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Report to the Chairman, Committee on Armed Services, U.S. Senate

June 1990

DEFENSE ACQUISITION PROGRAMS

Status of Selected Programs

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National Security and
International Affairs Division

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The Honorable Sam Nunn
Chairman, Committee on Armed Services
United States Senate

Dear Mr. Chairman:

This report responds to your request that we review the requirements, schedule, performance, cost, and funding support for selected Department of Defense (DOD) weapon system acquisition programs. As agreed with your office, we selected programs for which DOD was scheduled to make an acquisition milestone decision[1] during fiscal year 1991 and therefore were possible candidates for milestone authorization. Milestone authorization is a concept that would authorize up to 5 years of funding to cover the entire acquisition phase for either full-scale development or full-rate production. During our review, the services revised or eliminated the scheduled milestone decision dates for some programs; however, we retained these programs in our review.

The programs we reviewed and their next milestone decision as of March 1990 are shown by service in table 1.

[1]Major defense system acquisitions typically proceed through several phases, with each phase preceded by a senior management review, or "milestone decision," by the military services and/or DOD. The milestone 0 decision precedes the concept exploration phase, the milestone I decision precedes the demonstration and validation phase, the milestone II decision precedes the full-scale development phase, the milestone IIIA decision precedes low-rate initial production, and the milestone IIIB decision precedes full-rate production.

Table 1: Milestone Decisions for Programs GAO Reviewed

Program	Next milestone decision	Date
Army		
Non-Line-of-Sight (NLOS) Missile	[a]	[a]
Light Helicopter (LH)	II	Jan. 1991
Navy		
MK-50 Torpedo	IIIB	Apr. 1991
Air Force		
Sensor Fuzed Weapon (SFW)	IIIA	Sept. 1991[b]
Advanced Tactical Fighter (ATF)	II	June 1991
Joint Tactical Information Distribution System (JTIDS) Class 2 Terminals	Class 2M—IIIA[c] Class 2 and 2H—IIIB	Oct. 1991 Oct. 1993

[a]In the fiscal year 1991 budget request, DOD decided to continue to fund development but not procurement.

[b]The production contract is not expected to be awarded until December 1991.

[c]The milestones for the Army Class 2M terminals were rescheduled to coincide with the program schedule for the forward area air defense/command, control, and intelligence system, since the Class 2M terminal is a primary subsystem of that system.

Results in Brief

The current and anticipated instability in the overall defense budget and the recent changes in Eastern Europe are forcing DOD and the military services to reexamine the need, priority, and annual funding levels for many weapon system acquisition programs. DOD and the services have reexamined or are reexamining some of the systems we reviewed. For example, the Army had characterized the NLOS missile as a high priority, but its procurement was terminated by DOD in its fiscal year 1991 budget request. The Secretary of Defense initiated a review in December 1989 to reexamine, among other things, the need for the ATF. In April 1990 the Secretary announced that he had decided to maintain the ATF force level objective at 750 aircraft but proposed delaying its initial procurement by 2 years. The Secretary also recently initiated a similar review of the LH. Other programs can expect to be reexamined. For example, the changes occurring in Europe will likely result in a reexamination of the need for the SFW, a weapon designed to attack formations of enemy armored vehicles.

Although the six programs we reviewed are being developed to satisfy a stated military requirement, DOD and the services have not fully agreed that certain programs are the best or most cost-effective solution for satisfying the requirements. For example, the specific requirements for the LH have not yet been determined, and the Army does not know whether this aircraft is the most cost-effective way to accomplish the LH's projected missions. A revised cost and operational effectiveness analysis is expected to be finalized before the LH's next major acquisition milestone decision, scheduled for January 1991. In addition, the future of the JTIDS Class 2 terminal is unclear. The Air Force, as lead service, has reduced its planned procurement of JTIDS terminals for the F-15 aircraft from 160 to only 20 units. However, DOD has given the Air Force until June 1991 to decide whether to retain the terminals for the F-15 and expand the program or terminate it and transfer the 20 terminals to the Navy. In addition, a variant of the Class 2 terminal is being designed and built for the Army.

Each of the six systems we reviewed has experienced some schedule slippage, and cost estimates for four systems have increased. Five of the six programs have not yet demonstrated that the system being designed and/or produced can meet its requirements. Tables 2 through 5 summarize the results of our review, and detailed information on each of the programs is in appendixes II through IV.

Table 2: GAO's Assessment of the Status of the Programs Reviewed

Program	Stage of development	Recent schedule slippage	Future slippage indicated	Demonstrated it will meet requirements	Recent cost growth	Future cost growth indicated
LH	Early development	Yes	Yes	No	No	Yes
ATF	Early development	Yes	No	No	Yes	No
NLOS	Full-scale development	Yes	Yes	No	Yes	Yes
SFW	Full-scale development	Yes	Yes	No	Yes	No
MK-50	Initial production	Yes	No	Yes	Yes	No
JTIDS	Initial production	Yes	No	No	No	No

Table 3: Cost Estimates for Programs in Early Development

Escalated dollars in millions

Program	Early development cost	Full-scale development cost	Production cost	Total cost
LH	$921.6	$3,107.6	$41,700.0	**$45,729.2**
ATF	$3,817.6	$10,534.0	$65,082.2	**$79,433.8**

Table 4: Cost Estimates for Programs in Full-Scale Development

Escalated dollars in millions

Program	Development cost	Initial production cost	Full-rate production cost	Total cost
NLOS	$630.8	$0.0[a]	$0.0[a]	**$630.8**
SFW	$200.9	$762.6	$2,914.9	**$3,879.0**

[a]DOD decided to delete procurement funding for the NLOS missile from the fiscal year 1991 budget and the Five Year Defense Plan.

Table 5: Cost Estimates for Programs in Production

Escalated dollars in millions

Program	Development cost	Initial production cost	Cost for 5 years of full-rate production	Cost to complete	Total cost
MK-50	$1,472.3	$659.1	$2,544.9	$2,579.0	**$7,255.3**
JTIDS	$2,032.0	$773.1	$1,088.5[a]	[a]	**$3,893.7**

[a]Full-rate production of JTIDS is not expected to begin until fiscal year 1994 and will be completed within 5 years.

Scope and Methodology

To obtain the information for this report, we reviewed relevant program documents, such as operational requirements, selected acquisition reports, acquisition strategies, operational effectiveness analyses, program master schedules, cost estimates, cost performance reports, test reports, contract documents, and budget exhibits. We also discussed each program with responsible DOD and military service officials.

We conducted our work at Headquarters, Departments of the Army, Navy, and Air Force, Washington, D.C.; Defense Intelligence Agency, Washington, D.C.; Army Aviation Systems Command, St. Louis, Missouri; Army Missile Command, Redstone Arsenal, Alabama; Army Operational Test and Evaluation Agency, Washington, D.C.; Air Force Systems Command, Aeronautical Systems Division, Wright-Patterson Air Force Base, Ohio; Electronic Systems Division, Hanscom Air Force

Base, Massachusetts; Munitions Systems Division, Eglin Air Force Base, Florida; and Naval Sea Systems Command, Arlington, Virginia.

We performed our work from October 1989 to April 1990 in accordance with generally accepted government auditing standards. As requested, we did not obtain official agency comments. However, we discussed a draft of this report with DOD and service officials and incorporated their comments where appropriate.

We are sending copies of this report to the Chairmen, House Committees on Appropriations, Armed Services, and Government Operations and Senate Committees on Appropriations and Governmental Affairs; the Secretaries of Defense, the Army, the Navy, and the Air Force; and the Director, Office of Management and Budget. We will make copies available to other interested parties.

This report was prepared under the direction of Nancy R. Kingsbury, Director, Air Force Issues, who may be reached on (202) 275-4268 if you or your staff have any questions concerning this report. Other major contributors to this report are listed in appendix V.

Sincerely yours,

Frank C. Conahan
Assistant Comptroller General

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Abbreviations

ATF	Advanced Tactical Fighter
DOD	Department of Defense
FAADS	Forward Area Air Defense System
GAO	General Accounting Office
JTIDS	Joint Tactical Information Distribution System
LH	Light Helicopter
NLOS	Non-Line-of-Sight
SFW	Sensor Fuzed Weapon

Milestone Authorization

Milestone authorization is a concept that would authorize up to 5 years of funding to cover the entire acquisition phase for either full-scale development (milestone II) or full-rate production (milestone IIIB). 10 U.S.C. 2437, enacted in October 1986, established the milestone authorization concept to enhance program stability by alleviating some of the year-to-year funding uncertainties and minimizing the amount of management review within the Department of Defense (DOD) and the services. The concept was based on the principle that if DOD would commit to managing a program within set cost, schedule, performance, and other requirements, the Congress would commit to stable multiyear funding authorization. The legislation required the Secretary of Defense to (1) designate some DOD programs as "Defense Enterprise Programs" to receive streamlined management and (2) nominate some of these programs as candidates for milestone authorization. A 1987 amendment to the legislation enabled the House and Senate Committees on Armed Services to consider defense acquisition programs that have not been designated as Defense Enterprise Programs for milestone authorization and approve the programs for milestone authorization as appropriate.

In March 1987 the Secretary of Defense designated 10 acquisition programs as Defense Enterprise Programs and nominated 3 for milestone authorization: the Army's Mobile Subscriber Equipment, the Navy's Trident II D-5 Missile, and the Air Force's Medium Launch Vehicle. The Congress approved milestone authorization for the Army and Navy systems and two others: the Navy's T-45 Training System and the Army's Tactical Missile System. Since then, neither DOD nor the Congress has designated or nominated systems for the Defense Enterprise Program or milestone authorization.

In his July 1989 Defense Management report, the Secretary of Defense stated that DOD should take better advantage of the Defense Enterprise Program and milestone authorization. The report stated that the Under Secretary of Defense for Acquisition, with the Service Acquisition Executives, would carefully select several new Defense Enterprise Programs from programs in the Defense Acquisition Board's concept approval (post-milestone I) phase, provide strong policy direction and oversight in implementing the Defense Enterprise Program, and seek milestone authorization for such programs to enhance management stability.

Since then, a DOD task force has been preparing an implementation plan and a proposed list of candidate programs. However, DOD's fiscal year 1991 budget request to the Congress did not contain any candidate programs. In March 1990 DOD officials informed us that candidate programs are still being considered, but the final decision on nominations to the program had not yet been made, primarily because of the current and anticipated instability of the overall defense budget. As a result, DOD and service decisionmakers have had to cut the budgets and delay the schedules of many programs, including some of those that were being considered for the Defense Enterprise Program.

Army Programs

Non-Line-of-Sight Missile

The Non-Line-of-Sight (NLOS) Missile[1] is an important part of the Army's Forward Area Air Defense System (FAADS) because of its ability to attack enemy helicopters hidden from view by the terrain. DOD has decided not to fund the NLOS missile's procurement[2] because other programs have higher priority and its position that the forward area air defense mission can be accomplished by the Air Defense Anti-Tank and Pedestal Mounted Stinger Systems. According to Army officials, the Army plans to appeal DOD's decision during the fiscal year 1992 budget formulation process because it believes that a requirement for the missile's capabilities still exists. Therefore, we have included this program in our report to provide information on its status and identify issues that would be relevant if the program continues.

The NLOS missile program is in full-scale development, and an initial production decision was scheduled for July 1991. If DOD's decision not to fund the missile's procurement is sustained, current plans call for the program to be terminated after development is completed in December 1993, and the technology to be "shelved" for possible future use.

According to Army testing officials, the initial operational evaluation of a prototype[3] missile was successful in demonstrating the feasibility of the NLOS concept. However, components to be included in the full-scale development missile—such as an infrared seeker and a more powerful propulsion system—are not scheduled to be tested until fiscal year 1991.

