiscal year 1987 to fiscal year 1985. Subsequently, the program was authorized for fiscal year 1984, based on a modified LHA design.

The LHD-1 lead ship construction contract was awarded in February 1984 to Ingalls Shipbuilding, Incorporated. The LHD-1 was delivered to the Navy in May 1989 and is currently undergoing post shakedown availability.[1] The Navy's final acceptance of the LHD-1 is expected in October 1990.

Ingalls was also awarded a competitive, fixed-price contract in September 1986 for construction of LHD-2, with scheduled delivery to the Navy in 1992. This contract contained options for construction of LHDs-3 and -4. The option for LHD-3 was exercised in November 1987 with a scheduled delivery for January 1993 and the option for LHD-4 was exercised in October 1988 with a scheduled delivery for March 1994.

[1]Post shakedown availability is a period during which both government and contractor responsible deficiencies are corrected.

The Navy has requested approval for a multiyear contract to competitively procure three additional LHD class ships over 5 years, with a contract award planned for February 1991.

Proposed Multiyear Contract

Term: Fiscal years 1991-95 (Advance procurement in fiscal years 1990, 1992, and 1994).

Type: Competitive, fixed-price incentive contract.

Estimated cost: $2,115.3 million.

Estimated savings: $173.6 million (7.6 percent) compared to estimated annual contract costs.

Quantity: 3 ships.

Procurement objective: 10 (Multiyear procurement would provide units 5 through 7).

Unfunded cancellation ceiling: $20 million

Fiscal year 1991 funding: $961.8 million—	
RDT&E	$2.0
Procurement	959.8
Total	**$961.8**

Review Results

Savings Realism

- The Navy's estimate of multiyear contract savings was based primarily on actual cost data from LHDs-1 through -4. According to officials from the Cost Estimating/Analysis Branch of the Naval Sea Systems Command (NAVSEA), they developed cost estimates for both annual and multiyear contracts for LHDs-5 through -7 using actual cost data contained in cost performance reports furnished by the contractor, past contract awards, historical costs, and costs developed based on current labor and material rates. Program officials told us that these cost estimates were agreed to during senior working level reviews which included officials from the Office of the Assistant Secretary of the Navy, Shipbuilding and Logistics. However, we were unable to document such agreement.

- The Navy's October 1990 request for proposals will require proposals for both annual and multiyear contracts. Navy officials expect that four shipbuilders will bid for the contract. The Navy plans to award the contract in February 1991. LHDs-2 through -4 were competed in a similar manner in 1986 and approved for multiyear procurement. However, the contract was not awarded on a multiyear basis because a present value analysis of the proposals projected little savings (0.045 percent) compared to the cost of an annual procurement with options.

Requirement and Funding Stability

- NAVSEA officials said current DOD guidance for lifting one Marine Expeditionary Force plus one Marine Expeditionary Brigade requires 10 LHD ships. They also said the total number of amphibious ships required to meet the amphibious fleet's inventory objective is 65 ships, including the current requirement for 10 LHDs. This requirement is based on an outdated study[5] that is over 7 years old. Navy officials told us that a new amphibious requirement study,[6] which was forwarded to the Secretary of Defense in April 1990, found that nine LHDs are required for lifting an expeditionary force and brigade. Although this new study has been approved by the Secretary of the Navy, Navy officials would not release the study to our office until all the appendixes are complete. The study reportedly does not recommend specific force levels, but provides a basis for future force level planning within the Navy. According to Navy officials, the new study is not a definitive requirements document, rather, it is a guide to establishing force level goals and the assets required to achieve those goals. We were told that while the new study indicates a need for a minimum of seven LHDs, DOD has not agreed to a reduced requirement.
- An October 1989 Congressional Budget Office (CBO) study[7] raises questions concerning the administration's goals for amphibious ships. The administration's goal, based on the Navy's 1983 study, is to provide enough amphibious lift to transport about 50,000 Marine troops and associated aircraft, vehicles, and equipment. However, the CBO study notes that this goal is much larger than what has been required in any assault since World War II. For example, the landing at Inchon, South Korea, involved about 19,500 Marines, and a total force of about 25,000 troops. None of the five major events involving Marines since Inchon has

[5]Department of the Navy Long Term Amphibious Lift Requirement and Optimum Ship Mix Study (1983).

