

August 25, 1986

# DOD ACQUISITION

## Case Study of the Air Force Advanced Fighter Engine Program



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# Preface

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The Chairmen of the Senate Committee on Governmental Affairs and its Subcommittee on Oversight of Government Management asked GAO to examine the capabilities of the program manager and contracting officer in weapon systems acquisition. As part of this study, GAO examined 17 new major weapon system programs in their initial stages of development. These case studies document the history of the programs and are being made available for informational purposes.

This study of the Advanced Tactical Fighter Engine Program focuses on the role of the program manager and contracting officer in developing the acquisition strategy. Conclusions and recommendations can be found in our overall report, DOD Acquisition: Strengthening Capabilities of Key Personnel in Systems Acquisition (GAO/NSIAD-86-45, May 12, 1986).

*for*   
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# Advanced Tactical Fighter Engine

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## Origin of Start

The need for an advanced fighter engine is linked to development of the new advanced tactical fighter that dates back to January 1973. While this original need was withdrawn from consideration due to developments in the A-10, F-15, and F-16 aircraft at that time, the program reemerged when the air staff submitted a Mission Element Need Statement for approval by the Office of the Secretary of Defense in September 1981. On November 23, 1981, the Defense Resources Board approved the advanced tactical fighter program as a fiscal year 1983 new start.

The engine program is intended to demonstrate key propulsion technologies previously identified in such conceptual predesign studies as the Advanced Technology Engine Study and the Propulsion Assessment for Tactical Systems. These technologies have been initially assessed in the following programs: Advanced Turbine Engine Gas Generator, Aircraft Propulsion Subsystem Integration, Joint Technology Demonstrator Engine (funded by both Air Force and Navy), and Propulsion Component Technology. General Electric, Pratt & Whitney, Garrett, Detroit Diesel Allison Division of General Motors, and Teledyne were involved in these technology programs. In the joint advanced fighter engine demonstration efforts, these technologies will be integrated into a design that approximates the correct size, cycle, and specific design criteria for a tactical fighter engine. While initiated as a joint Air Force/Navy program, when the projected date of initial operational capability for the Navy application slipped past the year 2000, the Navy withdrew funding from the joint program. The Navy continues to share technology and to provide some technical support to the program.

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## Formation of the Project Office

In July 1981, a GS-13 engineer was assigned as program manager in the Aeronautical Systems Division of the Air Force Systems Command. The program manager had no previous program management experience, but holds a bachelor's and a master's degree in engineering and a master's degree in management. He was involved with the early technology programs (the Aircraft Propulsion Subsystem Integration and the Advanced Turbine Engine Gas Generator programs) in the Systems Division Aero Propulsion Laboratory and was assigned to the engine program before the needs statement was validated.

The first contracting officer was appointed to the program in September 1982. He was a GS-12 contract specialist with 2 years of college and 18 years of procurement experience. About 15 years of this experience involved propulsion systems procurement.

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## Development of the Acquisition Strategy

With the Defense Resources Board approval of the advanced fighter program as a fiscal year 1983 new start, the Aero Propulsion Laboratory began preliminary efforts to develop an acquisition strategy. The program manager was involved in the earliest program decisions. His proposal to award two equally-funded contracts for a combined concept definition and demonstration/validation phase was approved.<sup>1</sup>

Developing a strategy for acquiring a new system in the Air Force is generally an iterative process which begins with Air Force Systems Command providing the program office with general parameters such as extent of competition and funding. With this overall set of conditions, the program office usually develops a skeleton strategy which is given details and specifics as the program progresses through the acquisition phases (conceptual, demonstration/validation, full-scale development, production and deployment). As the start of each phase is approached, the details of the strategy for that phase are finalized and proposed to a number of management review panels. This review process culminates with Air Force Systems Command approval of the strategy for that particular phase. Consequently, a system's overall strategy is not finalized and approved until the program reaches the last phase (production and deployment) of the acquisition cycle.

Air Force Systems Command reviewed and approved the engine acquisition strategy through the combined concept definition and demonstration/validation phase. The extent of competition for this phase was essentially dictated by a limited large jet engine industry. While early predesign studies involved five engine contractors, it became apparent that a large thrust class engine would be needed as the requirements for the advanced fighter became better defined. Therefore, the extent of competition for both the remaining predesign studies and the engine demonstration program was reduced because of a limited number of potential contractors in the large jet engine industry. Only three domestic sources are capable of designing, developing, and producing the large thrust class engine required. General Electric, Pratt & Whitney, and Detroit Diesel Allison. A request for proposal was sent to each stating that only two contractors would be awarded contracts. Detroit Diesel Allison, having encountered technical problems with their advanced development demonstrators, did not think they were competitive and did not participate.