Background

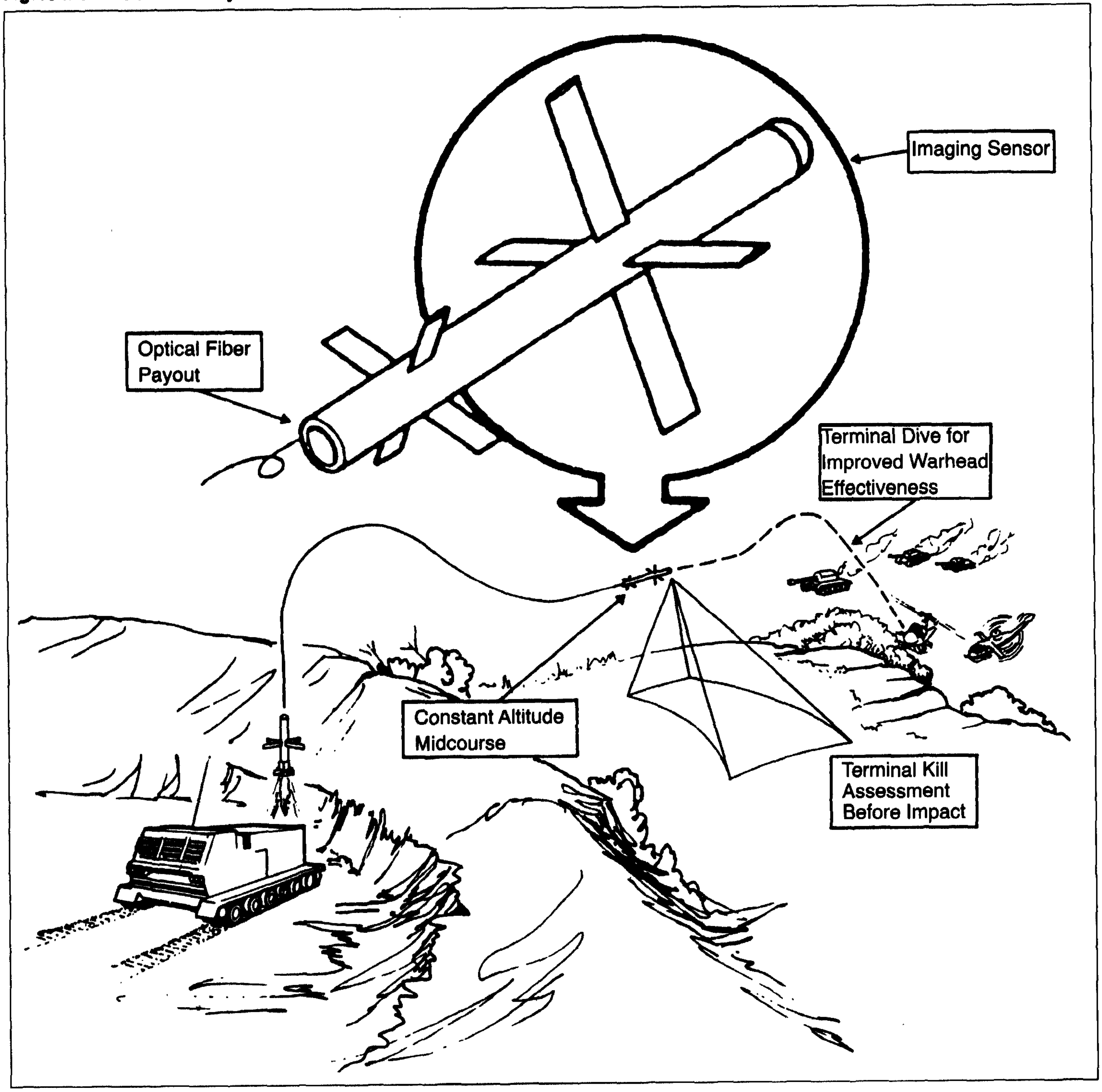
The NLOS missile system is designed to protect ground troops and vehicles by attacking enemy helicopters hidden from view by the terrain. The NLOS missile system consists of a fiber optic guided missile, launcher, gunner station, and communication and navigation equipment. Figure II.1 illustrates how the NLOS missile would be used in combat.

[1]The missile is also referred to as the Fiber Optic Guided Missile.

[2]DOD decided to delete procurement funding for the NLOS missile from the fiscal year 1991 budget and the Five Year Defense Plan.

[3]A prototype is the first working article of a new technology or design intended to serve as the pattern or guide for subsequent designs that will be incorporated in a weapon system.

Figure II.1: NLOS Missile System



The NLOS missile is to be mounted on vehicles, such as the High Mobility Multi-Purpose Wheeled Vehicle or the Bradley Fighting Vehicle, and operate in the forward area of the battlefield in concealed positions out of direct enemy view. The missile will receive target location information from its own sensor and from the FAADS command, control, and intelligence network, which will contain ground and aerial sensors. Once the missile is launched, it will use an on-board television camera or imaging infrared sensor to detect targets. The targets' images will pass though a fiber optic line to the gunner's monitor so the gunner can guide the missile to the target.

The NLOS missile program is currently in full-scale development. The Boeing Company was awarded a cost-plus-incentive-fee contract in December 1988 to develop a missile capable of operating in all types of weather and in the day or night. The missile includes a television camera, infrared seeker, and a more powerful propulsion system than the prototype missile. To reduce the risk in developing the missile, the Army built and tested a prototype missile containing only a television camera. In February 1988 the Army restructured the program, in accordance with congressional guidance, to delete plans for equipping the first operational units with missiles using the television camera only. However, the information learned from developing and testing the prototype missile has been transferred to Boeing.

Requirements

In 1986 the Joint Requirements and Management Board approved the concept for the overall FAADS program. The Army approved the requirements for the NLOS missile in October 1987, and the Defense Acquisition Board approved full-scale development of the missile in September 1988.

If DOD does not fund the NLOS missile's procurement, the Army will have to rely on the Air Defense Anti-Tank and Pedestal Mounted Stinger systems for forward area air defense. According to a FAADS program official, these systems are not capable of attacking targets concealed by terrain. Therefore, the Army's stated requirement for a non-line-of-sight forward area air defense capability will not be met.

Schedule

DOD's decision not to fund the NLOS missile's procurement will result in the termination of the program at the end of initial operational test and evaluation in December 1993. Table II.1 compares the missile's schedules from February 1988 through February 1990.

Table II.1: NLOS Missile Program Schedules

Event	Feb. 1988	Dec. 1989	Feb. 1990
Full-scale development decision	June 1988	Aug. 1988	Aug. 1988
Complete initial operational evaluation	Mar. 1989	Sept. 1989	Sept. 1989
Initial production decision	Jan. 1991	July 1991	[a]
Initial production contract award	Jan. 1991	July 1991	[a]
First unit equipped	Feb. 1992	Aug. 1993	[a]
Complete initial operational testing and evaluation	July 1992	Dec. 1993	Dec. 1993
Full-scale production decision	Sept. 1992	Jan. 1994	[a]
Full-scale production contract award	Jan. 1993	Mar. 1994	[a]
Initial operational capability	[b]	[b]	[a]

[a]These events have been deleted from the schedule due to DOD's decision not to fund the missile's procurement.

[b]This information is classified.

Between February 1988 and December 1989, the program experienced delays due to DOD and congressional budget reductions and technical problems. As a result, the schedules for first unit equipped, completion of initial operational test and evaluation, and the full-rate production decision and contract award dates slipped over 14 months.

DOD eliminated all procurement funds for the NLOS missile in its fiscal year 1991 budget request. Therefore, planned procurement decisions and related tests have been deleted from the schedule. Unless DOD decides to provide funding for the missile's procurement, current plans provide for the termination of the program after initial operational test and evaluation are completed in December 1993, and the technology will be "shelved" for future use.

Performance

Numerous tests of the prototype NLOS missile have been completed since 1988. According to Army operational testing officials, the tests have been successful in demonstrating the feasibility of attacking enemy helicopters hidden from view by the terrain. However, full-scale development NLOS missiles, which include infrared and television seekers and a more powerful propulsion system, are not scheduled to be tested until fiscal year 1991.

The NLOS missile acquisition strategy included early operational testing of a prototype missile and a technical risk reduction program. The program office devised a test schedule to include initial operational evaluation and extended user employment tests. The initial operational evaluation tests have been completed, but as of February 1990, the extended user employment tests were still being conducted.

The initial operational evaluation tests were conducted from November 1988 to September 1989. The tests included (1) captive flight tests to demonstrate that soldiers could detect and identify rotary wing and armor targets, (2) a force development test and experiments to investigate tactics, training, and crew performance, and (3) actual missile firings to demonstrate capability against helicopters and armored vehicles. Although the Army considers the tests successful, it had not finalized its evaluation reports on the results of the missile firing and the extended user employment tests as of February 1990.

During the missile firing tests, 5 of the 10 missiles fired hit their intended target. Initial results from the extended user employment test showed that 3 of the 6 missiles fired hit the targets. However, according to the Army's Operational Test and Evaluation Agency, the test revealed a serious navigation problem with the missile caused by software problems. Nevertheless, according to an Army official, a solution to this problem has been recently identified and successfully demonstrated in the extended user employment testing phase. The NLOS system engineer stated that Boeing is also addressing the problem as a part of the full-scale development.

The Army initiated a risk reduction program in 1988 to reduce technical risks in some NLOS missile components and serve as a backup development effort. Technical components considered high risk were the infrared seeker, a variable speed motor, and midcourse navigation. The technical risk reduction program is scheduled to end on September 30, 1990, and Boeing will be responsible for eliminating additional risks. According to Boeing's November 1989 cost performance report, technical risks could affect the schedule for completing full-scale development.

Cost

NLOS missile system cost estimates remained relatively stable until the DOD's recent decision not to fund production. From December 1988 to December 1989, research and development cost estimates increased by about $74 million (in escalated dollars) due to changes in testing plans and resulting delays in the testing schedule. Between December 1989 and February 1990, the research and development cost estimate changed because a new inflation factor was used and certain tests were eliminated. Table II.2 shows the changes in the cost estimates from December 1988 to February 1990.

Table II.2: NLOS Missile Cost Estimates

Escalated dollars in millions

Funding category	Dec. 1988	Dec. 1989	Feb. 1990
Research and development	$555.9	$629.7	$630.8
Procurement	2364.5	2334.1	0.0
Total	**$2920.4**	**$2963.8**	**$630.8**

Recent GAO Report

DOD Acquisition Programs: Status of Selected Systems (GAO/NSIAD-88-160, June 30, 1988).

Light Helicopter

The Light Helicopter (LH) program is intended to provide the Army with a new generation of lightweight helicopters to perform attack and scout missions. Demonstration and validation of the LH concept began in November 1988 and is scheduled to end in September 1990. At that time, the contractor teams will submit their final aircraft designs and full-scale development proposals to the Army, who will evaluate the proposals and select a single contractor team for full-scale development. The full-scale development decision is scheduled for January 1991. The Army estimates that research, development, and procurement costs for 2,102 LHs—6 development prototypes and 2,096 production aircraft—will cost $45.7 billion in escalated dollars.

The LH is expected to provide increased target acquisition, night vision sensor, and other capabilities over the helicopters it will replace: the OH-6, OH-58 and AH-1S. However, the Army has not yet determined that the LH is the best and most economical way to perform its attack and scout missions in the future; a Cost and Operational Effectiveness Analysis will be finalized before the upcoming full-scale development decision.

The successful development and application of advanced technologies will be required to meet the LH's survivability, weight, and multiple mission requirements. These technologies include sophisticated target acquisition and night vision sensors, a composite (nonmetal) airframe, and very high speed integrated circuitry. Integration of the mission equipment and sensor package and software are considered to contain the highest degree of risk, according to a program official. These technologies will be further developed in demonstration and validation but will not be demonstrated in prototype flight testing until full-scale development.

The Army plans to control cost growth by securing production and operating and support cost commitments from each contractor team during the full-scale development source selection. For example, system hardware must be designed to a specific cost, and any changes in specifications must be evaluated in terms of the impact on life cycle cost. In addition, if projected procurement funds do not become available, the estimated production rate of 216 aircraft per year may have to be reduced, which would increase LH unit costs. A program office official said that the $7.5 million (fiscal year 1988 dollars) average unit flyaway cost[4] goal is achievable because contractors can reduce or tradeoff system capabilities to meet this goal.

