BY THE COMPTROLLER GENERAL

Report To The Chairman, Committee On Armed Services House Of Representatives OF THE UNITED STATES

Review Of Air Force's Next Generation Trainer Aircraft Program : Department of Defense

The Air Force's original plans effectively eliminated the Navy's current primary trainer aircraft--the T-34C--from consideration as its new primary trainer aircraft. GAO believes this elimination is inconsistent with OMB Circular A-109. This inconsistency has, however, been negated by recent congressional direction for the Air Force to evaluate the T-34C as an alternative.

The Air Force could use the T-34C as its primary trainer. It does not, however, perform as well as the current primary trainer or well enough to meet the stated requirements for the new primary trainer. The relative cost effectiveness of various alternatives, including the T-34C, is uncertain. One analysis, prepared by a consultant for the Air Force, showed that the T-34C would be the least costly alternative for the primary phase of the Air Force's undergraduate pilot training program, but would be the most costly alternative if the total program were considered. Uncertainty exists regarding some assumptions and cost data in the analysis.

The Air Force is also considering a service life extension of its current primary trainer as an alternative to a new acquisition.

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COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-201269

The Honorable Melvin Price
Chairman, Committee on Armed
Services
House of Representatives

Dear Mr. Chairman:

In your March 13, 1980, letter, you asked us to review Air Force actions leading toward procurement of a next generation trainer aircraft for the primary phase of its two-phased undergraduate pilot training program. You submitted questions which had been provided to you by Congressman Jim Lloyd. (See app. I.) The questions concerned the capability of the Navy T-34C aircraft to perform the primary phase mission, the life cycle costs of the T-34C compared to alternative aircraft, and the extent to which the Air Force is complying with Office of Management and Budget (OMB) Circular A-109 and allowing consideration of the T-34C. You also provided the questions to the Air Force.

In August 1980 the Air Force completed its response. According to agreements made with your office, we reviewed and are commenting on the Air Force's response. The results of our review are discussed in detail in appendix II. In summary, we found that:

--The T-34C could be used as the Air Force's primary phase trainer. However, since the T-34C does not perform as well as the current primary trainer or well enough to meet stated requirements for the next generation trainer, its use could result in either additional flying hours in the primary and basic phases or lower undergraduate pilot training standards with additional training hours required in operational aircraft. Further, using the T-34C rather than an aircraft meeting the next generation trainer requirements could result in a larger number of training flight cancellations due to weather, increased air congestion problems, and greater use of auxiliary airports.

--The Navy is still buying T-34C aircraft for use as its primary phase trainer. Navy officials said that the T-34C has satisfactorily fulfilled the Navy's primary trainer aircraft requirements.

--The Air Force's life cycle cost comparison, which was prepared by a consultant, showed the T-34C was the least costly alternative if only the primary phase were considered. However, the comparison showed that it is the most costly if the total undergraduate pilot training program were considered. Our evaluation showed that some costs associated with using the T-34C aircraft were not included in the life cycle cost comparison. Also, some of the estimated costs in the comparison were based on contractor proposals and could not be substantiated.

--Air Force requirements and actions which effectively eliminated the T-34C from consideration in the program are not, in our opinion, consistent with OMB Circular A-109. We believe industry should have been as free to propose the T-34C as any other alternative aircraft. Congressional direction in August 1980, however, requested that the program be restructured to include consideration of the T-34C. Air Force officials are now taking action to comply with this direction. It should be noted that Air Force actions otherwise generally appear to be consistent with A-109. Its actions have resulted in competition--an important A-109 objective.

--The Air Force is performing a durability and damage tolerance analysis of the T-37B airframe to determine what modifications would be required to extend its service life to 25,000 hours. Analysis results are expected in May 1981. Extending the T-37B service life would not eliminate other T-37B deficiencies, such as excessive fuel consumption, noisy engines, outdated avionics, limited range, and lack of cockpit pressurization, but could result in the lowest initial investment for satisfying the requirement. Although the service life could be extended, the number of available T-37B aircraft will not be sufficient to meet projected pilot production rates beyond 1987.