[6]Department of the Navy Integrated Amphibious Operations and USMC Support Study (1990).

[7]Moving the Marine Corps by Sea in the 1990s (Oct. 1989).

required more than 1,700 troops in the initial landings that involved amphibious ships.[8] The CBO study suggested several options, including (1) retiring some older amphibious ships early and buying new ships according to the administration's plan; (2) keeping amphibious ships in the fleet through their expected service life, but canceling procurement of two amphibious ships, including one LHD, which would apparently be LHD-10; or (3) establishing a reduced goal for amphibious lift, which could be met by canceling procurement of all new amphibious ships, including LHDs-5 through -7.

- Multiyear procurement funding for LHDs-5 through -7 is contained in both the 1990 Five-Year Defense Program and the 1990 POM. We were not able to determine if LHDs-6 and -7 were included in the 1992 POM. Neither NAVSEA nor DOD officials would comment on the validity of statements that have appeared in trade publications indicating that procurement of LHDs-6 and -7 would be canceled.
- Funding for the fiscal year 1991 LHD-5 program is expected to increase approximately $233 million from the fiscal year 1989 LHD-4 program. Navy officials attributed this increase to (1) understated man hours by the shipbuilder on LHD-4, (2) inflation from fiscal years 1989 to 1991, and (3) improved combat and ship systems on the LHD-5. The officials said that none of the increase is for a gas turbine propulsion system for the LHD-5 and no change in propulsion systems is envisioned for LHDs-5 through -7.

Design Stability

- The LHD-1 is a derivative of the LHA class amphibious assault ship, which entered the fleet in 1976. NAVSEA officials considered the program risks minimal because the LHD is a modified LHA ship design and uses a steam propulsion system that has been installed in five LHAs. All major tests have been completed to ensure that the LHD-1 delivered to the Navy in May 1989 meets operational requirements. NAVSEA officials said deficiencies for which the contractor was responsible were considered minor and have been corrected. Deficiencies for which the government is responsible are scheduled for correction during post shakedown availability from June to October 1990. According to the officials, none of the deficiencies required any major rebuild of the ship.
- As late as June 1989, the Navy was considering design changes to a gas turbine propulsion system. However, in view of budget pressures and the relatively short time before contract award, the Navy decided to

[8]Although we recognize that about 50,000 Marines are currently being sent to the Middle East, this operation is not an amphibious assault.

proceed with a repeat procurement of the steam propulsion LHD-2 configuration. According to NAVSEA officials, current schedule and budget considerations continue to preclude consideration of a gas turbine propulsion system for LHDs-5 through -7.

Conclusions

The estimated multiyear savings of $173.6 million (or 7.6 percent) were based on actual cost data from prior LHD buys. However, the previously approved multiyear procurement for LHDs-2 through -4 was not awarded because a present value analysis projected little savings compared to the cost of an annual contract with options. Therefore, firm contract proposals for both annual and multiyear contracts for LHDs-5 through -7 should be evaluated, and the level of savings that would result from a multiyear contract should be carefully considered before contract award.

LHD requirements may be questionable because (1) the total amphibious ship requirement is based on a study that is over 7 years old and (2) the Navy's recent study has not been finalized. Finally, the 1989 CBO study suggested several options for amphibious requirements during the 1990s.

Funding support appears uncertain. The status of the LHD program is currently being debated and questioned in the 1992 POM finalization process.

Design for the LHD appears to be stable.