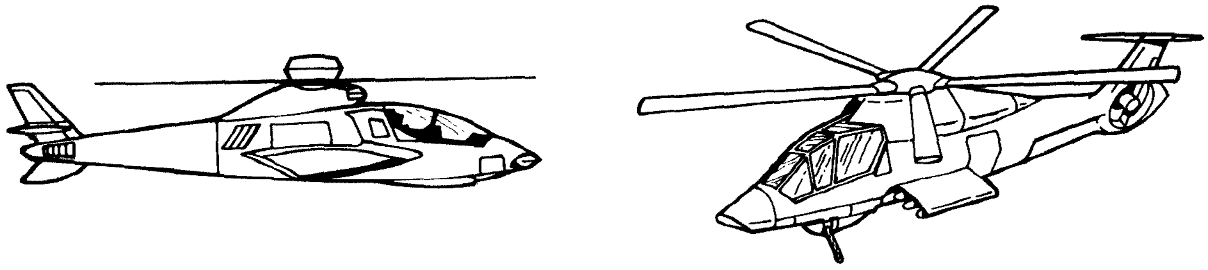
Background

The LH is intended to perform multiple missions into the 1990s and beyond, including light attack and armed reconnaissance roles. In the light attack role, the LH will be equipped with Hellfire antitank missiles and engage enemy armored units in maneuvers against ground forces. In the armed reconnaissance role, the LH will fly over enemy territory and report back to ground commanders on enemy positions. The Army also intends to use the LH to conduct air-to-air combat missions against enemy helicopters and long-range attack missions into enemy territory.

In November 1988 the Army awarded cost-plus-fixed-fee contracts to two contractor teams for competitive demonstration and validation of the LH airframe design and avionics. Boeing Helicopters and Sikorsky Aircraft Division of United Technologies Corporation comprise one team, and McDonnell Douglas Helicopter Company and Bell Helicopter Textron comprise the other. The 23-month demonstration and validation contract period is scheduled to end in September 1990. The full-scale development contract award is scheduled for January 1991. Figure II.2 shows the two contractor teams' proposed LH designs.

[4]Flyaway cost includes all recurring and nonrecurring production costs that are incurred in the manufacture of a usable end item. It includes mission equipment (basic structure, propulsion, electronics), project management, systems engineering, system test, and the allowances for engineering changes and warranties. Research and development costs, training equipment, support equipment, initial spares, technical data, and publications or contractor services are not included.

Figure II.2: Proposed LH Designs



Bell/McDonnell Douglas

Boeing/Sikorsky

The Army awarded a firm-fixed-price contract in October 1988 for development of the LH's T800 engine to the Light Helicopter Turbine Engine Company, a company formed by Garrett Engine Division of the Allied Signal Corporation and the Allison Gas Turbine Division of General Motors. Full-scale development of the engine is scheduled for completion in April 1991.

Requirements

The Army's objectives for developing the LH are to replace the current light fleet of AH-1, OH-6, and OH-58 A/C helicopters with fewer LHs and to provide a multiple mission helicopter capable of meeting future threats.

Requirements for a new observation/light attack helicopter are defined in a draft Required Operational Capabilities document. According to a program official, however, even though the LH has been established to meet these projected needs, full validation is pending the completion of the LH Cost and Operational Effectiveness Analysis. The analysis will assess how mixes of other aircraft will perform in various scenarios. Other helicopter systems, such as the Army Helicopter Improvement Program and improved Apache are still being considered. An interim report on the analysis will be completed in April 1990, and the final report will be completed in October or November 1990, before the full-scale development decision scheduled for January 1991.

The Army was forced to change its original single-seat design to a two-seat design because the LH's mission requirements were too demanding. As a result, the projected weight and cost of the LH has increased. In addition, when DOD determined in 1988 that the program was not affordable, the Army reduced some of its functional requirements to lower aircraft cost and weight. In the demonstration and validation phase, scheduled for completion in September 1990, contractor teams have been proposing tradeoffs to reduce weight and cost. According to LH program officials, both contractor teams have indicated that the 7,500-pound weight goal will be achieved by the end of the demonstration and validation phase.

Schedule

Although the LH's schedule changed many times in previous years, it has remained relatively stable since the June 1988 decision to begin the demonstration and validation phase. The only significant schedule delay occurred in March 1989, when the demonstration and validation contract was definitized at a 23-month performance period, instead of the originally planned 18-month period. This change resulted from an imbalance between the funds available and work required during the first year of the demonstration and validation contract. As a result, the contractor source selection evaluation process was shortened by 4 months. The LH's current schedule is shown in table II.3.

Table II.3: LH Program Schedule as of December 1989

Event	Date
Complete demonstration and validation contracts	Sept. 1990
Full-scale development decision	Jan. 1991
First flight of full-scale development aircraft	Aug. 1993
Low-rate initial production decision	Nov. 1994
Complete full-scale development	Sept. 1996
Complete initial operational test and evaluation	Sept. 1996
Full-rate production decision	Nov. 1996
Initial operational capability	Dec. 1996

Program officials characterized LH's schedule as low risk. However, when the program was restructured in 1988, the Army compressed the schedule and deleted the test and evaluation of competitive prototype aircraft from the demonstration and validation phase. As a result, competition between the two contractor teams consists of paper studies, mock-up designs, wind tunnel tests, surrogate flight tests, and field tests of the target acquisition systems. By not building competitive prototypes, decisionmakers may not have critical information that would have been provided during the early fabrication and testing processes. Technical performance demonstration will be reduced, and the Army will have to use cost estimates instead of actual costs for a longer period of time. Thus, the Army will have to select a contractor and decide whether to move to full-scale development with less information than was originally planned.

In addition, the low-rate initial production decision is scheduled for November 1994, almost 2 years before full-scale development is completed in September 1996. Thus, important information from the latter part of the full-scale development phase, such as results of prototype operational testing, will not be available until after low-rate initial production has begun. Program officials believe this concurrency is manageable and can benefit the program by providing the impetus to complete full-scale development by a specific date and to preclude a break between the end of full-scale development and the beginning of production. Program officials emphasized that only 12 of 2,096 aircraft will be procured before the end of full-scale development.

Moreover, achieving the schedule will depend on successfully developing and integrating the LHs advanced technologies while controlling aircraft cost and weight. Nevertheless, program officials believe that the schedule is achievable through the full-scale development phase and that adequate information will be available when decisions need to be made.

Performance

Even though some requirements have been reduced to control weight and cost, the LH is still expected to be a sophisticated aircraft. The development of the LH's avionics and mission equipment/sensors, which are similar to those to be developed for the Air Force's Advanced Tactical Fighter, involve considerable technical risks. Mission equipment consisting of sensors and avionics remains the most critical program element. High-speed, high-capacity integrated circuits for processing threat, flight, and other critical data and advanced threat sensors are examples of the LH's required technological advancements and applications. In addition, the LH will utilize advanced technologies in developing an all-composite (nonmetal) airframe to reduce weight.

The integration of various technologies also poses risks. The Army has been involved in a risk reduction program on the LH for several years and the contractor teams are conducting additional efforts during the demonstration and validation phase to reduce cost and technical risks. However, even though preliminary mission equipment testing will occur during the demonstration and validation phase, a fully integrated system will not be tested until full-scale development.

The LH program also faces the challenge of keeping aircraft weight down while meeting performance requirements. Enhanced maneuverability and agility as well as reduced procurement and operation and support costs are some of the expected benefits from reduced aircraft weight. The LH's empty weight goal remains at 7,500 pounds, although in 1987 the estimates exceeded the goal by as much as 2,300 pounds. The increased weight can be attributed to attempts to achieve performance requirements. An Army official said that the contractors are required to achieve the 7,500-pound requirement with delivery of the first aircraft from the second production lot. In addition, the 5- to 10-percent weight growth that has historically occurred during aircraft development is not considered a significant problem, according to an LH program official. However, future weight growth—totaling several hundred pounds—due to the anticipated addition of the Longbow millimeter wave radar is excluded from the weight requirement.

Cost

According to the Army's February 1990 estimate, the acquisition of 2,102 LHs will cost $45.7 billion[5] in escalated dollars: $4.0 billion for research and development and $41.7 billion for procurement. The total program cost estimate in constant fiscal year 1990 dollars is $31.2 billion. Program costs reached their highest point in November 1987, after which the Army initiated program reductions, including reducing the number of LHs by 2,199 and conducting design trade-offs, which nearly halved the total cost by June 1988. Since then, the total projected cost has remained relatively stable. Table II.4 shows these changes.

Table II.4: LH Cost Estimates

Fiscal year 1990 dollars in millions

Category	Feb. 1987	Nov. 1987	June 1988	Mar. 1989	Feb. 1990
Research and development	$4,354	$5,311	$3,590	$3,649	$3,644
Procurement	47,163	55,814	28,588	28,494	27,550
Total	**$51,517**	**$61,125**	**$32,178**	**$32,143**	**$31,194**
Quantity	4,509	4,301	2,102	2,102	2,102
Unit cost	$11.4	$14.2	$15.3	$15.3	$14.8

[5]Approximately $3 billion for the Longbow millimeter wave radar program has been included in this estimate.

The cost increases leading up to the November 1987 peak were a result of the demanding mission requirements established by the Army. During 1988 the Army and DOD attempted to control costs by (1) eliminating competitive prototypes from the demonstration and validation phase, (2) lowering production quantities from 4,301 to 2,096 by deleting a proposed utility version of the LH, and (3) establishing strict aircraft cost and weight goals, including the $7.5 million unit flyaway cost goal. These changes and the resulting cost reductions are reflected in the June 1988 estimate.

Costs decreased further for the March 1989 estimate as a result of (1) lower mission equipment weight related to decreased capabilities, (2) other cost reductions, which are estimated as a percent of total costs, and (3) reduced engine production cost estimates agreed to by the engine manufacturer. The February 1990 estimate showed that the costs have been reduced again by almost $1 billion. Program officials attribute this decrease to the continuing requirement tradeoffs and reductions to meet the cost and weight goals.

Despite the significant LH program reductions undertaken by DOD and the relative stability of the cost estimates since June 1988, program uncertainties remain, which may lead to increased costs. The Office of the Secretary of Defense's Cost Analysis Improvement Group reported in May 1988 that difficulties in systems integration, potential software development problems, weight growth, and avionics uncertainties are likely to increase the LH's costs. Program officials agree that the cost of avionics, software, and integration are areas in which costs are uncertain. However, the officials believe the risk reduction efforts, including the current demonstration and validation phase, have been adequate to identify the areas of uncertainty and validate the Army's estimates. Program officials believe the $7.5 million (fiscal year 1988 dollars) unit flyaway cost goal is achievable because both contractor teams have the flexibility to reduce or tradeoff system capabilities to meet the goal. For example, the triple redundant navigation system and some ballistic protection have been eliminated to reduce cost.

Program officials also said that the reliability of cost estimates for LH is improving because some estimates are being derived from engineering information rather than modeling or parametric data, which was done previously. The program office is currently revising the baseline cost estimate to prepare for the full-scale development decision.

Schedule delays could also increase costs. For example, if either DOD or the Congress determine that it is not possible to fund the procurement of 216 LHs per year, as the Army is planning, schedule delays will occur. A reduction of the annual production rate would increase total program costs if the total procurement quantity remains at 2,096.

According to program officials, the LH was the primary research and development program in the Army. Nevertheless, the program remains a target for future funding cuts due to the affordability issue raised by DOD and the large investment required. Funding is considered adequate to carry out LH research and development under the revised acquisition strategy. The fiscal year 1991 budget request for continued research and development is $465.1 million. However, even with no cost growth, officials concede that currently projected annual procurement funding levels are inadequate for the planned production rate. In addition, future funding reductions are possible as a result of possible overall defense budget reductions.

Recent GAO Reports

Defense Acquisition Programs: Status of Selected Systems (GAO/NSIAD-90-30, Dec. 14, 1989).

Light Helicopter Program: Risks Facing the Program Raise Doubts About the Army's Acquisition Strategy (GAO/NSIAD-89-27, Dec. 23, 1988).

Navy Program

MK-50 Torpedo

The MK-50 is an advanced lightweight torpedo intended to counter Soviet submarine threats. It will be launched from ships and aircraft and will provide the Navy's fleet with enhanced performance and lethality over the MK-46 torpedo, which has been in the Navy's inventory since 1961. According to the Navy, the MK-46 torpedo needs to be replaced due to improvements in Soviet submarine capabilities. No North Atlantic Treaty Organization countries are developing alternatives to meet this requirement.

