United States General Accounting Office

GAO

Report to the Honorable
William S. Cohen, U.S. Senate

February 1991

AIRCRAFT DEVELOPMENT

Reasons for Recent Cost Growth in the Advanced Tactical Fighter Program

GAO/NSIAD-91-13

GAO

United States
General Accounting Office
Washington, D.C. 20548

National Security and
International Affairs Division

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February 1, 1991

The Honorable William S. Cohen
United States Senate

Dear Senator Cohen:

In April 1990, the Secretary of Defense announced that a review of the Air Force's Advanced Tactical Fighter (ATF) program had found that the ATF is needed to replace the F-15 for the air superiority mission, but its production could be delayed because of changed world conditions and the possibility of a longer F-15 service life. Air Force officials subsequently told your staff that the production delay and other program changes increased the total estimated program cost in escalated dollars[1] from $79.5 billion to $102 billion. In January 1991, you asked us to identify the key factors in the ATF's cost estimate that contributed to the increase. Given the short time frame in which you wanted this information, we have relied on data provided by the Air Force. We have not independently verified the estimates.

Results in Brief

The $102 billion estimate was a preliminary effort to quickly assess the impact of the changes directed by the Secretary of Defense. The ATF Program Office has subsequently prepared a detailed cost analysis of the program that shows the total program cost is estimated at $103.7 billion. This more recent estimate is still considered preliminary, until it is reviewed and approved by the Air Force Systems Command, which has final approval authority.

The principal factor that led to the $24.2 billion increase in the total estimated program cost, from $79.5 billion to $103.7 billion, is inflation, which is associated with the stretchout of the program from the year 2006 to 2014. Inflation accounts for approximately $16 billion, or about 66 percent, of the increase. Other contributing factors were

- program changes ($2.6 billion), such as the addition of two-seat aircraft to both the development and production programs, increased aircraft weight, and updated prices for the selected avionics suite;
- estimating changes ($1.3 billion), such as adjustments in labor rates and material costs; and

[1]Escalated dollars measure the cost of goods and services in terms of prices current at the time of purchase.

- schedule changes ($4.3 billion), such as the reduction of the peak annual production rate from 72 to 48 aircraft and a longer development period because of the 2-year delay in the start of production from fiscal year 1994 to 1996.

The Air Force expects further changes to the $103.7 billion estimate as a result of (1) reductions in the Air Force's fighter force, which will likely reduce the number of ATFs to be acquired; (2) better cost estimates for full-scale development of the aircraft because of the contractors' cost proposals submitted in January 1991; (3) a potential slip in the start of full scale development currently planned for July 1991; and (4) updated Department of Defense inflation indexes. The net effect of these changes is unknown at this time.

Background

The ATF is being developed by the Air Force as a follow-on to the F-15 in the air superiority role. The Navy is also evaluating a variant of the ATF as a possible replacement for the F-14 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 a pilot's vision.

The program is nearing the end of the demonstration and validation phase during which two competing airframe contractor teams conducted numerous studies to refine system requirements, built and demonstrated critical subsystems, and flew prototype aircraft. Integral to this demonstration and validation effort, two engine companies developed and tested prototype ATF engines. The Air Force received cost and technical proposals from the competing contractor teams in January 1991, and it is evaluating those proposals. The Air Force plans to select the winning contractors in April 1991 for the further development and production of the aircraft and its engine. Although the Air Force had planned and received appropriations to start full-scale development in July 1991, the National Defense Authorization Act for Fiscal Year 1991 (P.L. 101-510) prohibited the obligation of funds for this purpose. The Air Force is evaluating options that could delay the start of full-scale development.

In response to changed world conditions and increasing fiscal constraints, the Secretary of Defense directed a Major Aircraft Review,

which included the Air Force's ATF and the Navy's version of the ATF.[2] In April 1990, the Secretary announced that the review showed the ATF to be the most effective aircraft for the air superiority mission. However, the review also showed that ATF production could be delayed because of a reduced conventional threat in Europe and indications that the life of the F-15 airframe could be extended beyond the year 2000. The Secretary directed that the initial production of the ATF be delayed from fiscal year 1994 to 1996 to provide the contractors with additional time to develop the aircraft, the peak rate of production be reduced from 72 to 48 aircraft per year, and the total procurement quantity be maintained at 750 aircraft at least until another review of the total force structure is completed.

Cost Implications of Program Changes

The estimated cost of the ATF program has continued to increase with program changes. In January 1988, we reported[3] that in an effort to control cost and to keep the program affordable, the Air Force reduced the ATF's original unit flyaway[4] cost goal in base year 1985 dollars from $40 million to $35 million and the estimated total program cost from $69.7 billion to $44.3 billion in 1985 dollars ($64 billion escalated dollars). The program unit cost[5] was estimated at $85.8 million per aircraft in escalated dollars.