LCAC

The Navy's LCAC boats are carried by many amphibious ships in their well-decks. They require a crew of five to transport troops, vehicles, and cargo from the amphibious ship to the target landing area while the ship remains 25 to 50 miles at sea. The LCAC can deliver its load of up to 60 tons to the landing area at a speed of over 40 knots. These boats can be loaded, launched, and docked while the amphibious ship is underway. The LCAC boat is powered by four gas turbines and moves about on a cushion of air rather than through the water like conventional boats. This capacity allows the LCAC boats to deliver the troops, vehicles, and cargo to an inland target area over obstacles of up to 4 feet in height. Conventional landing boats deliver cargo to the beach.

The LCAC concept originated from demonstrations of air cushion vehicles in the 1960s. These led to the amphibious assault landing craft program,

which, from 1968 to 1984, consisted of evaluating the concept and producing two competing hovercraft boats—the JEFF(A) and JEFF(B). The JEFF(B), built by Textron Marine Systems, was selected as the boat on which to design the LCAC system.

In December 1981, after the milestone III review, the Secretary of the Navy approved the limited production of LCAC. The Navy's requirement is for 107 LCACs. In addition to Textron Marine Systems, Avondale Gulfport Marine was selected as a second source. These two companies are the current LCAC contractors. To date, 60 LCACs have been contracted, and 20 have been delivered.

Proposed Multiyear Contract

Term: Fiscal years 1991-94 (Advance procurement starting in fiscal year 1989).

Type: Firm fixed-price contract to either Textron Marine Systems or Avondale Gulfport Marine, or a contract to each contractor.

Estimated cost: $1,080.4 million.

Estimated savings: $90.5 million (7.7 percent) compared to estimated annual contract costs.

Quantity: 47 LCACs.

Procurement objective: 107 (Multiyear procurement would provide units 61 through 107).

Unfunded cancellation ceiling: $20 million.

Fiscal year 1991 funding: $267.7 million—Procurement	$244.5
Advance procurement	23.2
Total	**$267.7**

Review Results

Savings Realism

- The estimated cost and savings, which were prepared by the NAVSEA comptroller's office, were based on prior contract bid and actual cost

data. Since 1985, six LCAC contracts have been awarded to the two contractors.

- Most recently, the two contractors submitted cost proposals for the production of 12 LCACs in response to a 1988 request for proposal. This is the same rate of production planned for the proposed multiyear contract. NAVSEA officials said that the request for proposal will require the two contractors to submit proposals for a 4-year contract for 47 craft and for one annual contract for 12 craft.
- Navy officials said they do not expect the estimated multiyear savings of 7.7 percent to change whether a multiyear procurement is awarded to one contractor or is split between both contractors. Although the multiyear procurement for 47 LCAC craft is being competed between the two contractors, NAVSEA assumed, for cost estimating purposes, that one multiyear contract award will be made for all 47 craft.

Requirement and Funding Stability

- The Navy requirement is for 107 LCACs to support one Marine Expeditionary Force and one Marine Expeditionary Brigade. Forty-five LCACs would be ported on the east coast, 45 on the west coast, and the remaining 17 would be used for training, spares, and replacements. The need for 107 craft was approved in 1980 and the administration's 1991 budget request shows a goal of 107 craft.
- In July 1990, NAVSEA officials, in response to reports that the Navy was seriously considering reducing the LCAC program, stated that the official program requirement is still 107 LCACs. They said that any reductions or changes to official program quantities would have to be finalized within OSD and, to date, no revisions to requirements have been made.
- The requirement for 107 LCACs was supported by the Navy's outdated 1983 amphibious lift study. The Navy has reevaluated LCAC requirements in a new amphibious requirements study, which was provided to the Secretary of Defense in April 1990. This study, not yet released to our office, provides a basis for future force level planning for amphibious ships, which also affects LCAC requirements. However, the Navy has not finalized this study and DOD has not determined what its amphibious ship requirements should be. A 1989 CBO study[9] suggested options, some of which raise questions about the requirement for LCACs as well as amphibious ships. The number of LCACs required is directly related to the number of well-deck ships and the size of the Marine Corps. If the Navy could not field both a Marine Expeditionary Force and a Marine

[9]The Navy's 1983 and 1990 studies and CBO's 1989 study are discussed in the section on the LHD amphibious ship.