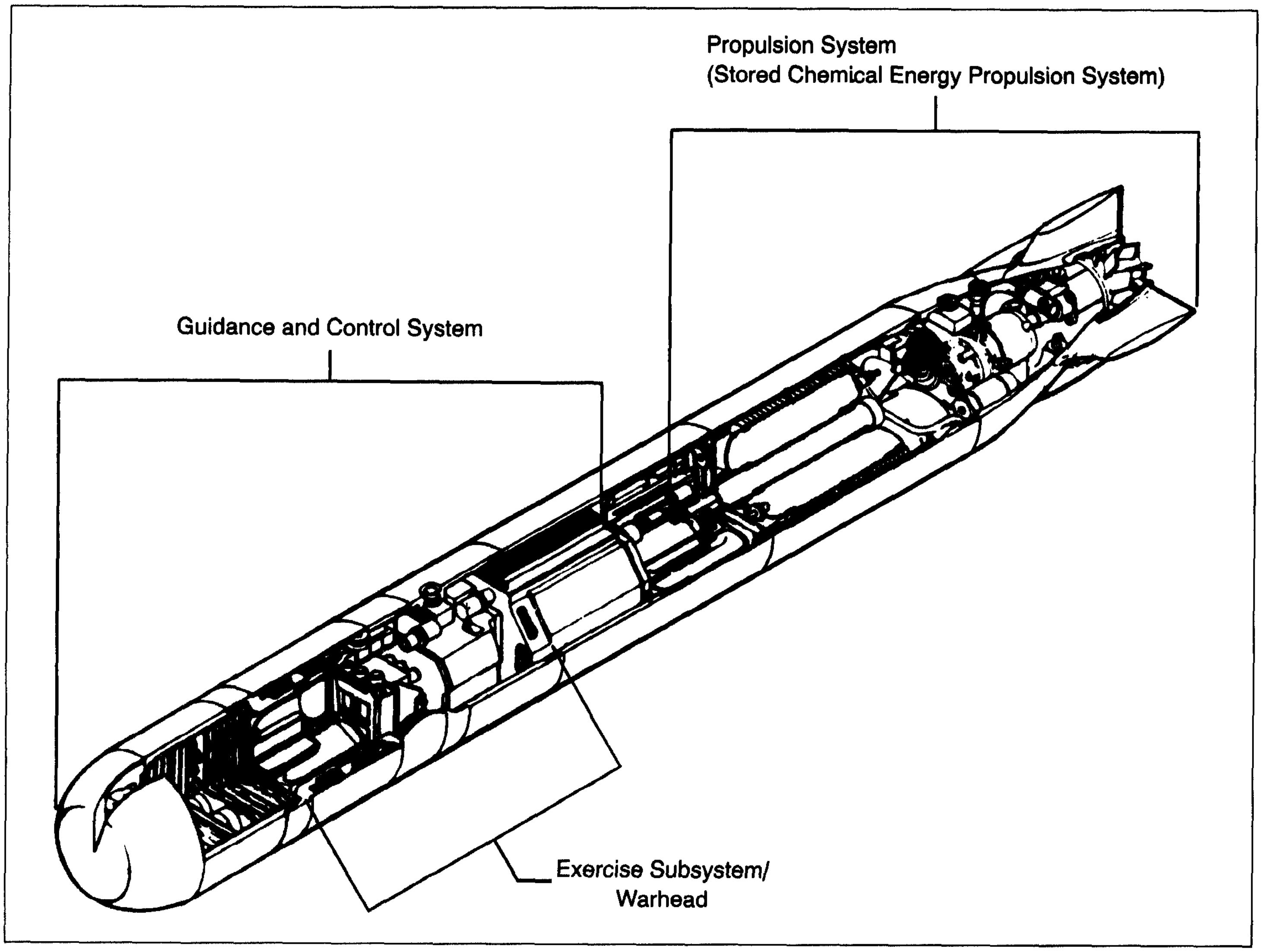
The MK-50 program is close to the end of its full-scale development phase and has been in limited production since March 1989. As of December 31, 1989, the MK-50's total development, procurement, and military construction cost was estimated to be almost $7.3 billion (escalated dollars).

After an initial operational test and evaluation period identified performance problems, the Navy restructured the MK-50 full-scale development program in 1987 and revised its cost, schedule, and performance estimates. According to program officials, the development of the MK-50 is currently proceeding well, and only minor changes are anticipated. The Navy completed initial operational test and evaluation in November 1988. The Navy awarded limited-rate production contracts to Honeywell, Incorporated, in October 1988 and to Westinghouse Corporation in December 1988. Initial torpedo deliveries are expected in the summer of 1990. The Navy plans to decide whether to enter full-rate production in April 1991.

Background

The MK-50 system consists of a torpedo and automatic test equipment. Figure III.1 shows the torpedo and its major subsystems.

Figure III.1: MK-50 Torpedo



The MK-50 torpedo includes a command and control system for guidance and speed control, a stored chemical energy propulsion system for power (electrical and thrust), a sonar for target search and acquisition, and either a warhead or an exercise section for testing. The exercise section includes recording instrumentation and a buoyancy system to facilitate recovery after in-water exercises. The torpedo also includes air-launch accessories, such as a parachute.

The MK-50 is designed to be launched from ships and fixed- and rotary-wing antisubmarine warfare aircraft. The MK-50 is a fire-and-forget weapon; that is, once launched, it independently searches, locates and attacks its target.

The MK-50's concept development began in 1975. DOD approved advanced development of the torpedo in 1979, full-scale development in 1984, and limited production in March 1989. The MK-50 full-scale development contract with Honeywell is a cost-plus-incentive-fee contract with a fixed ceiling price and is structured to reduce cost risk to the government. Full-rate production will be competitive, using a leader-follower acquisition strategy with Westinghouse Corporation as the follower.

Requirements

Improvements in Soviet submarine design and performance (speed, hull strength, maneuverability, depth, smaller acoustic target size, and lower radiated noise) and in countermeasure capability necessitate an advanced antisubmarine warfare torpedo. According to the Navy, the MK-50 is the only conventional air- and surface-launched antisubmarine warfare weapon capable of countering the newer Soviet submarines. DOD anticipates that the MK-50 will meet or surpass North Atlantic Treaty Organization requirements for a lightweight torpedo for the 1990 and beyond time frame.

In April 1974 the Navy established an operational requirement for an advanced lightweight acoustic homing torpedo capable of defeating the post-1985 Soviet submarine threat. In 1984 DOD revalidated the MK-50 requirement when it authorized full-scale development. The Defense Intelligence Agency validated the August 1987 System Threat Assessment Report on Antisubmarine Warfare Weapons Systems, which included an assessment of the MK-50, for use in threat analysis supporting Defense Acquisition Board milestone decisions.

Schedule

The Navy originally planned to complete operational test and evaluation in July 1988. However, in 1987 the schedule was extended, and a new target date for completing operational test and evaluation was set for July 1990. In addition, the target date for ending full-scale development and beginning full-rate production was set for January 1991. The Navy cited initial test failures, hardware and software development problems, contractor management problems, and funding reductions as causes for the schedule slippage. Since the program was restructured, the target date for completion of operational testing and full-scale development has again slipped and been reset for December 1990. The Navy deputy project manager said that congressional budget reductions have caused the full-rate production decision to be delayed until April 1991. Table III.1 shows the changes in the MK-50's schedule since late 1985.

Table III.1: MK-50 Program Schedules

Event	Dec. 1985	Dec. 1987	Dec. 1989
Demonstration and validation decision	July 1979	July 1979	July 1979
Full-scale development decision	Jan. 1984	Jan. 1984	Jan. 1984
Critical design review	June 1986	May 1988	May 1988
Complete initial operational test and evaluation	Sept. 1986	Sept. 1988	Nov. 1988
Initial production decision	Dec. 1986	Feb. 1989	Mar. 1989
Complete operational evaluation	July 1988	July 1990	Dec. 1990
Full-rate production decision	Oct. 1988	Jan. 1991	Apr. 1991

The MK-50 deputy program manager assessed the restructured program's schedule risk as low. According to the MK-50 acquisition plan, cost-sharing provisions of the renegotiated contract provide an incentive for Honeywell to meet the current schedule. The deputy program manager said that only minor development tests remain. According to program officials, the major factor that could further delay completion of operational testing is the availability of Navy ships for testing.

According to Navy officials, the restructured program, unlike earlier program schedules, has low to moderate risk. They stated that moderate concurrency between full-scale development and initial production exists primarily to achieve the earliest possible fleet deliveries. However, only 4 months has been allotted between the end of operational testing and evaluation and the start of full-rate production to solve unexpected problems without extending the schedule.

According to the Navy, the acquisition strategy controls the risks of concurrency through selected management reviews and decision points before both initial and full-rate production begin. The strategy includes a critical in-design review, the use of prototype torpedoes and fleet test equipment in development, and an operational evaluation conducted against operational submarines and in realistic scenarios. The program office informed us that all necessary changes to the torpedo design identified during the full-scale development phase will also be implemented into the production units. If production units have already been delivered, then a retrofit will be ordered. The program office also stated that all test torpedoes are representative of production units.

Performance

The program office currently estimates that the MK-50 torpedo will achieve all technical and operational performance characteristic thresholds. The torpedo warhead, propulsion system, and tactical logic are considered significant technical advances. For example, the torpedo employs a unique advanced stored chemical energy propulsion system with an extremely high-energy density. A pump jet propulsor drives the torpedo through the water. This design enables the torpedo to achieve high speeds regardless of depth, is quieter than an open-cycle engine, and produces little wake. Technical risk is considered low because most critical technical challenges have been proven on advanced development and prototype torpedoes.

The first successful in-water test of a full-scale development prototype torpedo occurred on July 30, 1986. The Navy originally attempted a concurrent development and initial operational test phase beginning in October 1986. However, in April 1987 the initial operational test phase was suspended because the MK-50 was decertified by Navy's program office. Development tests continued, and on August 29, 1988, initial operational testing resumed and continued through November 1988. The Navy's Operational Test and Evaluation Force concluded in December 1988 that the MK-50 torpedo was potentially operationally effective and suitable. These findings supported the Navy's initial production decision (milestone IIIA) in March 1989.

Between July 1986 and March 1990, 262 in-water full-scale development tests were made. The Navy plans to commence operational test and evaluation in mid-1990; the results will be used to support the anticipated full-rate production decision scheduled for April 1991.

Cost

Table III.2 shows the MK-50's cost growth over the past 2 years.

Table III.2: MK-50 Cost Estimates

Escalated dollars in millions

Funding category	Dec. 1987	Dec. 1989
Development	$1,432.1	$1,472.3
Procurement	5,202.1	5,783.0
Military construction	12.3	35.9
Total	**$6,646.5**	**$7,291.2**

The development cost increase resulted from Honeywell's revised estimated target price of $698 million, which was about $50 million more than the 1987 target price. The revised ceiling price is now $730 million. The development cost increase was caused primarily by problems with building the MK-50 automated testing equipment, late hardware deliveries, and in finalizing technical issues. The procurement cost increase was caused by schedule slippages in the early portion of the procurement program, resulting in increased quantities to be procured in the later years of the program, at escalated prices. The military construction cost increase was largely due to the addition of an intermediate maintenance activity for the MK-50 at Charleston, South Carolina.

Recent GAO Reports

DOD Acquisition Programs: Status of Selected Systems (GAO/NSIAD-88-160, June 30, 1988).

Observations on the Advanced Lightweight Torpedo MK-50 Program (GAO/NSIAD-84-28, Aug. 30, 1984).

Air Force Programs

Sensor Fuzed Weapon

The Sensor Fuzed Weapon (SFW) is a cluster-type weapon designed to provide a multiple kill per aircraft pass capability and operate in the day or night and in all weather conditions. The Air Force is developing the SFW to attack enemy armored vehicle formations.