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<sup>1</sup>Information in this report is mainly concerned with early approval actions on the program manager's proposal. Recent changes in approach are discussed on page 8.

Competition for the combined concept definition and demonstration/validation phase strategy evolved from the original program direction and was refined through a series of management reviews. Initially, the Air Force Systems Command provided guidance for competition by requiring program officials to (1) actively seek competition during all phases of the program, (2) consider providing for the recompetition of the system by either acquiring the technical data and assistance as a prepriced option, or reducing the contractors rights to the data, and (3) consider providing for the separate pricing of high value components and allowing this to be a factor in the full-scale development source selection.

From this general guidance, the program manager and contracting officer proposed that two contractors be awarded 50-month firm fixed-price contracts for a combined concept definition and demonstration/validation phase. This strategy was briefed to the management panels discussed in the next section. A follow-on 72-month full-scale development phase was planned to meet schedule requirements. The program manager expected that only one of the two initial contractors would be funded for full-scale development.

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## Management Review Process

Both Air Force Systems Command and Aeronautical Systems Division require acquisition strategies to be reviewed by a number of panels to help the program manager develop the most effective acquisition strategy. During these meetings, the panels share with the program manager experiences and lessons learned from other acquisitions.

Normally, the strategy for each acquisition phase must be approved by Systems Command. Systems Command approval is achieved via its Business Strategy Panel. In preparation for this Systems Command required panel, the Systems Division conducts two similar panels on the acquisition strategy. The Business Strategy Panel is normally the first panel to review a particular strategy, setting the groundwork for a second review by the Acquisition Management Panel. The Acquisition Management Panel is a Systems Division required panel and is the vehicle for gaining the commander's approval of the acquisition strategy before it is briefed up the chain of command.

The Systems Command Business Strategy Panel meeting held in January 1983 made the following observations on the proposed engine strategy: (1) competition should be restricted to domestic sources, (2) the draft

request for proposal should be modified to include performance requirements for fuel consumption and should address key engine support items, important elements in full-scale development, and (3) the use of a firm fixed-price contract for the combined concept definition and demonstration/validation phase was questioned. The program manager considered these three observations and concluded that because of the security classification of the program, competition would be restricted to domestic sources, the fuel consumption requirement would be included in the request for proposal, and the type of contract—firm fixed-price—would be retained to provide for contractor competition and a reduced cost risk to the government.

Since the need for the engine is linked to that of the advanced tactical fighter, the review of their acquisition strategies was also linked. The April 1984 Systems Division Business Strategy Panel for the advanced fighter included certain recommendations relative to the engine. This panel recommended that long-range planning should not prevent the program from carrying two engine contractors through full-scale development. The panel stated that the plan should leave open such considerations as competitive development of certain engine components and use of a leader-follower approach. The engine program manager stated that funding in the Program Objective Memorandum provided long-lead hardware from both contractors to support the full-scale development schedule. While the then-current engine budget did not preclude the strategy of carrying two contractors through critical design review, the program manager estimated that extended competition would require at least another \$1.5 billion (in fiscal year 1983 dollars). He believed the Congress would be unwilling to provide these additional funds to develop two engines simultaneously. However, he stated the strategy being pursued in the engine combined concept definition and demonstration/validation phase did not preclude this, or any alternative competition strategy.

Aircraft engine development in the last decade has produced substantial improvements in engine materials, aerodynamics, structure, and cooling concepts. These can provide significant increases in aircraft capability, supportability, and maintainability. The combined concept definition and demonstration/validation phase was intended to integrate these technological advances into a fighter engine design and demonstrate and validate the component, gas generator, and turbine engine hardware at sea level and altitude test facilities.

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## Contracts Awarded

Two equally funded firm fixed-price contracts for the combined concept definition and demonstration/validation phase were awarded to General Electric and Pratt & Whitney in September 1983

Primary contract objectives included completion of the development, demonstration, and validation of key tactical fighter engine technologies to ensure a low-risk transition to full-scale development. Once the design had been finalized, individual components and two demonstrator engines were to be fabricated and tested by each contractor. Demonstration of each contractor's engine configuration was to include a comprehensive altitude performance and operability test at a government test facility and a 250-hour accelerated mission test.