Expeditionary Brigade, the requirement for 107 LCACs would no longer be valid.

- The LCAC program has been funded since 1981, and has under contract or delivered 60 of the 107 LCACs. The Navy's 1990 POM and DOD's 1991 budget request include the required funding for the proposed multiyear contract.

Design Stability

- The LCAC has a stable design, with initial design studies dating back to 1978. The first of 12 LCACs were produced under a 1981 contract and full production began in 1987.
- All operational test and evaluation requirements were successfully completed in 1987. The LCAC has been used during five major deployments accumulating about 100 months of LCAC operation. The Navy does not believe problems noted during these deployments were significant enough to require major engineering or design changes. Further, NAVSEA did not request research and development funds for the LCAC system in fiscal year 1990.

Conclusions

Although proposals for multiyear and annual contracts will not be evaluated until the autumn of 1990, the Navy's cost and savings estimates were derived from years of contract bid and actual cost data and appear realistic. The LCAC design is stable and DOD had requested sufficient funding for the proposed multiyear contract.

The current requirement of 107 LCACs is based on an outdated study, so the number of LCACs needed to meet the Navy's mission may be subject to change.

Navstar GPS Block II Replenishment Satellites

The Navstar GPS is a joint service program that supports two major missions: navigation and nuclear detonation detection. The system is to provide precise, continuous, all-weather, three-dimensional position, velocity, time and navigation, and nuclear detonation information to properly equipped air, land, sea, and space-based military and civilian users.

The military services have been jointly developing GPS since 1973; the program is currently in the production and deployment phase. Between February 1978 and October 1985, 11 development phase (Block I) satellites were bought from Rockwell International Corporation Satellite Systems Division—6 were still in orbit and operating as of May 1990. In

May 1983, a noncompetitive, firm fixed-price multiyear contract was awarded to Rockwell for the production of 28 operational (Block II) satellites. The last of the Block II satellites is scheduled to be delivered in October 1992 and launched in May 1994. In June 1989, General Electric Company's Astro-Space Division was competitively awarded a fixed-price contract to produce 20 to 26 Block II replenishment (Block IIR) satellites. This contract included options to exercise either multiyear or annual contract provisions. Alternate annual production options were included in the contract to provide a comparison with the same production rate as the multiyear provisions. The multiyear provisions of the Block IIR contract only apply to the first 20 satellites. The government will provide most of the navigation and nuclear detonation detection components to General Electric for integration.

Proposed Multiyear Contract

Term: Fiscal years 1992-96 (Advance procurement in fiscal years 1991-95).

Type: Fixed-price to General Electric with an economic price adjustment clause.

Estimated cost: $556.9 million.

Estimated savings: $137.7 million (19.8 percent) compared to estimated annual contract costs.

Quantity: 20 satellites.

Procurement objective: 26 (Multiyear procurement would provide units 1 through 20).

Unfunded cancellation ceiling: $0.

Fiscal year 1991 funding: $179.2 million—RDT&E	$ 26.6
Procurement	56.3
Advance procurement	96.3
Total	**$179.2**

Review Results

Savings Realism

- The Navstar GPS annual and multiyear contract cost estimates, as well as the savings estimate, are based on firm fixed-price options in a June 1989 competitively awarded contract. The contract requires that the Air Force exercise the multiyear production option on or before October 30, 1990. Air Force officials said the required award date could be extended if a contract modification is negotiated with the prime contractor.
- Based on the multiyear procurement options to the Block IIR contract, satellite deliveries would begin in fiscal year 1995 and continue through 1999. If Block II operational and launch experience remains favorable, Block IIR satellites may need to be stored because of the overlap between the need for the last Block II and delivery of the first Block IIR. The estimated savings could be slightly reduced because of these storage costs. The Air Force estimates that annual storage costs would be $200,000 per satellite, per year. GPS program officials stated that no additional costs would be incurred for retesting the satellites and repairing any deficiencies identified after removing them from storage up to a period of 4 years. The contract requires General Electric to assume responsibility for ensuring that each satellite is capable of being stored with a shelf life of 4 years. Program officials said it would be unlikely that any of the satellites would be in storage beyond 4 years.