The SFW program has experienced significant technical problems since full-scale development began in late 1985, including numerous test failures, which resulted in schedule slippages and cost increases. Consequently, the program was restructured in 1986 and in 1989. The latest restructuring caused costs to increase over $600 million—about one-half of which was due to the use of higher inflation indexes—and major milestones to slip by 16 to 18 months. The Air Force estimated that as of February 1990 the cost to procure 19,958 SFWs will be about $3.7 billion in escalated dollars. A decision on low-rate initial production is anticipated in September 1991.

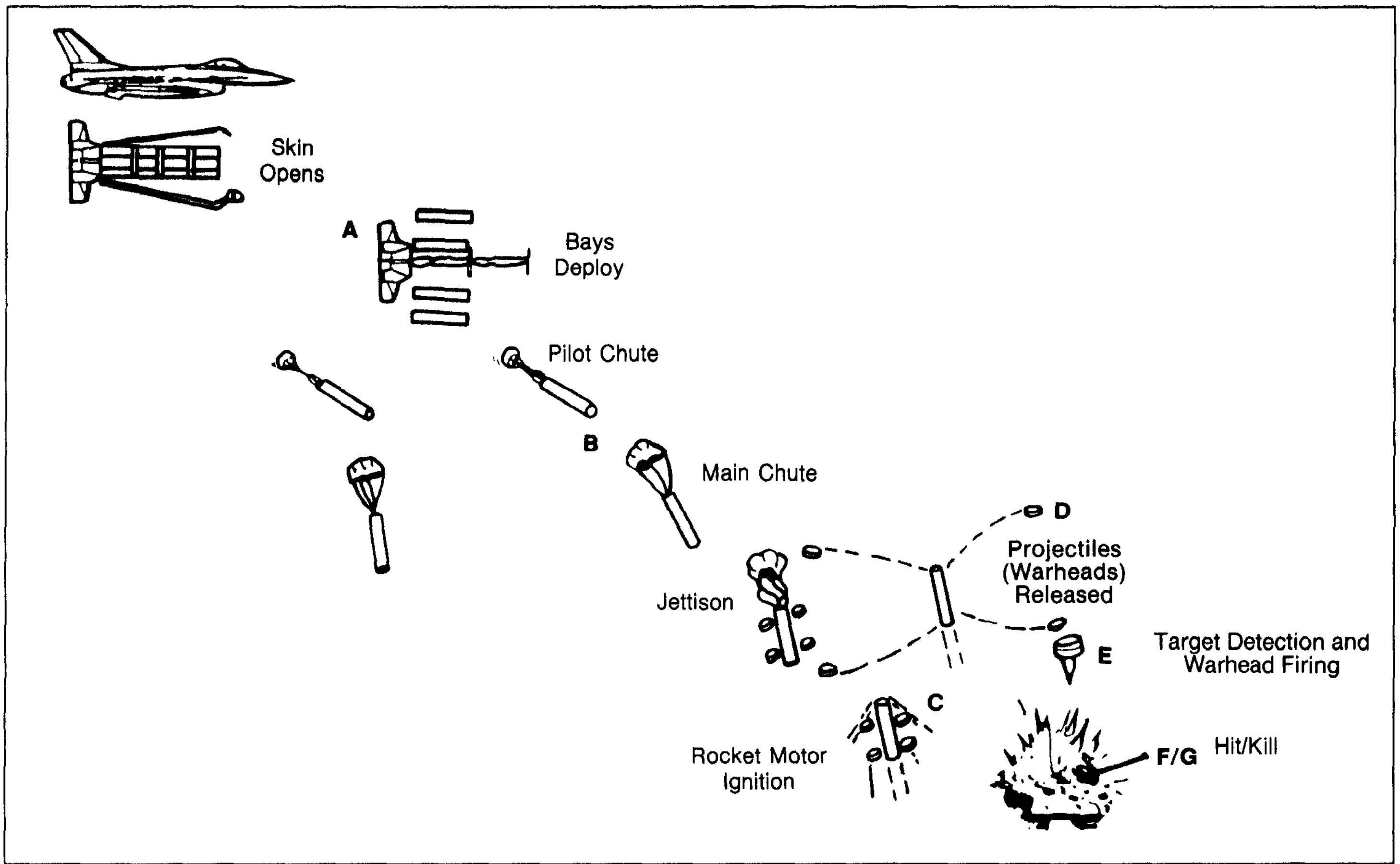
Because the program was recently restructured, it is too early to assess whether schedule milestones will be met. Test hardware deliveries were somewhat behind schedule, and several tests had been delayed for short periods. However, SFW development testing is expected to continue until December 1990, and operational testing is scheduled to start in July 1990 and end in October 1991. Although there are no indications at this time that the SFW will not meet its established performance requirements, the Air Force cannot be certain that it will meet its requirements until more testing is performed.

Background

The SFW will consist of a tactical munitions dispenser containing 10 submunitions. Each submunition contains four individual projectiles, or warheads.

The delivery aircraft will launch the dispenser once it reaches the target area. At a preset time or altitude, the dispenser will release the submunitions. Parachutes will deploy from the submunitions to stabilize their descent. At a predetermined distance from the ground, a rocket motor fires to elevate and spin the submunition to dispense the projectiles. An infrared sensor in each of the projectiles scans the target area, and once the sensor detects the heat of a vehicle, the projectile will fire an armor-piercing penetrator into the target. Figure IV.1 illustrates the SFW and its operational sequence.

Figure IV.1: SFW Deployment Events



The SFW can be launched from several aircraft, including the F-15E, F-16, A-10, F-111, and several allied nations' aircraft. It will not replace any existing weapon system.

Requirements

The Air Force established a requirement for a wide-area anti-armor weapon in the late 1970s. A 1978 Air Force General Operational Requirement document and a 1979 Air Force Mission Element Need Statement established requirements for the SFW.

In May 1987 the Air Force Center for Studies and Analyses prepared an analysis to determine whether the SFW is a cost-effective weapon for attacking second-echelon, enemy armored formations. The analysis compared the SFW with the Maverick missile, Combined Effects Munition, and 30-millimeter gun and concluded that the SFW would be considerably more effective against enemy armor formations.

In May 1989 the Air Force approved a System Operational Requirements document for the SFW. The document amplified and refined the basic requirements documents and explained how the proposed system will be operated.

Schedule

In November 1985 the Air Force awarded a fixed-price incentive fee contract for SFW full-scale development to Textron Defense Systems. Because of cost and schedule problems, the Air Force restructured the SFW program in June 1986 and established a program cost and schedule baseline. Between June 1986 and April 1989, schedule slippages and test failures forced the Air Force to temporarily suspend contractor testing and to begin a restructuring of the program a second time.

In March 1989 the Air Force convened a group of government and industrial leaders in infrared technology to assess the SFW's design. The group concluded that the design was sound.

In April 1989 the Air Force contracting officer notified Textron that development performance was not satisfactory and that the Air Force would consider terminating the contract for default if the situation were not remedied within 60 days. Among other things, the contracting officer's letter cited consistent test failures and consistently underachieved schedules as reasons for the Air Force's concerns. Textron's initial response was rejected by the Air Force because it did not provide a comprehensive plan of actions, initiatives, and commitments needed to put the program back on track. Textron revised its plan of action to address the problems and, on June 19, 1989, the Air Force accepted Textron's plan.

The restructured SFW program included additional testing to define performance margins better and a multistage improvement program to address future changes in the threat. In addition, the testing, production start, and second source qualification schedules were changed to reflect more realistic program goals. For example, the program manager decided it was inappropriate to accept proposals for the second source qualification contract until after the September 1991 low-rate initial production (milestone IIIA) decision. Therefore, the second source qualification contract will not be awarded until February 1992, or 2 months after the expected award of the initial production contract.

The program manager stated that most operational testing will be completed before the low-rate initial production decision in September 1991. He also stated that the tests added to the restructured program will be completed before the initial production decision.

The restructured program was approved by the Air Force in November 1989 and approved by the Under Secretary of Defense for Acquisition in April 1990. Table IV.1 compares the June 1986 schedule to the February 1990 restructured schedule.

Table IV.1: SFW Program Schedules

Event	June 1986 schedule	Feb. 1990 schedule	Delay (months)
Full-scale development contract award	Nov. 1985	Nov. 1985	0
Critical design review	July 1987	Aug. 1989	25
Start government development tests	Mar. 1988	Dec. 1988	9
Initial production decision	Nov. 1988	Sept. 1991	34
Production contract award	Dec. 1988	Dec. 1991	36
First delivery to inventory	July 1990	Dec. 1993	41

The restructuring resulted in slipping the dates for testing and qualification of a second source for the production program. Table IV.2 compares some events before and after the program restructured in 1989.

Table IV.2: SFW Program Schedule Changes Due to 1989 Restructuring

Event	Schedule before restructuring	Schedule after restructuring	Delay (months)
Complete Air Force development test and evaluation	Aug. 1989	Dec. 1990	16
Complete initial operational test and evaluation	Apr. 1990	Oct. 1991	18
Complete second source qualification	Oct. 1992	Mar. 1994	17

We reviewed the status of the program schedule after it was restructured and noted that one development test was delayed in December 1989 and two development tests were delayed in January 1990 because hardware was not available for testing. A test official from the SFW program stated, however, that he believes there is enough time to recover from these delays and the development test program can be back on schedule within 2 months.

As of February 1990, the SFW program manager's assessed the program's schedule as "yellow"[6] because funding constraints in the President's fiscal year 1991 budget will cause the initial operational capability date to slip 4 months. The slippage was incorporated in the baseline schedule approved by the Under Secretary of Defense for Acquisition in April 1990.

Performance

Since the program was restructured in 1989, much of the testing has been done in a somewhat controlled environment to determine whether problems revealed in earlier testing had been corrected. The SFW program manager believes that recent development testing has been successful and that solutions to earlier technical problems have been identified, fixed, and successfully retested. Nevertheless, sufficient testing has not yet been completed to demonstrate that the SFW will meet its established performance requirements. At this time, however, there are no indications that the SFW will not meet any of its performance parameters.

Subsystem tests conducted by Textron in 1988 and early 1989 revealed a number of technical problems. For example, multiple submunition drop tests conducted during 1988 showed that the detonation of one of the SFW projectiles or warheads could cause the premature detonation of nearby warheads, a phenomenon known as "sympathetic firing." Textron made design changes to correct the problem and successfully conducted additional tests using single warheads. However, a multiple submunition test in February 1989 showed that the problem was not resolved. The Air Force formed a team consisting of officials from both government and industry to conduct an independent technical review and determine the cause of the February 1989 test failure. The team concluded that the likely cause of the failure was that the projectiles' infrared sensors and the processor circuit were oversensitive. Textron changed the sensor's sensitivity, and a repeat test was successfully conducted in July 1989.

In addition, the first two development tests conducted by the Air Force were unsuccessful. These tests were intended to demonstrate proper separation of the tactical munitions dispenser from the aircraft and the release of inert submunitions from the dispenser. In two development

[6] A "yellow" rating means that significant potential exists for a program not meeting its performance parameters, cost thresholds, or schedule milestones.

tests conducted in July 1989, all 10 submunitions were successfully ejected and all parachutes deployed properly.

To reduce technical risk and validate potential solutions to identified problems, the program office added four series of tests. For example, instrumentation was added to SFW warheads so that more complete test data could be collected. In addition, a series of captive carry tests of the SFW sensor was added to collect more data on the sensor's reaction to countermeasures and various operational environments. The additional testing is to be completed in August 1990 and is expected to provide the confidence needed to proceed with the development test and evaluation effort and the initial operational test and evaluation.

Since testing was resumed in July 1989, 13 development tests have been conducted, all of which were considered successful. Some problems occurred in the testing, but according to the program manager, the tests have demonstrated that the problems that led to restructuring the program have been resolved.

The Air Force plans to complete development test and evaluation of the SFW in December 1990. Also, initial operational test and evaluation is not scheduled to start until July 1990. Until additional development and operational testing is performed, the Air Force cannot make an accurate assessment of whether the SFW will meet established performance requirements.