Five contractors completed concept exploration studies for a next generation trainer in October 1980. The primary objective of the studies was to determine the lowest life cycle cost approach to maintaining the Air Force's pilot

training capability. Each contractor selected an alternative aircraft, performed tradeoff studies, and prepared a life cycle cost estimate for the proposed alternative. The Air Force completed its evaluation of the contractors' studies in December 1980. This was completed too late for us to assess their evaluation. The Air Force plans to solicit proposals for full-scale development from the five concept exploration study contractors. These proposals, as well as acquisition of the T-34C and a service life extension of the T-37B, will be evaluated by the Air Force to determine which alternative would be the most cost-effective solution to the primary trainer needs.

We interviewed officials at the Office of the Secretary of Defense, Air Force Headquarters, Navy Headquarters, and Naval Air Systems Command in Washington, D.C.; Air Training Command, Randolph Air Force Base, Texas; and Aeronautical Systems Division, Wright-Patterson Air Force Base, Ohio. Using documents and other information supplied, we analyzed Air Force data regarding the need for a new trainer aircraft, compared the operating capabilities of the T-34C and the T-37B aircraft with the requirements for a new trainer aircraft, evaluated the Air Force's efforts to comply with OMB Circular A-109 during the acquisition of a new trainer aircraft, and analyzed the Air Force procedures for issuing the request for proposal for the concept exploration studies of the next generation trainer. We also discussed the Air Force's implementation of OMB Circular A-109 with OMB officials. We did not evaluate the effectiveness of the current undergraduate pilot training program. As arranged with your office, we submitted a draft of this report to Department of Defense officials for their review. We did not request official comments. High level officials associated with the management of the program reviewed the draft to determine whether it was accurate and complete, and they agreed with its content.

Unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days

from the date of the report. At that time we will send copies to interested parties and make copies available to others upon request.

Sincerely yours,

Comptroller General
of the United States

APPENDIX I

QUESTIONS FOR THE GENERAL ACCOUNTING OFFICE ON THE NEXT GENERATION TRAINER (NGT)

1. Is the Navy T-34C used for primary flight training in the Navy capable of performing the primary flight training mission now performed in the Air Force by the T-37?

2. If not, state the specific training requirements and aircraft performance characteristics which the Navy T-34C cannot achieve but which the Air Force T-37 can.

3. Is the Navy T-34C used for primary jet pilot training capable of performing the primary flight training mission of the Air Force as set forth in appropriate AF DOD documents, specifically the mission element need statement for primary under-graduate pilot training system (NGT) as approved by the Deputy Secretary of Defense on June 26, 1979?

4. If not, state the specific training requirements and aircraft performance characteristics which the Navy T-34C cannot achieve but which the NGT can.

5. To what extent, if any, would the Air Force primary flight training mission be degraded by the failure to meet specific training requirements and performance characteristics identified in:

   a. #2 above.

   b. #4 above.

6. What alternatives, if any, other than a new or modified aircraft, could be used to compensate for or to fill the specific training requirements not met by the Navy T-34C as listed in #2 and #4 above?

7. If the Navy T-34C were introduced into USAF primary training at the earliest possible time, what would the 20 year life cycle fuel consumption of the T-34C be for this mission compared to:

   a. The T-37 as currently operated by the Air Force, except service life extended to 25,000 hours.

   b. The T-37 modified and modernized to meet requirements of Request for Proposal (RFP) for NGT Conceptual Studies-F33615-80-R-0102 of 15 February 1980.

c. A new or next generation trainer.

8. What would the 20 year life cycle fuel cost of the Navy T-34C be compared to:

a. The T-37 as currently operated by the Air Force (25,000 hour service life).

b. The T-37 (modified, etc.).

c. A new or next generation trainer.

9. What would the acquisition cost of the Navy T-34C be compared to:

a. The T-37 as currently operated by the Air Force (25,000 hour service life).

b. The T-37 (modified, etc.).

c. A new or next generation trainer.

10. What would be the test and evaluation costs of the Navy T-34C compared to:

a. The T-37 as currently operated by the Air Force (25,000 hour service life).

b. The T-37 (modified, etc.).

c. A new or next generation trainer.

11. What would the 20 year operation and support cost of the Navy T-34C be compared to:

a. The T-37 as currently operated by the Air Force (25,000 hour service life).

b. The T-37 (modified, etc.).

c. A new or next generation trainer.

12. What would the research and development costs of the Navy T-34C be compared to:

a. The T-37 as currently operated by the Air Force (25,000 hour service life).

b. The T-37 (modified, etc.).

c. A new or next generation trainer.

13. What would the 20 year total life cycle costs be of the Navy T-34C be compared to:

a. The T-37 as currently operated by the Air Force (25,000 hour service life).

b. The T-37 (modified, etc.).

c. A new or next generation trainer.