Requirement and Funding Stability

- The Block IIR satellites are required to maintain the GPS constellation of 21 operational satellites and 3 on-orbit spares. This requirement was validated by DOD's Joint Requirements Oversight Council in January 1988. The Air Force launched the first Block II satellite in February 1989. As of May 1990, seven of the satellites had been successfully launched. The Air Force plans to launch two more Block II satellites before October 1990, when the multiyear production option for Block IIR satellites must be exercised. The Air Force expects 24 Block II satellites to be in orbit by May 1993.
- Navstar GPS program officials estimate that three Block IIR satellite launches will be required beginning in fiscal year 1995 to replace failed Block II satellites. The Air Force used statistical model projection based on a constellation availability requirement of 0.98, expected operational and launch failures, and a planned satellite design life of 7.5 years to determine the 1995 launch requirement. The design life of 7.5 years is equal to 6.1 years mean mission duration or the actual expected life. However, if the Block II satellites experience no early operational or

launch failures and the first satellite operates to its full design life, no Block IIR satellite would be needed until June 1997. GPS program office officials stated that, based on their experience with the Block I satellites, it is unrealistic to think there will be no satellite failures during the design life of 7.5 years. Some of the past projections using this statistical model have been conservative. However, in view of the long lead time to procure satellites, GPS program officials would rather risk keeping satellites in storage rather than not having a satellite available when required.

- Past experience with the GPS Block I development satellites has shown that design life can be exceeded. For example, as of May 1990, the Block I satellites had exceeded their design life of 5 years; lasting an average of 5.6 years.
- The GPS satellites are currently being launched by Delta II expendable launch vehicles. The Medium Launch Vehicle program office has a current contract with McDonnell Douglas to launch the first 18 Block II satellites on the Delta II and negotiations are in process for a contract to support the remaining Block II launches. Medium Launch Vehicle and GPS program management directives both support the same number of Block IIR launches from fiscal years 1995 through 2000.
- Funding for the proposed GPS multiyear contract is included in DOD's fiscal year 1991 budget request and the Five-Year Defense Program. The GPS Program Executive Officer told us that GPS has a high funding priority within the Air Force and DOD, and he would expect funding support to be provided during the multiyear contract period.
- In fiscal year 1990, the Congress reduced the GPS procurement budget by $16.3 million, or about 23 percent of the total request, but did not specifically object to the Rockwell Block II multiyear procurement. In addition, the Air Force withheld $6 million of the approved budget to be used for other programs. To accommodate these reductions, among other things, the GPS program office restructured the firm fixed-price portion of the Rockwell Block II multiyear contract to delay funding until future years.

Design Stability

- Block IIR satellites represent a redesign of the Block II satellites to provide (1) improved reliability, supportability, and producibility, (2) increased autonomy, and (3) increased survivability. The GPS program office believes the overall Block IIR design changes are minor because an existing satellite bus, supporting subsystems, and qualified, flight-proven components are being used in the Block IIR design.

- In 1988, Rockwell and General Electric were awarded contracts to develop the Block IIR satellite. General Electric was awarded the production contract in June 1989. Although General Electric has built other military satellites, it has no production experience with the Block IIR satellite.
- General Electric is in the development phase of the contract. A critical design review is scheduled for August 1990, 2 months before a decision on the production options. Development and production will be concurrent. About $48 million of the $106 million estimated development cost is currently scheduled for funding between fiscal years 1991 and 1992, during the early production period. GPS program officials said this development effort is low risk because development funds are for performing component qualification and developing satellite test equipment. The production funds are for long lead items and some component level fabrication.