Cost

The SFW's estimated total acquisition cost increased by about $1.5 billion (escalated dollars) since the June 1986 baseline cost estimate, primarily due to an increase of 5,874 units to be procured, from 14,084 to 19,958. Between the February 1989 and February 1990 estimates, the program was restructured, and the estimated total acquisition cost increased by $668 million from about $3.2 billion to $3.9 billion. The increase was attributed to added research and development costs due to added testing, a delayed production start, delaying procurement of weapons to later in the production cycle, and higher inflation indexes. About one-half the increase or $333 million was attributed to the higher inflation indexes. Table IV.3 shows the changes in the cost estimate.

Table IV.3: SFW Cost Estimates

Escalated dollars in millions

Category	June 1986	Feb. 1989	Feb. 1990
Development	$128	$180	$201
Procurement	2,278	3,031	3,678
Total	**$2,406**	**$3,211**	**$3,879**
Quantity	14,084	19,900	19,958
Unit cost	$0.171	$0.161	$0.194

As of February 1990, the program manager's assessment of cost performance was "yellow" because the prime contractor had exceeded the ceiling price of the development contract. The President's fiscal year 1991 budget request does not include procurement funds for the SFW program in fiscal year 1991. The Air Force plans to make the low-rate initial production decision in September 1991 and award a production contract in December 1991 if fiscal year 1992 procurement funding is approved.

Recent GAO Reports

Defense Acquisition Programs: Status of Selected Systems (GAO/NSIAD-90-30, Dec. 14, 1989).

DOD Acquisition Programs: Status of Selected Systems (GAO/NSIAD-88-160, June 30, 1988).

Advanced Tactical Fighter

The Advanced Tactical Fighter (ATF) is being developed to meet the Air Force's air superiority requirements in the mid-1990s and beyond. The ATF program is in the demonstration and validation phase, and flight tests of two competing prototype aircraft are scheduled to begin in May and June 1990. One of the prototypes will be selected in April 1991, and a decision whether to begin full-scale development is scheduled for June 1991. Program acquisition costs for 750 aircraft are estimated by the Air Force at $79.4 billion in escalated dollars.

The ATF development plan incorporates technological advances in design, materials, propulsion, and electronics to provide an advanced aircraft system superior to any Soviet system currently projected. The Air Force has defined broad performance goals, a cost and weight goal, and a program schedule. During the demonstration and validation phase, the program manager intends to assess the likely benefits and costs of incorporating these new technologies and plans to make the necessary trade-offs to maintain the cost, weight, and performance goals of the program.

As of February 1990, about 70 percent of the demonstration and validation phase had been completed; some critical cost and performance trade-off decisions and system demonstrations still need to be completed. The ATF's design and system specifications are subject to change, and the Air Force will not assess the ATF's performance capabilities for full-scale development until the required cost and trade-off studies, engineering analyses, component tests, and prototype demonstrations have been completed. Nevertheless, the Air Force has been directed by the Defense Acquisition Board to submit the specific radar cross section, supersonic cruise, maneuver, mission radius, and integrated avionics capabilities to be achieved during full-scale development before the evaluations are completed.

Background

The ATF is being developed as a follow-on to the F-15 in the air superiority role. It is expected to have new and expanded capabilities, including the ability to cruise at supersonic speeds over long distances with greater maneuverability, longer range, lower detectability, and better reliability and maintainability than any existing fighter aircraft.

The ATF is to be a single-seat, twin-engine fighter armed with AIM-120A Advanced Medium Range Air-to-Air Missiles, AIM-9 Sidewinder missiles, and a 20-millimeter gun. It is expected to be able to fight in all types of weather, in the day or night, over land or sea, and at ranges greater than current fighter aircraft. The ATF design concept includes use of stealth technology, advanced materials, new engines capable of propelling the aircraft at supersonic speeds without afterburner, and an advanced, highly integrated avionics system capable of detecting, identifying, and engaging the enemy at ranges beyond the pilot's vision.

At the direction of the Congress, the Navy is evaluating the ATF as a possible replacement for the F-14 fighter aircraft. In June 1987 the Navy established a tentative operational requirement for a variant of the ATF that must have a stronger structure and excellent low-speed flying qualities compatible with Navy carrier operations. The Navy will participate in the Air Force's source selection decision for full-scale development by evaluating proposed designs of a Navy variant of the ATF to be submitted by both contractor teams participating in the program. The Navy estimated that acquiring a variant of the ATF could save

$9.9 billion—$4.9 billion in development costs and $5 billion in procurement costs—over a separate aircraft development and procurement program.

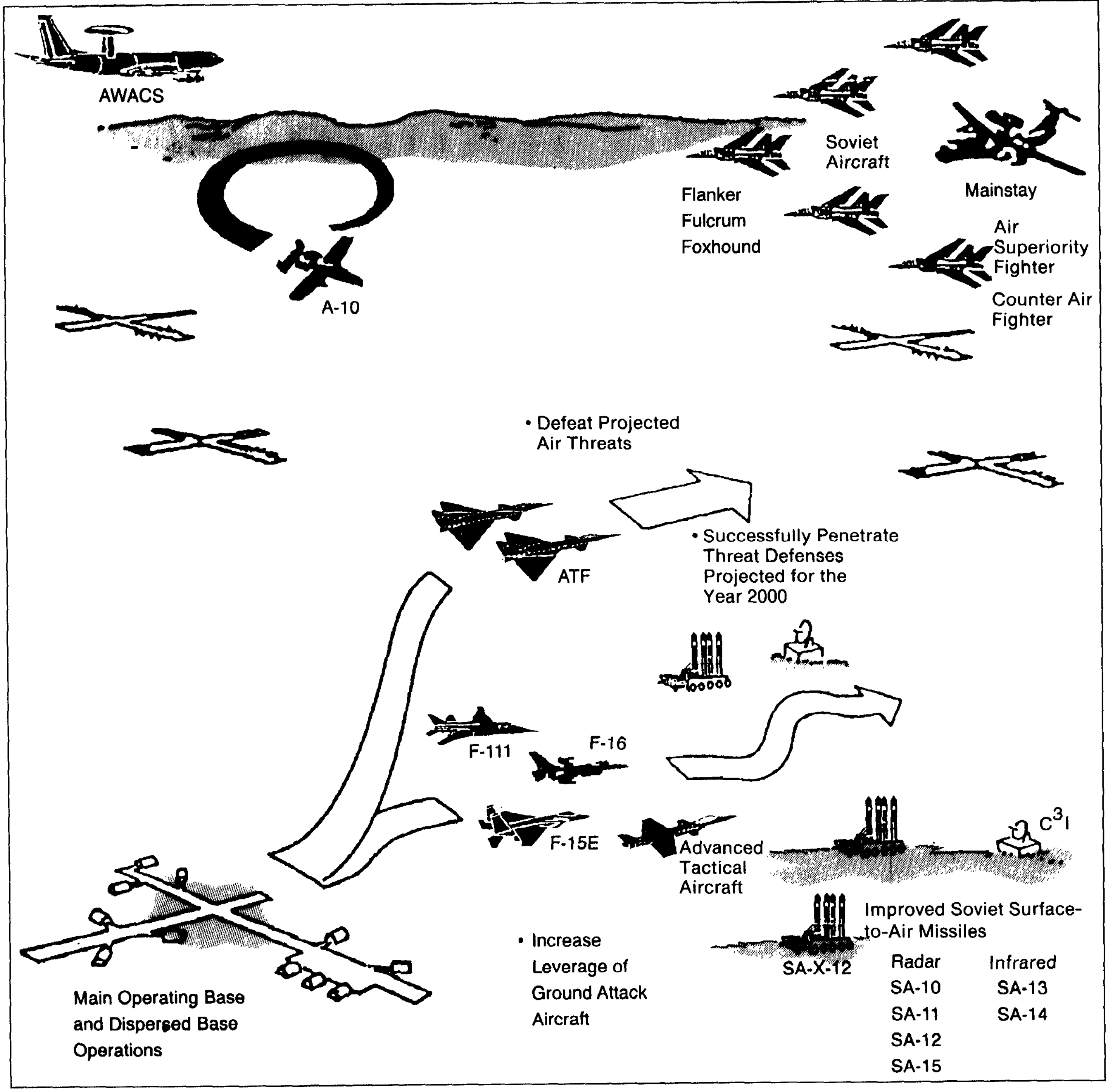
Requirements

The ATF program is the Air Force's highest priority tactical research and development program. The Air Force's Tactical Air Command, the primary user of the ATF, believes that the ATF is needed to replace the F-15, which will be near the end of its useful life by the year 2000. The F-15 is the only dedicated Air Force air superiority fighter, but more than half will be over 22 years old by the year 2000. In addition, some DOD officials believe that the ATF's promised technological capabilities are currently needed to counter the growing effectiveness of fighter and ground threat systems located in the Soviet Union and other Warsaw Pact countries and third world nations.

DOD initially recognized the need for an ATF in November 1981 and reaffirmed the need in an October 1986 milestone I decision, which authorized the program to begin the demonstration and validation phase. The next major DOD review of the program is the milestone II decision, which authorizes the start of full-scale development, scheduled for June 1991.

Before the recent changes in Eastern Europe, an Air Force analysis of the threat indicated a need for an air superiority fighter with advanced technologies and superior capabilities to counter the numerical advantage of Soviet and other Warsaw Pact forces and the emergence of Soviet aircraft with capabilities equivalent to current U.S. fighters. Figure IV.2 shows how the ATF is expected to be used in offensive counterair missions.

Figure IV.2: ATF's Projected Role in Offensive Counterair Missions



Air Force-sponsored analyses have also examined the need for air superiority and alternatives to achieve it, such as using ground-based air defense systems and/or upgrading existing fighter aircraft with many of the technologies planned for the ATF. The analyses not only affirmed the need for an advanced air superiority fighter but also concluded that both ground-based and airborne systems were essential and complementary in the air defense mission. The analyses showed that airborne fighters have greater mobility and flexibility to cover defensive gaps than other air defense systems and that they augment ground-based air defense forces such as the Patriot and Hawk missile systems. Unlike relatively fixed ground-based defenses, airborne fighters can be deployed over large distances in short periods of time. The analyses also indicated that fighters would destroy more enemy aircraft than ground-based air defense systems.

The Air Force also examined the effectiveness of modifying or enhancing versions of current fighter aircraft for airborne air defense as well as producing a lower cost variant of the ATF. Modifying current fighters would make them more effective, but the improvements would be marginal compared to the ATF's expected capabilities. Also, their survivability would be lower than the ATF's, thus requiring a greater number of modified fighters to ensure air superiority in the mid-1990s and beyond. Regarding a lower cost ATF variant, many of the current ATF's expected capabilities were retained while other key capabilities were degraded in an effort to contain cost.

According to Defense Intelligence Agency officials, recent intelligence assessments of the political changes occurring in the Warsaw Pact countries indicated that even though the number of Soviet forces are decreasing, the capabilities of the remaining Soviet forces will continue to be a formidable threat. New fighter aircraft continue to enter the inventory, and other military equipment continue to be modernized. In addition, the spread of high-technology weapons to many other countries presents a new and more sophisticated global threat to U.S. forces.

In December 1989 the Secretary of Defense initiated a review of the ATF and three other major aircraft programs to reexamine the need for these aircraft. This review included an assessment of (1) needed ATF capabilities that current aircraft do not provide, (2) the extent to which the ATF will provide the needed capabilities, and (3) ATF fiscal and acquisition strategy considerations, including cost, schedule, and performance.

On April 26, 1990, the Secretary announced that the review found that the ATF is the most effective aircraft for the air superiority mission. Therefore, the Secretary decided to maintain the ATF force level objective at 750 aircraft at least until another review of the total force structure is completed. However, the Secretary proposed delaying the initial procurement of ATF for 2 years to fiscal year 1996 and a lower peak annual production rate. The delay is expected to reduce the concurrency between development and production and facilitate orderly testing of the aircraft. However, the delay would also postpone the procurement of the Navy variant of the ATF by 2 years and reduce the number of aircraft from 618 to 546.

Schedule

The Air Force revised the ATF's acquisition program in 1986 in response to a recommendation by President Reagan's 1986 Blue Ribbon Commission on Defense Management that a high priority be placed on building and testing prototype systems to demonstrate that new technology can substantially improve military capability. The revised program added the demonstration of prototypes before the selection of the ATF's design for full-scale development.