14. Does the procedure used by the Air Force in its RFP for the NGT allow consideration and evaluation of the T-34C used by the Navy for the comparable Navy mission?

15. If not, what prevents the Navy T-34C from being considered and evaluated?

16. What savings, if any, could be obtained by the Air Force if it eliminated the requirement in the RFP that the aircraft used for the Air Force primary flight training must be limited to twin-engine, side-by-side seating?

17. Is the procedure used by the Air Force in its RFP for the NGT Conceptual Studies in full compliance with OMB Circular A-109 issued April 5, 1976 and amendments thereto?

18. If the Navy T-34C is declared ineligible as a candidate for evaluation of the above RFP, can the Air Force under applicable procurement statutes, nevertheless, evaluate the Navy T-34C against the winner of the NGT competition in that same RFP, to determine whether the Navy or Air Force aircraft is most cost effective, and then select for procurement the aircraft determined to be most cost effective?

19. Since, by intent to Congress, and statement of the Air Force, the VTX is planned to replace the current Air Force T-38 trainer; and the T-34C is planned to be used by the Navy as a primary trainer to interface with the VTX; would it not appear logical that the T-34C be considered as a contender for a primary training aircraft by the Air Force?

EVALUATION OF AIR FORCE PROGRAM TO PROCURE A NEW PRIMARY TRAINER AIRCRAFT

COULD THE NAVY'S T-34C BE USED FOR THE AIR FORCE'S PRIMARY PILOT TRAINING MISSION?

(Questions 1, 2, 3, 4, 5, and 6 from app. I.)

The T-34C could be used as the Air Force's primary phase undergraduate pilot training (UPT) aircraft. However, since the T-34C does not perform as well as the current primary trainer or well enough to meet the Air Force's stated requirements for NGT, its use could result in either additional flying hours in the primary and basic UPT phases or lower UPT standards with additional training hours in operational aircraft. Further, T-34C use could result in (1) an inability to reduce sortie losses caused by bad weather, (2) increased air congestion problems, and (3) greater use of auxiliary airports.

T-34C is less capable than the T-37B and the planned NGT

In defining the requirements for the NGT aircraft, the mission element need statement (MENS) identified deficiencies in both the T-37B aircraft currently used by the Air Force as a primary trainer and the T-34C aircraft currently used by the Navy as a primary trainer. The T-34C performance capabilities are less than that of both the T-37B and the planned NGT. Using the T-34C as a primary trainer aircraft would require more UPT flying and would not reduce the weather cancellation and airspace congestion problems that exist at UPT bases.

On June 26, 1979, the Deputy Secretary of Defense approved a MENS for an Air Force primary UPT system. The MENS identified the following T-37B deficiencies.

--The aircraft is approaching the end of its certified service life.

--Limited weather capability restricts full training potential.

--Instrument displays are not consistent with Air Force mission aircraft.

--Fuel consumption is excessive when compared to modern standards.

--Engine noise levels are twice that permissible under Federal Aviation Regulations.

--Limited range and endurance restricts mission flexibility.

--Limited performance restricts training to lower altitudes where airspace is becoming more congested, hazardous, and difficult to obtain for pilot training.

The MENS also stated the Navy T-34C aircraft was unsuitable because (1) it did not have the performance and handling characteristics required for the Air Force UPT primary phase and (2) the performance and handling differences between the T-34C and the T-38 (the Air Force basic phase trainer) would require additional flight hours in the T-38. The additional flight hours would, according to the MENS, offset any economic advantage of using the T-34C.

A comparison of the major NGT operating requirements with the T-34C and the T-37B performance capabilities is included as appendix III (see p. 22) and shows that the T-34C does not meet the NGT operating requirements for rate of climb, cruise speed, cruise altitude, sustained load factor, crosswind capability, anti-icing capability, ejection seats, cockpit pressurization, and wind screen impact resistance. Compared to the T-37B, the T-34C has a slower cruise speed and rate of climb under full power, does not have ejection seats, and does not have a wind screen certified for its capability to withstand hitting a bird.

If the T-34C were used as the UPT primary trainer aircraft, more UPT flying hours would be required, sortie cancellations due to weather would persist, and airspace congestion problems near UPT bases would continue. These factors are discussed in the following sections.