Conclusions

With a signed fixed-price contract for the GPS Block IIR procurement, there is little uncertainty that the estimated multiyear contract savings are realistic. However, savings could be slightly reduced if the Block II satellites perform better than predicted and the Block IIR satellites are produced before they are needed. In this case, the government would incur storage costs. Funding support for the Block IIR procurement appears to be adequate.

The stability of the Block IIR requirement depends on the number of replacement satellites that will be needed to replenish the GPS constellation. That will depend on how long the satellites will operate. The Air Force contends that satellite life is difficult to predict accurately and, accordingly, makes conservative estimates. The actual on-orbit experience with Block II satellites is less than 2 years. Block I satellites are lasting longer than their design life. Because a solid data base does not yet exist, it is uncertain whether the Block IIR satellites will be needed in fiscal year 1995.

Design of the Block IIR satellite may be relatively stable; however, there is some risk because the critical design review, scheduled for August 1990, is 2 months before the deadline for exercising the multiyear procurement option provisions. Also, development will continue during the early production phase of the contract, and no production history exists for the redesigned Block IIR satellite.

Objective, Scope, and Methodology

The Chairman, Subcommittee on Defense, Senate Appropriations Committee, asked us to review six of the seven systems proposed for multiyear procurement in DOD's fiscal year 1991 budget. The objective of the review was to determine whether the proposed multiyear contracts met the criteria in Public Law 97-86. The criteria require that (1) the estimated contract costs and projected savings be realistic, (2) the minimum requirement (total quantity, production rate, and annual procurement rate) be expected to remain substantially unchanged, (3) there is a reasonable expectation that sufficient funding will be requested by DOD to carry out the contracts, and (4) the design be stable. Failing to meet one or more of the criteria may not necessarily mean that a system is an inappropriate candidate, but indicates areas of increased risk that must be weighed against the potential savings to determine whether multiyear procurement approval should be granted.

We reviewed information on the six candidates in the January 1990 multiyear contract justification package submitted by OSD to the Congress. We evaluated the support and underlying assumptions used by each program office to prepare its justification package and reviewed other documents related to each program's cost, schedule, and performance.

To evaluate the realism of estimated contract costs and projected savings, we reviewed the cost estimating methodology, past procurement history, acquisition strategy, schedule for executing a multiyear contract, funding profiles, and present value analyses of estimated expenditure flows. We also calculated present values of the estimated expenditure flows using a different method than is used by DOD.

To evaluate whether the minimum requirement was expected to remain substantially unchanged and whether DOD planned to request funding necessary to complete the multiyear contract, we evaluated the military service's procurement objective, reviewed the historical and proposed rates of production, and requested each service and DOD to confirm that service and DOD plans for future budget years included sufficient funds to complete the multiyear contract program as proposed to the Congress. We also reviewed congressional actions on the six candidates.

To evaluate whether the design of the candidates was stable, we determined whether research and development funding and testing of the system were complete. We reviewed the history of production deliveries, test results, operational performance, and engineering changes in process.

We performed our work at the following locations:

- Office of the Assistant Secretary of Defense (Comptroller), Washington, D.C.
- Headquarters, U.S. Army, Washington, D.C.
- Headquarters, U.S. Navy, Washington, D.C.
- Headquarters, U.S. Air Force, Washington, D.C.
- U.S. Army Aviation Systems Command, St. Louis, Missouri.
- U.S. Army Missile Command, Huntsville, Alabama.
- U.S. Army Tank-Automotive Command, Warren, Michigan.
- NAVSEA Command, Washington, D.C.
- U.S. Air Force Space Systems Command, Space Systems Division, Los Angeles, California.

We discussed our findings with officials of OSD, the military services, and the program offices. Our work was performed from March through July 1990 in accordance with generally accepted government auditing standards.

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