The schedule for completing demonstration and validation and the beginning of full-scale development remained basically unchanged from 1986 until January 1990. However, in January 1990 the schedule was extended by 6 months to June 1991 to reduce the risks associated with entering full-scale development. In addition, the first flight of prototype aircraft slipped from October 1989 through March 1990 to May through June 1990. Table IV.4 compares the ATF's 1986 schedule with the January 1990 schedule.

Table IV.4: ATF Program Schedules

Event	1986 Schedule	1990 Schedule	Change (months)
First flight of prototypes	Between Oct. 1989 and Mar. 1990	Between May and June 1990	7
Full-scale development decision	Nov. 1990 (9 aircraft)	June 1991 (9 aircraft)	7
Start development test and evaluation with full-scale development aircraft	Nov. 1992	June 1994	19
First production lot contract award	Nov. 1992 (18 aircraft)	Jan. 1994[a] (4 aircraft)	14
Low-rate initial production decision	Nov. 1992	Dec. 1994	25
Second production lot contract award	Nov. 1993 (36 aircraft)	Jan. 1995 (8 aircraft)	14
First flight of full-scale development aircraft with full avionics	June 1994	Mid-1995	About 12
Third production lot contract award	Nov. 1994 (48 aircraft)	Jan. 1996 (16 aircraft)	14
Start initial operational test and evaluation	June 1995	After Jan. 1996	At least 7
Delivery of first production aircraft	Dec. 1994	Jan. 1996	13
High-rate production decision	Nov. 1995	Dec. 1997	25

[a]The aircraft will be used in initial operational test and evaluation.

Although the January 1990 schedule provides for some concurrent development and production, it reduces the risk associated with concurrency by committing only one lot of four aircraft to production before the first flight test of a full-scale development aircraft in June 1994. In contrast, the 1986 schedule committed 18 aircraft to production at the same time as the first full-scale development flight test. The four production aircraft are scheduled to be on contract 5 months before the first flight test. Further, even though they are funded with production funds, the aircraft will be used for initial operational test and evaluation and are not intended for the ATF operational inventory.

The January 1990 schedule also lowers the risk associated with concurrency by committing only 12 aircraft to production before the first flight test of a full-scale development aircraft with a complete avionics suite, whereas the 1986 schedule committed a total of 54 aircraft to production before that event.

Performance

As of March 1990, the approved baseline for the ATF contained only technical characteristic "goals" for the system. Specific characteristics and performance thresholds will not be established until the system specification for full-scale development is written at the end of the demonstration and validation phase. Only limited testing of the aircraft systems has been done to date, and initial operational test and evaluation of the ATF will not begin until full-scale development.

Two competing contractor teams are each fabricating two prototype aircraft, and two competing engine contractors are each fabricating and testing prototype engines. Both engines will be flight tested by each airframe contractor team.

As of February 1990, the aircraft contractor teams were approaching final assembly and completion of structural testing of their prototype aircraft. The flying prototypes will be the initial test resource for demonstrating the aerodynamic performance, flying and handling qualities, supersonic cruise speed, and engine compatibility with the airframe.

Through February 1990 the engine contractors have tested engine components and full-scale engines at sea level and simulated altitude conditions. They have accumulated a combined total of about 2,500 hours of ground testing to prepare for flight testing in the prototype aircraft. Both contractors' engines are to be cleared for flight by July 1990.

The primary resources for testing avionics during the demonstration and validation phase are avionics ground prototypes being built by both aircraft contractor teams and avionics prototypes to be flown in commercial-type aircraft. The avionics system architecture, system software, integration of functions, modular packaging, cooling, built-in test, and diagnostic functions of each contractor's design are currently being tested through a series of avionics ground prototype demonstrations scheduled to end about late August 1990. The avionics prototypes to be flown in commercial-type aircraft are to confirm the ground demonstrations and further test the avionics sensors and apertures, such as the radar, infrared search and track set, and electronic countermeasures. Only limited avionics will be available for testing in the prototype aircraft.

As of February 1990, both contractors successfully accomplished limited ground prototype demonstrations of modular integration architecture, large portions of Ada language software, radar, infrared search and track, communications, navigation, and electronic warfare functions.

Cost

As of February 1990, the ATF's total acquisition cost was estimated at $79.4 billion in escalated dollars. This estimate included $14.3 billion for the research and development: $3.8 billion for early development and $10.5 billion for full-scale development. The $79.4 billion estimate also included the cost to procure 750 aircraft estimated at $65.1 billion.

The $79.4 billion estimate is $12.3 billion more than the May 1989 estimate of $67.1 billion. An ATF program cost official attributed the increase to inflation. The official explained that the increase was caused by a combination of using higher inflation rates in the current estimate, the 6-month extension of demonstration and validation, and the reduction of the number of aircraft to be produced in the earlier years of production, when inflation is lower.

The estimate for the early development included the cost of the 6-month extension. This estimate should not change significantly, since it is covered by fixed-price contracts. No contracts have been awarded for full-scale development and production; the cost estimates for these phases were constructed using both analogous and parametric estimating methodologies. Both methods are appropriate to use for a program in early development, such as the ATF. However, as actual cost and engineering data become available from producing the prototype articles and the configuration becomes defined, the Air Force anticipates that an estimate with a greater level of confidence will become available.

The Air Force is using a $35 million (1985 base-year dollars) unit flyaway goal to maintain cost discipline in the program. Table IV.5 shows that the most recent estimate of unit flyaway is $37.2 million (1985 base-year dollars), $2.2 million per unit over the goal. (In then-year dollars, the unit flyaway cost is estimated at $67.6 million.) Reducing the estimated unit flyaway cost to attain the $35 million goal and achieving the desired ATF performance characteristics will be a challenge for the Air Force and the contractors.

Table IV.5: ATF Cost Estimates as of February 1990

Dollars in millions

Category	Base-year dollars	Then-year dollars
Research and development	$10,846.2	$14,351.6
Production	35,809.5	65,082.2
Total	**$46,655.7**	**$79,433.8**
Unit flyaway cost	$37.2	$67.6
Program unit cost[a]	$61.5	$104.7

[a]Program unit cost is the sum of development and production cost divided by the number of development and production aircraft.

Recent GAO Reports

Aircraft Development: Navy's Participation in Air Force's Advanced Tactical Fighter Program (GAO/NSIAD-90-54, Mar. 7, 1990).

Defense Acquisition Programs: Status of Selected Systems (GAO/NSIAD-90-30, Dec. 14, 1989).

Aircraft Development: The Advanced Tactical Fighter's Costs, Schedule, and Performance Goals (GAO/NSIAD-88-76, Jan. 13, 1988).

DOD Acquisition: Case Study of the Air Force Advanced Tactical Fighter Program (GAO/NSIAD-86-45S-12, Aug. 25, 1986).

Joint Tactical Information Distribution System Class 2 Terminal

The Joint Tactical Information Distribution System (JTIDS) is a secure, jam-resistant, digital information link for conventional forces. In 1975 the Office of the Secretary of Defense assigned the Air Force as the lead service in developing JTIDS terminals. The Air Force, along with the Army, Navy, and Marine Corps, intended to incorporate JTIDS into airborne, shipboard, and ground command and control centers, as well as fighter aircraft. However, the Air Force has changed its original plan and now expects to use JTIDS on only 20 of its F-15 fighter aircraft.

DOD designated the first generation of JTIDS as the Class 1 terminal, but the volume and weight of the terminals made them unsuitable for use in fighter aircraft and Army situations requiring mobility. Therefore, in the late 1970s, the JTIDS Joint Program Office began to develop a smaller terminal, designated Class 2, that was to satisfy the needs of all the services. As development progressed, however, two terminals emerged, the Class 2 and 2H. These terminals were essentially similar but the Class 2H has a high-power amplifier for greater range. In the mid-1980s, the

Army changed its requirements, resulting in the need for an even smaller, lighter terminal; this new terminal was designated the Class 2M. The redesign needed for the Class 2M terminal was extensive enough to warrant a separate development track and separate production approval from the Defense Acquisition Board.

Although the Class 2 terminal is currently below its required laboratory and field reliability requirements, as measured by mean time between failures, it has achieved at least the threshold values for other performance requirements established by the 1981 Secretary of Defense Decision Memorandum. Nevertheless, in October 1989 the Under Secretary of Defense for Acquisition approved low-rate initial production for the JTIDS Class 2 and 2H terminals. However, approval of low-rate initial production for the Army Class 2M terminal is currently scheduled for October 1991. The Under Secretary has segmented Class 2 and 2H low-rate production into three consecutive annual production lots, and the program office awarded the first Class 2 and 2H production contract in March 1990. However, the Under Secretary has identified specific criteria, such as reliability improvements, that must be satisfied before the second and third production contracts can be awarded.

The services and DOD are sharing the $2 billion cost of developing the JTIDS Class 2 terminal. The program office estimates that development will continue through 1995. The services will purchase production terminals with their own funds. As of February 1990, total program costs through production are estimated at about $3.9 billion.

Background

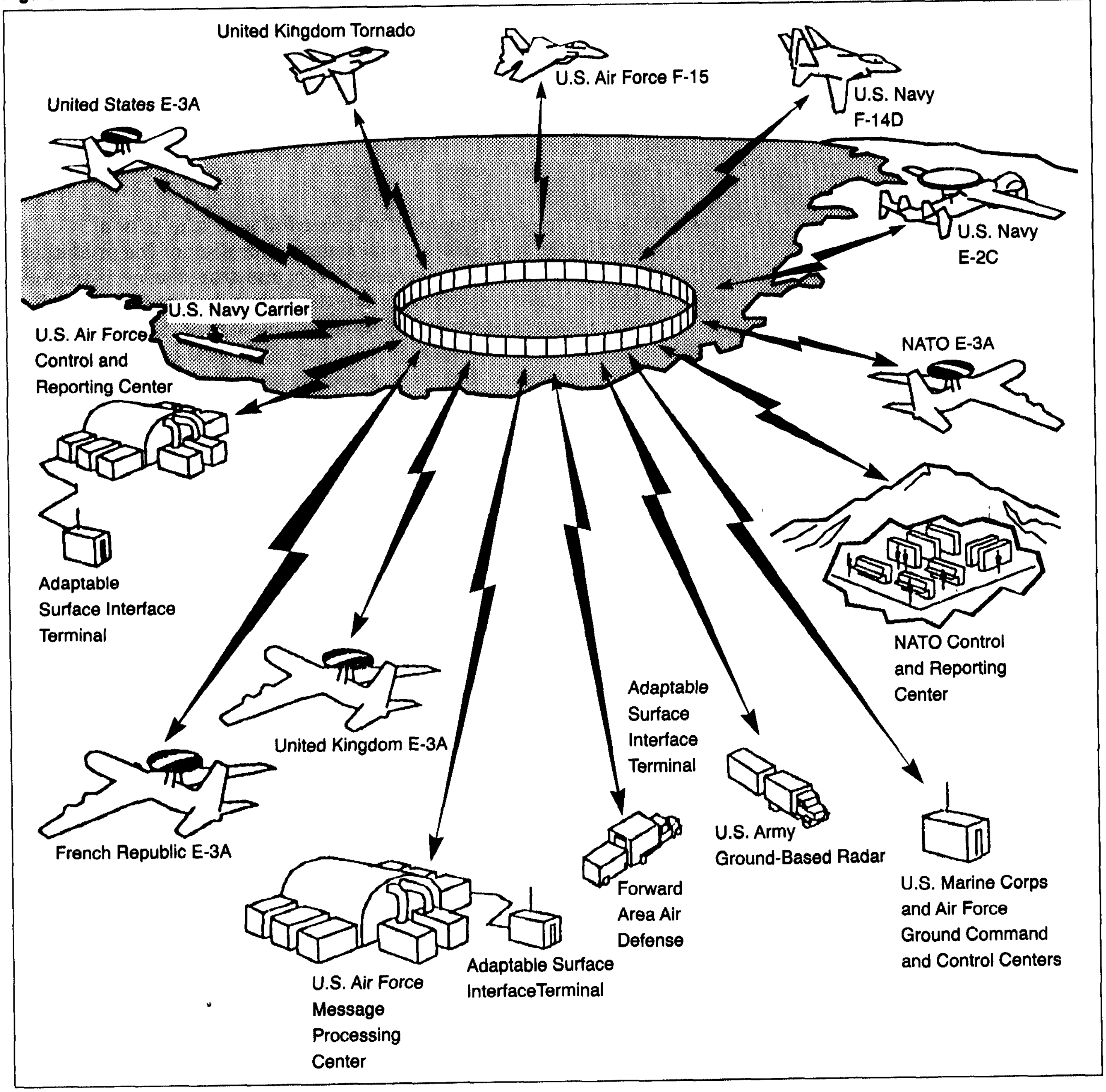
Commanders at all levels require timely information to employ their forces and make real-time assessments during fast-moving, complex combat operations. Combat experience gained in Southeast Asia, the Middle East, and Grenada exposed deficiencies in the tactical communication, navigation, and identification capabilities to support commanders in their tactical decision-making. An information link that provides digital and voice transmissions for tactical use in combat, the JTIDS has the potential to connect scattered sources of surveillance and intelligence data, weapon controllers, weapon systems, and command elements. It is designed to be used for command and control among all equipped airborne, ground, and naval elements in the tactical theater.