Use of T-34 aircraft requires more flying hours

If used as the Air Force's UPT primary trainer, the T-34C would require additional flying hours to maintain training standards because of its slower speed and rate of climb. Some of the additional flight training would disrupt normal flight operations and could require use of additional auxiliary airports. The additional UPT flying hours would increase training costs, aircraft and instructor pilot requirements, and simulator training hours.

Air Force officials said that the T-34C could be used to provide some degree of training in all training categories now included in the UPT primary phase. An Air Training

Command analysis showed, however, that use of T-34C would increase the number of UPT flying hours if training standards are maintained. Air Training Command officials used syllabus development techniques to determine the impact on UPT if the T-34C was used as a primary trainer. No change in UPT standards was assumed. The analysis revealed the following:

--Because of the T-34C's slower speed and rate of climb, the average sortie length would have to be increased from 1.3 to 1.7 hours.

--The equivalent of two additional sorties would be required to teach simulated engine flame-out training in the single-engine T-34C. Simulated flame-out training is not necessary in a twin-engine aircraft. Instead, training for simulated single-engine operations is required.

--Because of the large differences in the handling and performance characteristics of the T-34C and the T-38 aircraft, the number of T-38 sorties was increased from 80 to 100 to provide efficient transition from the T-34C to the T-38 and to meet course training standards.

These changes would require about 50 additional flying hours during UPT.

Air Training Command officials said the simulated flame-out training in a single-engine aircraft would disrupt normal flight operations and would interfere with other flight training. Traffic pattern and airspace problems would result from the attempt to sequence simulated flame-out practice with other flight operations. Simulated flame-out training is not compatible with other operations because it is flown at different altitudes, ground tracks, and airspeeds. Consequently, traffic pattern delays for sequencing would result. These delays, coupled with the complexity of simulated flame-out training, would increase the flying time in the primary phase. The disruptive impact of simulated flame-out training could be reduced by using auxiliary airports. Operation of these auxiliary airports would be an additional cost. Conversely, training for simulated single-engine operations in a twin-engine aircraft can be accomplished within normal flight patterns and does not interfere with other flight operations.

Air Training Command officials acknowledged that the number of additional flying hours that would be required cannot be precisely determined until validated by actual

experience or appropriate testing. Some additional flying hours would obviously be required because of the T-34C's slower speed and rate of climb and the need for increased training time to transition from the low performance T-34C to the high performance T-38.

The additional sorties and flying hours required by using the T-34C would lengthen the UPT program and either increase aircraft and simulator requirements or decrease UPT production capacity. Air Force officials estimated that the additional sorties and flying hours would add 54 training days for each student pilot. This would increase the student load on a training base at any given time, and thereby, increase training costs. The Air Force estimates that the number of T-34C aircraft required to support the additional flying would be about 100 more than the number of T-37 aircraft. In addition, the Air Force estimates that 100 more T-38 aircraft would be required to support the increased flying hours if the pilot training capacity is maintained. There would also be a need for an additional 10.4 hours of simulator time for each student and about 360 instructor pilots. Some of these additional costs are discussed in a later section of this evaluation. If the additional T-38 aircraft and other needed resources were not obtained to support the additional flying requirements, the UPT capacity would be decreased by about 550 pilots a year.

Sortie losses due to range and weather limitations would persist with the T-34C

Although the T-34C aircraft is capable of partially meeting NGT range requirements, it, like the T-37B, would be restricted from operating under known icing conditions and would similarly be limited to a maximum altitude of 25,000 feet because the cabin is not pressurized. Therefore, sortie losses similar to those currently experienced in the T-37B would persist if the T-34C were used as the primary UPT training aircraft.

Approximately 20 percent of scheduled UPT primary phase sorties are canceled due to weather. The majority of these cancellations are due to a lack of suitable alternate airfields within the range of the T-37B. Some sorties, however, had to be canceled when suitable alternate airfields were available because the T-37B could not fly through or above adverse weather conditions, such as known icing conditions, turbulence, and thunderstorms.

Because of the similarity in operational limitations between these aircraft, using the T-34C would perpetuate current flight time losses because it cannot fly through and

above adverse weather conditions enabling it to accomplish some portion of a planned mission and still proceed enroute to a suitable alternate airfield if necessary. Conversely, if NGT operational requirements are realized, using this alternative aircraft would reduce weather cancellations since it could fly through and above weather, accomplish some portion of a mission, and be capable of going to a suitable alternate airfield.