In June 1990, we reported[6] that the unit flyaway cost estimate had grown to $37.2 million and that the total program cost had grown to $46.6 billion in 1985 dollars ($79.4 billion escalated dollars). The program unit cost was estimated at $104.7 million per aircraft in escalated dollars. The increase was attributed to an extension of the ATF's demonstration and validation phase, a reduction in the number of aircraft to be produced in the earlier years, and the use of higher inflation rates.

[2]The Defense Major Aircraft Review, which was initiated in December 1989, also included the Air Force's B-2 bomber and C-17 transport, the Navy's A-12 attack aircraft, and the Air Force's version of the A-12, the Advanced Tactical Aircraft.

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

[4]Unit flyaway cost includes all production costs (recurring and nonrecurring) that are incurred in the manufacture of a usable end item. It includes the cost of prime mission equipment (basic structure, propulsion, electronics) and allowances for engineering changes and warranties. It excludes such primary cost factors as training, support equipment, and spare parts.

[5]Program unit cost is determined by dividing the total development, production, and military construction cost estimate by the number of aircraft to be produced.

[6]Defense Acquisition Programs: Status of Selected Programs (GAO/NSIAD-90-159, June 27, 1990).

As of January 1991, the unit flyaway cost, as estimated by the ATF Program Office, had grown to $44.5 million and the total program cost had increased to about $54.9 billion in 1985 dollars. The program's total estimated cost in escalated dollars was about $103.7 billion: $16.6 billion for research and development and $87.1 billion for production of 750 aircraft. The program unit cost was estimated at $136.0 million per aircraft in escalated dollars. The $103.7 billion estimate represents a $24.2 billion, or about 30 percent, increase over the $79.5 billion estimated program cost that supported the President's fiscal year 1991 budget. According to the Program Office's cost estimate, program, estimating, and schedule changes account for the increase, as shown in table 1

Table 1: Changes in ATF Program Costs

Dollars in millions

	1985 base year dollars	Inflation	Escalated dollars
Pre-Major Aircraft Review estimate	**$46,655.7**	**$32,844.3**	**$79,500.0**
Program changes			
Added two-seat ATFs to the full-scale development and production programs	496.4	321.9	818.3
Enhanced avionics	1,701.6	4,242.6	5,944.2
Increased ATF weight	445.2	943.8	1,389.0
Total	**2,643.2**	**5,508.3**	**8,151.5**
Estimating changes			
Reduced estimate of engine cost for full-scale development	(96.0)	(83.7)	(179.7)
Reduced estimate for engineering change orders	(32.0)	(27.9)	(59.9)
Adjusted cost estimating factors	1,395.2	2,438.7	3,833.9
Total	**1,267.2**	**2,327.1**	**3,594.3**
Schedule changes			
2-year extension of full-scale development testing	452.6	391.3	843.9
2-year production slip and reduced peak annual production	3,854.3	7,775.1	11,629.4
Total	**4,306.9**	**8,166.4**	**12,473.3**
Total changes	**8,217.3**	**16,001.8**	**24,219.1**
Program Office's current estimate	**$54,873.0**	**$48,846.1**	**$103,719.1**

As table 1 shows, about $16 billion of the increase, or about 66 percent, is attributed to the effects of inflation. This occurred because the production program for 750 aircraft was extended 8 years until the year 2014 due to the 2-year slip in the start of production (fiscal year 1994 to 1996) and the added years needed to produce all 750 aircraft with a

reduced peak annual production rate of 48 aircraft. The cumulative impact of inflation projected by the Department of Defense over the remaining 24 years of development and production is large.

Program Changes

During 1990, the Air Force approved a long-standing Tactical Air Command requirement for two-seat ATF aircraft to assist in the orientation and training of future pilots. The Air Force plans to acquire 80 ATFs in the two-seat configuration; 2 during full-scale development for the flight test program and 78 during the production phase.

The current estimate recognizes a projected 723-pound per aircraft weight increase to reflect greater use of traditional materials such as aluminum and titanium in place of some of the initially planned state-of-the-art composites. Program officials told us the development of lighter weight composite materials has not matured as rapidly as expected. Since the estimating methodology for the current and previous estimates considers aircraft weight as a key factor in estimating acquisition costs, the higher projected weight results in higher costs.

Previous ATF cost estimates assumed a preliminary avionics suite until the completion of comprehensive studies undertaken during the demonstration and validation phase to look at cost and performance options. The current cost estimate reflects the ATF avionics configuration for full-scale development, which is expected to cost about 41 percent more in base year 1985 dollars than previously assumed.