The Office of the Secretary of Defense initiated this multiservice program in 1975 and assigned the Air Force to be the lead service. The first generation of JTIDS terminals was designated Class 1, but the volume and weight of the terminals made them unsuitable for use in fighter aircraft and Army situations requiring mobility. In the late 1970s, the program office began to develop the smaller, Class 2 terminal, which was to satisfy the needs of all the services. As development progressed, however, two terminals emerged, the Class 2 and 2H. The Class 2H terminal is essentially the same as the Class 2, except the Class 2H has a high-power amplifier for greater range.

In the mid-1980s, the Army changed its requirements, resulting in the need for an even smaller, lighter terminal and this new iteration was designated the Class 2M. The program office initially hoped that this new terminal could be developed using the same design except the voice and tactical air navigation capabilities, which the Army considers unnecessary. The amount of redesign work needed for the Class 2M was so extensive, however, that a separate development track was set up which will require its own Defense Acquisition Board decision before production.

JTIDS will provide the services with a common link for sharing data. Figure IV.3 shows which friendly air, sea, and ground forces are expected to use JTIDS. Both Air Force and Navy fighter aircraft will use Class 2 terminals, whereas Air Force, Navy, and Marine Corps command and control units will use Class 2H terminals. The Army will use its lighter, smaller Class 2M terminal for forward area air defense command and control units.

Figure IV.3: JTIDS Users



It is unknown whether the Air Force will incorporate JTIDS on all F-15 fighters. Of the JTIDS terminals to be produced in fiscal year 1990, the Air Force will designate only 20 for its F-15 aircraft, and the production units schedule does not include the acquisition of additional terminals for the F-15. The Under Secretary of Defense for Acquisition has given the Air Force until June 1991 to decide whether to include other F-15s in the JTIDS program or terminate its participation and transfer all JTIDS F-15 terminals to the Navy.

The program office is employing the leader-follower acquisition strategy: the leader and follower will compete for each of the production contracts. Plessey Electronic Systems Corporation, the leader, is responsible for the design and development of the digital data processor and interface unit. Collins Government Avionics Division of Rockwell International, the follower, is responsible for the design and development of the receiver/transmitter and the high-power amplifier.

However, Plessey and Collins did not compete for the first production lot of the low-rate initial production contract. The Navy's portion of the first production lot—37 Class 2 and 2H production terminals—will be produced by Plessey. The Air Force is also procuring 37 terminals in the first production lot—Plessey will produce 21 and Collins will produce the other 16 terminals. Competition will begin with the second production lot of the low-rate initial production contract and is expected to continue through full-rate production.

Requirements

The 1981 Joint Chiefs of Staff operational requirement for JTIDS stated that existing communication systems lacked the capability to provide, in real time, the quantity and quality of accurate information necessary to ensure adequate mission performance. As recently as 1989, the program office reported that current voice radios and data links could not provide sufficient communication quality or volume. The program office also noted that existing Navy, Marine Corps, and Army tactical data links have limited capacity, are susceptible to jamming, and are not secure. In addition, the Air Force has no ground-to-air or air-to-air data links for its tactical fighter aircraft.

For all services, information regarding the location of and actions among supporting and opposing forces, as well as the status of targets, must be made available to tactical operators through a single, more useful, and timely system. Individual capabilities will continue to be needed. However, no single system or collection of systems available, other than

JTIDS, can satisfy service requirements for tactical data and voice links, which provide coherent situation awareness, jam resistance, and secure communications.

Schedule

In October 1989 the Under Secretary of Defense for Acquisition approved low-rate initial production for the JTIDS Class 2 and 2H terminals. The Army Class 2M terminal was not included in this milestone decision and its milestone IIIA decision is currently scheduled for October 1991. The Class 2 and 2H low-rate initial production is segmented into three consecutive annual production lots, starting in fiscal year 1990. The program office awarded the contracts for the first production lot in March 1990. The Under Secretary has identified specific criteria that must be satisfied before contracts for second and third lots can be awarded.

Only the Air Force has completed Class 2 preproduction testing (on its F-15 aircraft). On the basis of the results of these tests, we found that the Class 2 terminal does not meet the reliability requirements established by the Secretary of Defense in 1981. Because testing aircraft are unavailable, the Class 2H terminal has not been extensively tested. The Army plans to conduct its Class 2M operational assessment between March and June 1991. The Navy plans to begin technical and operational evaluation testing in November 1992 and May 1993, respectively.

The program office has scheduled a full-rate production decision for the Class 2M terminal in August 1993 and for the Class 2 and 2H terminals in October 1993. Table IV.6 highlights some important events in the program's schedule.

Table IV.6: JTIDS Program Schedule as of December 1989

Event	Date
Complete Class 2 (F-15) initial operational test and evaluation	Apr. 1987
Complete Class 2M initial operational assessment	June 1991[a]
Low-rate initial production decision	
Class 2 and 2H	Oct. 1989
Class 2M	Oct. 1991
Complete testing to support full-rate production decision	
Air Force Class 2 and 2H phase 2 multiplatform operational tests	Apr. 1993
Navy Class 2 and 2H operational evaluation	May 1993
Army Class 2M initial operational test and evaluation	Apr. 1993
Full-rate production decision	
Class 2 and 2H	Oct. 1993
Class 2M	Aug. 1993
Initial operational capability	
Air Force Class 2 (F-15)	[b]
Navy Class 2H	Sept. 1993
Class 2M	Oct. 1993

[a]The milestones for the Army's Class 2M terminal were rescheduled to coincide with the program schedule for the forward area air defense/command, control and intelligence system. The Class 2M terminal is a primary subsystem of that system.

[b]Because only 20 F-15s will be equipped with JTIDS, initial operational capability is not considered to be relevant.

Performance

Although the Class 2 terminal is currently performing below required laboratory and field reliability specifications, as measured by mean time between failures, it has achieved thresholds set for the other performance parameters established by the 1981 Secretary of Defense Decision Memorandum. The performance parameters for the Class 2H and 2M are basically the same as for the Class 2, although the Army's field reliability requirements are more stringent than requirements for the other services.

Development test and evaluation and initial operational test and evaluation took place at Eglin Air Force Base in 1986 and 1987. The testing included an assessment of the reliability and maintainability of the Class 2 terminal on an F-15. The terminal demonstrated only 17 hours between failures in the field, far less than the 102 hours set out in the 1981 memorandum. This low reliability led to a terminal redesign and the establishment of a Reliability Growth Plan to ensure that the first production terminals will meet or exceed the user's reliability requirements and that no inherent design weaknesses will go unaddressed. The plan describes the reliability testing that must be successfully performed from December 1989 through December 1993. Testing actually started in December 1989. The assumption behind this testing is that achieving laboratory reliability thresholds will ensure that field reliability thresholds will be met.

The low-rate initial production contract for the first production lot includes an incentive for the Air Force F-15 terminals to achieve reliability beyond the required threshold. As a result of the reliability growth efforts to date, the demonstrated laboratory reliability, although still below the threshold of 400 hours, has increased to 316 hours between failures. This was achieved in verification tests completed in August 1988. The increased operating hours and data collection that become possible as additional terminals are acquired are expected to move laboratory reliability toward its goal of 500 hours between failures.

Before the October 1989 Defense Acquisition Board's low-rate initial production decision, an operational assessment was conducted, but quantitative improvements in field reliability could not be demonstrated due to a limited number of terminal operating hours (129 hours with 2 critical terminal failures). Therefore, the Air Force Operational Test and Evaluation Center could not make a statistically confident assessment beyond the 17 hours between failures previously reported. However, the Joint Test and Evaluation Master Plan summarizes the test results and states that terminal reliability has improved since initial operational test and evaluation, but it does not yet meet user requirements.

Development test and evaluation and initial operational test and evaluation for terminals other than the Class 2 have not been completed as of March 30, 1990, since the F-15 was the only platform available for testing. However, additional development testing has recently been initiated. The Navy began flight testing the Class 2H on its E-2C Hawkeye in January 1990 and the Army began an informal engineering test at the contractor's plant in March 1990.

In addition, other test events are expected to support full-rate production decisions, including (1) the Navy's operational evaluation, scheduled for February through May 1993, (2) the Air Force's phase 2 multiplatform operational test and evaluation, scheduled for March or April 1993, and (3) the Army's initial operational test and evaluation of the forward area air defense command, control and intelligence system, scheduled for November 1992 through April 1993. According to a program office official, the terminals should accrue enough operating hours during these tests to allow an accurate assessment of terminal reliability before the full-rate production decisions in 1993.

The Army Class 2M terminal, currently under development, is scheduled to complete technical test and initial operational assessment by July 1991. Before the low-rate initial production decision scheduled for October 1991, the terminal must demonstrate reliability thresholds of 400 hours between failures in the laboratory and 207 hours between failures in the field. The Class 2M terminal is scheduled to complete initial operational test and evaluation, including the forward area air defense/command, control and intelligence system and multiservice operational testing, before the full-rate production decision scheduled for August 1993.

Although the October 1989 Acquisition Decision Memorandum approved low-rate initial production, stating that "reliability growth depends on conducting low-rate initial production with automated production facilities," the Under Secretary of Defense for Acquisition approved low-rate production in three phases and established criteria to be met and verified by the Air Force and the Navy before the second and third phases can begin. Before allowing the Lot 2 buy in fiscal year 1991, the Under Secretary is requiring the Air Force and the Navy Service Acquisition Executives to certify that the Class 2 fighter terminal has met its laboratory reliability threshold of 400 hours between failures and that the Class 2H high-power amplifier has undergone a specified amount of laboratory reliability testing. The memorandum also requires the services to submit an updated program baseline for approval and requires the Navy to approve Navy production funding for the Class 2 and 2H terminals to be installed on F-14 and E-2C aircraft.

Further, the memorandum stipulated that before the third production lot buy can be executed in fiscal year 1992, the Air Force and the Navy must certify that the Class 2H terminal has reached a laboratory reliability threshold of 300 hours between failures, and development, operational, and multiservice testing has been completed for the F-15 and E-3 Class 2 and 2H terminals.

Cost

The program office estimates that development of JTIDS terminals will cost over $2 billion and continue through 1995. On the basis of data available at the program office, we estimated that total program costs through production are about $3.9 billion. Table IV.7 shows the JTIDS total estimated costs as of February 1990.

Table IV.7: JTIDS Cost Estimates as of February 1990

Escalated dollars in millions

Funding category	Cost
Development	$2,032.1
Procurement	$1,861.6
Total	**$3,893.7**

Note: These estimates were based on information from the February 1990 "Defense Acquisition Executive Summary" prepared by the JTIDS Joint Program Office.

As of February 1990, the estimated number of production terminals and trainers to be procured was 1,441. The total procurement cost estimate of $1.861.6 billion includes the cost of spare parts to support the 1,441 terminals. The most significant change in the JTIDS quantities to be procured was the reduction of 140 terminals from the F-15 program. The Air Force now proposes to equip only 20 F-15s with JTIDS terminals, using aircraft procurement funds appropriated for fiscal years 1988 through 1990.

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