Use of the T-34C would not relieve airspace congestion

Using the T-34C would not relieve the current airspace congestion at UPT training bases and may even aggravate the problem. Four of the five UPT bases are located near one or more of the Nation's top 100 busiest airports. In addition, approximately 17,000 new civil aircraft are sold and introduced into the national airspace system every year. This influx of civil aircraft is increasing competition for available airspace between 10,000 and 25,000 feet. As this airspace becomes more crowded, it becomes more difficult for the Air Force to operate safely at the lower altitudes. Consequently, training will be forced upward. The availability of UPT training space is dictated by airspace congestion, aircraft performance, and ground elevations.

Because of the airspace congestion and limitations, the Air Force has established a requirement that the UPT primary phase aircraft be able to perform daily training missions at altitudes of 20,000 to 30,000 feet, and some missions up to 35,000 feet. These altitudes are higher than can be achieved in either the T-37B or T-34C. The Air Force expects NGT to solve this T-37B deficiency by effectively using the less congested airspace at higher altitudes where few civil aircraft fly. According to Air Force officials, the T-34C is even less capable than the T-37B in performing the UPT mission at these higher altitudes. The T-34C would, therefore, need to be flown within the heavily traveled lower airspace, adding to the congestion.

Increased demand for low altitude airspace creates a safety hazard between civil aircraft and UPT aircraft flying in training areas. It has also resulted in (1) the Federal Aviation Administration imposing flight restrictions on UPT missions using training areas, (2) numerous interruptions and loss of flight training while avoiding other air traffic until it clears the training area, and (3) a loss of over 600 square miles of UPT training area since early 1977. A further contraction of training airspace is possible.

Ground elevation beneath present primary phase training areas range from about 500 feet to 7,800 feet. To insure an adequate safety margin for maneuver recovery, the bottom of a flight training area is generally moved upward 5,000 to 6,000 feet above the ground elevation.

The close proximity of UPT bases to high concentrations of civil aircraft coupled with the loss of usable airspace and high ground elevations makes it unlikely that training areas could be lowered or located proportionately closer to the UPT bases to compensate for T-34C lower performance. Therefore, the T-34C may not be suitable for supporting future UPT.

Other alternatives to satisfy training requirements which the T-34C cannot meet

Alternatives to the use of the T-34C with additional UPT training, discussed above, that could be taken to satisfy the Air Force's training requirements include (1) use of the T-34C aircraft for UPT training with a transfer of training requirements to operational aircraft and (2) an extension of the T-37B service life. The transfer of training requirements to operational aircraft would be more costly. The Air Force is studying extension of the T-37B service life.

Air Force officials consider any reduction of UPT standards to be unacceptable. They said any reduction in the quality of graduate pilots would ultimately affect the national defense posture. If training standards were reduced, additional flying would probably be done in operational aircraft to overcome the pilot training deficiences. Additional flying in operational aircraft would be more costly and use more fuel than flying trainer aircraft. The following chart of fiscal year 1981 planning factors shows the cost and fuel usage for each flying hour in a T-37B or the T-38 is considerably less than selected operational aircraft.

Aircraft	Fuel required for each flying hour	
	Gallons	Costs
T-37	185	$ 276
T-38	396	619
A-10	576	1,550
C-130A	785	1,500
B-52H	3,349	3,936
FB-111A	1,370	3,596

The cost of fuel has increased since the above planning factors were established. If the price of fuel continues to increase, the disparity in operating costs between trainer aircraft and operational aircraft will become even greater.

Extending the T-37B service life would permit continued usage of the T-37B as a trainer aircraft but would not eliminate other operating deficiencies nor provide sufficient aircraft to accommodate anticipated student loads in 1987 and beyond. The T-37B operating deficiencies include noisy engines, outdated avionics, excessive fuel consumption, a lack of pressurization, limited range, and limited weather capability. As of March 31, 1980, 372 T-37B aircraft had been flown more than 10,000 hours and are, therefore, approaching the aircraft's current certified service life of 15,000 hours. A T-37B aircraft is normally flown about 550 hours each year. The Air Force is performing a durability and damage tolerance analysis of the T-37B airframe to define the inspection and modification requirements which would extend the T-37B service life to 25,000 hours. The analysis is expected to be completed in May 1981. During tests, the Air Force Logistics Command has identified six modifications which would be required to extend the T-37B service life to 25,000 hours. The estimated cost of these modifications was $70,000 an aircraft in 1979 dollars.