Estimating Changes

The Air Force initiated early development of full-scale development engines during the demonstration and validation phase to protect the planned full-scale development schedule. The current estimate provides an allowance for this investment by reducing the full-scale development estimate. Similarly, the longer full-scale development program directed by the Secretary of Defense and the successful demonstration and validation program has led the Program Office to reduce the amount of engineering change order and management reserve funds previously estimated.

Cost estimating factors and methods were adjusted by the Program Office in the current estimate to more accurately project ATF costs. For example, the current estimate reflects higher anticipated costs for materials and labor associated with airframe fabrication and assembly.

Program officials told us previous estimates have been refined because of lessons learned by other aircraft programs.

Schedule Changes

The principal schedule changes were directed by the Secretary of Defense in April 1990, and they are the largest contributors to the increase in the estimated total program cost in base year 1985 dollars. These include a 2-year delay in the start of production, from fiscal year 1994 to 1996, and a decrease in the maximum annual production rate, from 72 to 48 aircraft a year. Also contributing to the increased cost is an Air Force change that provides for a slower buildup to the maximum production rate to reduce concurrency between development, testing, and production commitments. For example, the current production schedule shows that the Air Force plans to buy 20 ATFs in the first 3 years of production, whereas the earlier schedule had the Air Force buying 28 ATFs in the same period.

Additional Factors Expected to Affect Cost

The Air Force expects further changes to the $103.7 billion cost estimate, although their net effect cannot be estimated at this time. For example, the Air Force is planning a sizable reduction in its current 36-wing[7] tactical fighter force because of a reduced conventional threat in Europe and increased fiscal constraints. According to Tactical Air Command officials, acquisition of fewer ATFs is being examined because of these factors. The impact of a reduced procurement quantity would decrease the total program cost but increase the unit cost of the aircraft.

In January 1991, the competing contractors submitted cost and technical proposals for full-scale development. These proposals are expected to capitalize on the contractors' cost experience in building the engines, avionics, and prototype aircraft. Program Office officials told us the next cost estimate will include the winning contractors' cost data to help refine the estimate. By comparison, the current and previous cost estimates were based on a combination of known costs of similar systems and mathematical analyses of cost estimating relationships developed from prior acquisition programs. Because the ATF is to incorporate technologies and capabilities that have never been incorporated on an air superiority fighter, these cost estimating methodologies are considered imprecise but probably the best available.

[7]A tactical fighter wing usually consists of 3 squadrons of 24 combat aircraft each. The Air Force's Tactical Air Command estimates it needs about 100 aircraft for every fighter wing: 72 for combat, 18 for training, 8 for backup inventory, and 2 for testing.

The Air Force had planned to start full-scale development in July 1991, and it received fiscal year 1991 appropriated funds for this purpose. However, the National Defense Authorization Act for Fiscal Year 1991 (P.L. 101-510) prohibited the use of these or prior year funds for full-scale development because of concerns about the aircraft's readiness for this phase and the need for a mission effectiveness analysis. In light of these differences, the Air Force is considering several options on when and how to proceed.

The current cost estimate does not reflect new Department of Defense inflation indexes released in January 1991. According to Air Force officials, the new rates are higher than the 1990 rates. Thus, use of the new rates may significantly increase total cost primarily because of the ATF's long development and production period.

Objectives, Scope, and Methodology

Our objectives were to identify and report on the factors leading to an increase in the cost of the ATF development and procurement program before and after the Major Aircraft Review of April 1990. In performing our evaluation, we relied upon the current, draft cost estimate completed by the Program Office on December 21, 1990, and supporting documents. This estimate is being reviewed by the Air Force Systems Command and is not expected to be finalized until late February 1991. Since the current estimate was made available to us on January 14, 1991, we did not perform a detailed examination of it. Rather, we compared it to the cost estimate that was completed by the Program Office in August 1989 and subsequently updated in February 1990. We focused on those areas that explain the higher costs of the current estimate.

We interviewed officials and reviewed the estimates and supporting documents provided by the ATF Program Office located at Wright-Patterson Air Force Base, Ohio. We conducted our review during January 1991 in accordance with generally accepted government auditing standards. As requested, we did not obtain official agency comments on this report. However, we discussed the information with Department of Defense and Air Force officials and included their comments where appropriate.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 1 day after its issuance date. At that time, we will send copies to interested congressional committees; the Secretaries of Defense and the Air Force; and the Director, Office of Management and Budget.

Please contact me at (202) 275-4268 if you or your staff have any questions concerning this report. Other major contributors to this report are listed in appendix I.

Sincerely yours,

for Nancy R. Kingsbury
Director
Air Force Issues

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