Under the program manager's approved plan, the engine of either one or both of the contractors could be selected for full-scale development. Air vehicle contractors were to evaluate both engines for use in their aircraft, but the Air Force would make the final engine selection.

The milestone I requirements review by the Defense Systems Acquisition Review Council, scheduled for November 1984, was postponed to allow the Air Force to study the affordability of the advanced tactical fighter in relation to other needed systems. Current plans call for a review by the Joint Requirements and Management Board in August 1986.

During 1985, responsibility for the program was transferred from the Aeronautical Systems Division Propulsion Laboratory to the Deputy for Propulsion, and the program manager was replaced by a military officer

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## External Influences

Both the air vehicle and engine programs were restructured to reflect funding reductions that occurred during development of the fiscal year 1985 Program Objective Memorandum. As part of an overall Air Force budget reduction, the Air Force reduced the air vehicle fiscal year 1985 budget from \$162.3 million to \$94.3 million. The engine budget was likewise cut, from \$111.5 million to \$81.2 million. This caused an 18-month slip in the Advanced Tactical Fighter program and delayed its initial operational capability from fiscal year 1993 to fiscal year 1995. The combined engine concept definition and demonstration/validation phase was extended 6 months to coincide with the air vehicle development schedule.

## Cost Estimate

The engine cost estimate was developed jointly by the Systems Division Deputy for Propulsion and the Propulsion Laboratory. The following chart shows the Department of Defense's 1987 development budget.

Table 1: DOD's FY 1987 Budget

Millions of dollars

	Fiscal Year						Additional to Completion
	1983	1984	1985	1986	1987	1988	
Engine development	\$16.5 <sup>a</sup>	\$29.0 <sup>b</sup>	\$81.2	\$138.5	\$154.0	\$144.0	\$128.0

<sup>a</sup>From fiscal year 1985 budget

<sup>b</sup>From fiscal year 1986 budget

## Evaluation of Roles and Acquisition Strategy

### Roles and Responsibilities

Both the program manager and contracting officer participated in key processes that helped design and implement the program. The program manager assumed responsibility for planning competition in the combined concept definition and demonstration/validation phase by making the initial decision that at least two contractors would be funded. Further, the program manager took primary responsibility for developing the source evaluation criteria and selection plan and the statement of work.

The contracting officer took primary responsibility for implementing the strategy in terms of writing contract business terms and conditions, conducting the negotiations, and evaluating the cost proposals. The contracting officer also reviewed the source evaluation criteria and the source selection plan for consistency with the acquisition strategy and with appropriate procurement laws and regulations.

The type of contract for this phase was a joint decision by both the program manager and contracting officer.

The program manager played a lead role in structuring the acquisition strategy from the earliest program decisions. The program manager was involved in the predesign technology studies and was assigned to the

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program before the Mission Element Need Statement was validated. Air Force management provided general guidance regarding competition. The management panels became involved in some specific aspects of the program's strategy, but the program manager developed the basic strategy and sustained it in briefings through the chain of command.

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### The Design Competition

Department of Defense Directive 5000.1 encourages competitive design work up to full-scale development (the third program phase) or beyond, if cost effective. The Air Force is achieving this competition up to full-scale development, that is through the demonstration/validation phase. Continuing competition into the full-scale development phase is not precluded.

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### Present Status

In early 1986, the Air Force modified the engine acquisition program. Instead of demonstrator engines, each contractor is to build two prototype engines and have them flight qualified by December 1989. Both contractors are expected to continue participating in the acquisition through the preliminary design review step of the full-scale development phase. Final strategies for the development and the production phases are being developed.

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# Chronology of Events

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July 1981	Program manager appointed.
September 1981	New fighter Mission Element Need Statement validated by air staff and submitted to the Office of Secretary of the Defense to support the fiscal year 1983 new start budget request.
November 1981	Milestone 0 program initiation approved as a fiscal year 1983 new start by the Defense Resources Board.
September 1982	Contracting officer assigned.
May 1983	Development and demonstration request for proposal issued.
September 1983	50-month engine development and demonstration contracts awarded.
August 1986	Joint Requirements and Management Board review scheduled.

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