WHAT ARE THE LIFE CYCLE COST ESTIMATES OF THE T-34C AND ALTERNATIVE AIRCRAFT?

(Questions 7, 8, 9, 10, 11, 12, 13, and 16 from app. I.)

A life cycle cost comparison prepared by an Air Force consultant concluded that although the T-34C aircraft would be the most cost-effective aircraft if only the primary phase of UPT were considered, it would be the least cost effective if total UPT program costs were considered. Our evaluation shows that (1) the life cycle cost comparison was based on data that could not be substantiated and (2) some costs associated with use of the T-34C were not considered.

Determining the lowest life cycle cost approach to maintaining the Air Force's pilot training capability was the primary objective of the concept exploration studies completed in October 1980. In December 1980, the Air Force completed an evaluation of the life cycle cost data developed by five aircraft manufacturers during these studies. This was completed too late for us to assess the Air Force's evaluation.

The Air Force consultant's analysis compared the life cycle costs of conducting UPT using as a primary trainer

aircraft (1) the current T-37B with a minimum modification to extend service life to 25,000 hours, (2) a modified T-37 which meets NGT requirements, (3) a new T-37 which meets NGT requirements, (4) the T-34C aircraft, and (5) a new design NGT. The consultant made two comparisons of the estimated life cycle costs. When considering only the primary phase of UPT, the estimated life cycle costs using the T-34C was about $2.1 billion, or at least $340 million less than any other alternative. When considering the entire UPT program, however, the estimated life cycle costs using the T-34C as a primary trainer aircraft was about $10.2 billion. This was about $640 million more than using the current T-37B with an extended service life and at least $830 million more than any of the other three alternatives. Appendixes IV and V contain the consultant's life cycle cost comparisons for the UPT primary phase and the total UPT program, respectively, when using each of the five alternative aircraft as the primary trainer aircraft. Some of the assumptions used in the life cycle cost comparisons and our analysis of the assumptions are discussed below.

Cost comparison based on additional flying hours for T-34C

In the life cycle cost comparison, the consultant assumed that more flying hours would be required if the T-34C was used as the primary trainer. The consultant said that because the T-34C has less performance capability, the UPT training syllabi would have to be changed and the number of flying hours would have to be increased. He said some of the training currently done in the primary phase would have to be transferred to the basic phase. In computing the life cycle costs for the T-34C alternative, he assumed that 25 additional flying hours would be required during both the primary and the basic phases of UPT if the T-34C were the primary trainer. For each of the other alternatives considered, the consultant assumed no change in the number of flying hours from the current program.

As discussed in a prior section, an Air Training Command analysis showed that use of the T-34C as a primary trainer aircraft would increase the number of UPT flying hours if training standards are maintained. Therefore, it is appropriate to use additional flying hours when computing the life cycle costs of the T-34C alternative. As previously noted, the number of additional hours would have to be determined through actual experience or appropriate testing.

Number of required aircraft may be understated

Because more flying time would be needed in both the primary and basic phases of UPT if the T-34C were used as the primary trainer, the Air Force estimated a need for additional T-34C and T-38A aircraft if planned pilot training capacity is to be achieved. On the basis of the Air Force's estimated requirements, the consultant understated the T-34C and T-38A aircraft requirements if the T-34C were used as the primary trainer. As a consequence, the Air Force believes the T-34C procurement and total life cycle costs shown in the consultant's study are understated.

An Air Force analysis estimated a need for 83 more T-34C aircraft in the primary phase than shown in the consultant's cost comparison. If only procurement costs are considered, these additional aircraft would add about $35 million to total T-34C life cycle costs. The Air Force analysis also showed a need in the basic phase for 100 additional T-38A aircraft if the T-34C were the primary trainer aircraft and planned pilot training capacity were achieved. The acquisition cost of these aircraft, however, was not included in the consultant's computation of life cycle costs for the T-34C alternative. Using only procurement cost, the 100 additional T-38 aircraft would add $160 million to the life cycle costs of the T-34C alternative.

Predicated on the increase in UPT syllabus hours, the need for additional aircraft appears reasonable.

Fuel consumption may be more than estimated

Fuel usage for some aircraft included in the life cycle cost comparison had to be estimated because there was no actual experience. Fuel saved by using the T-34C during the primary phase would be offset by increased flying time in the T-38 during the basic phase.

The consultant's comparison showed that if the T-34C were used during the primary phase, the 20-year fuel costs for the total UPT program would be $477 million more than if NGT were used during the primary phase, and $417 million more than if a new or modified T-37 were used. The fuel cost for the T-34C alternative is more because of the additional flying in the T-38 during the basic phase. Our computation of fuel consumption showed similar results.

While actual fuel consumption data was available for the T-34C and the T-37B, no such data was available for other

aircraft considered in the study. In computing life cycle costs, the consultant estimated 80 gallons a flying hour for NGT and 90 gallons an hour for a modified or new T-37. According to Air Force officials, engines considered during the NGT concept exploration studies were off-the-shelf or modified off-the-shelf candidates. Air Force officials said study efforts indicated that fuel usage would be about 80 to 90 gallons an hour or less. Therefore, the consultant's estimates appear reasonable.

Any increased flying time during the basic phase would add to the cost of the UPT program because the T-38 uses more fuel. While the T-34C and the T-37B use 37 and 185 gallons of fuel each flying hour, respectively, the T-38 uses 396 gallons each flying hour. Therefore, fuel savings from using the T-34C during the primary phase would quickly be offset by additional flying in the T-38 during the basic phase.

The life cycle cost estimates may have been understated because actual fuel usage for the T-38 may be greater than the amount the consultant used. In the life cycle cost comparison, the consultant used a May 1979 Air Force pamphlet showing consumption of 390 gallons a flying hour for the T-38. A February 1980 Air Force pamphlet containing fiscal year 1981 cost and planning factors shows the T-38 aircraft uses 396 gallons of fuel each flying hour. Therefore, fuel consumption for the total UPT program may be understated by 6 gallons for each T-38 flying hour for all alternatives considered. The understatement would affect fuel costs more if the T-34C were the primary trainer because an estimated 25 additional flying hours in the T-38 would be required. Assuming 25 additional hours in the T-38, the additional 6 gallons of fuel for each T-38 flying hour would increase fuel costs for the T-34C alternative about $9 million more than the increase in fuel costs for the other aircraft alternatives.

The consultant also understated the T-37B fuel consumption. In computing the T-37B fuel consumption, the consultant used 180 gallons for each flying hour. Air Force data showed the T-37B used 185 gallons an hour. On the basis of 185 gallons for each hour, the fuel costs for the T-37B alternative would be about $30 million more than shown in the consultant's comparison.

Estimated costs based on contractor proposals

Estimated costs included in the life cycle cost comparison for some alternatives were based on contractor proposals and cannot be completely substantiated at this time. Analysis of available data showed, however, that estimated costs for the modified or new T-37 alternatives were reasonable or possibly overstated while the estimated costs for the T-34C alternative may be understated. Some of the NGT estimated costs could not be verified.

The consultant based the estimated acquisition (research and development and procurement) costs for a modified or new T-37 on a 1978 unsolicited proposal submitted by the T-37 manufacturer. The estimates in the unsolicited proposal were based on producing 600 aircraft while the consultant based his estimate on the procurement of 401 aircraft. Extrapolation of data in the unsolicited proposal showed the estimated acquisition costs for a modified or new T-37 in the life cycle cost comparison was reasonable.

The consultant based the estimated NGT acquisition costs on information provided by three aircraft manufacturers, including two who responded to the NGT concept definition request for proposals. The consideration of life cycle costs during concept definition studies is discussed in a later section. Because of the competitive environment during the concept definition studies, we did not contact any aircraft manufacturers and were, therefore, unable to determine whether the estimated NGT acquisition costs were reasonable.

The consultant based the T-34C procurement costs of $204 million on data provided by Beech Aircraft and included about $11 million for possible Air Force changes. This amount may, however, be understated. For example, installation of ejection seats in the T-34C would cost $70,000 to $80,000 an aircraft, and increase the total T-34C procurement cost by as much as $37 million.

The life cycle operating and support costs for the T-37B, T-38, and the T-34C were based on Air Force and Navy actual costs while the life cycle operating and support costs for the modified or new T-37 and the NGT were based on manufacturers' proposals. The consultant used Air Force fiscal year 1980 cost and planning factors as the basis for computing the life cycle operating and support costs for the T-37B and the T-38.

In its concept of operation for the UPT primary phase, the Air Training Command anticipated that a modern easier to maintain aircraft could substantially reduce maintenance requirements. The consultant estimated the life cycle operating and support costs for the modified or new T-37 and the NGT to be about 83 percent of the T-37B costs. Conversely, in its 1978 unsolicited proposal, the T-37 manufacturer estimated that maintenance requirements for a modified or new T-37 would be about 65 percent of the T-37B requirements. On the basis of these factors, the consultant's estimated life cycle operating and support costs for a modified or new T-37 and the NGT may be overstated. The concept exploration studies, discussed later, should better define the expected operating and support costs of a T-37B replacement.

The consultant used data from the Navy's T-34C maintenance contract to compute the T-34C operating and support costs. He stated, however, that if Air Force personnel were used to maintain the T-34C, the number of maintenance hours for each flying hour would probably be more than that now used by the T-34C maintenance contractor. Under the present UPT program, the Air Force uses Air Force maintenance at four UPT bases and contractor maintenance at only one UPT base. Air Force officials said this practice would probably continue if the T-34C was the primary trainer. If Air Force personnel were used to maintain aircraft, the T-34C maintenance costs could be more than now included in the life cycle cost comparison.

Other life cycle costs not considered

Other life cycle costs associated with using the T-34C as a primary trainer aircraft were not included in the consultant's cost comparison. Air Force analysis of the UPT syllabus shows the need for additional flight simulator time, another training base, and more instructor pilots if the T-34C is used as the primary trainer. The comparisons of total life cycle costs did not include any amounts for these factors and therefore, may be understated.

An Air Force analysis shows that to compensate for the slower T-34C speeds, an additional 10.4 hours of flight simulator time is necessary for each student to maintain the present level of simulator training. The consultant did not include any costs for additional simulator training. The increased simulator time would add at least $40 million to total T-34C life cycle costs.

Using the T-34C could extend the UPT course length and reduce the annual pilot training capacity. Therefore, a sixth UPT base could be required to meet future Air Force pilot production needs. The cost to open and operate another base over a 20-year period could add an additional $71½ million to total T-34C life cycle costs.

Using the T-34C as a primary trainer would require an estimated 160 more T-34C instructor pilots and over 200 additional T-38 instructor pilots to support both current and planned UPT. Although no cost was estimated for the increased number of instructor pilots, it would nevertheless be a significant addition to total T-34C life cycle costs.

Life cycle cost considered during concept exploration studies

Determining the lowest life cycle cost approach to maintain the Air Force pilot training capability was the primary objective of the concept exploration studies completed in October 1980 by five aircraft manufacturers. Air Force evaluation of the study results was completed in December 1980.

In June 1980 the Air Force awarded contracts to five aircraft manufacturers to perform concept exploration studies of alternative aircraft that would meet the NGT requirements. During the studies, each contractor selected one or more alternative aircraft and performed tradeoff studies to define the most cost-effective aircraft that would meet the NGT requirements. The alternative aircraft were

--modernized T-37B aircraft,

--other existing aircraft or modified aircraft, and

--new aircraft designs.

Using an operating and support cost model provided by the Air Force, each contractor prepared a life cycle cost estimate of its proposed concept. The estimate included the cost of research and development, production, operation, and support.

Because of the competition, we did not contact any of the contractors making the studies. In December 1980 the Air Force completed its evaluation of the life cycle estimates submitted by the five contractors. This was computed too late for us to assess the Air Force's evaluation.

APPENDIX II

Eliminating twin-engine, side-by-side requirement may not produce savings

Available data does not show whether any savings would result if the Air Force eliminated the NGT requirement for a twin-engine, side-by-side seat aircraft. In March 1978 the Air Force issued a request for information to obtain thoughts, suggestions, and supporting data from the aircraft industry on such issues as single engine versus twin engine and tandem versus side-by-side seating in a replacement for the T-37B aircraft. Eight aircraft manufacturers submitted information about 17 possible designs based on 1 of the following 4 aircraft configurations: twin engine with side-by-side seating; single engine with side-by-side seating; twin engine with tandem seating; and single engine with tandem seating. The responses showed a wide range of estimated development, production, and life cycle costs for each configuration.

Three manufacturers submitted estimated cost data on three or more configurations. Our analysis of this cost data was inconclusive. The following examples illustrate the inconsistency of the cost data.

--One manufacturer's estimated production and life cycle costs for a single-engine, tandem seat aircraft were more than comparable costs for either twin-engine aircraft. Conversely, another manufacturer's estimated production and life cycle costs for a single-engine, tandem seat aircraft were less than the comparable costs of either twin-engine aircraft.

--When comparing the life cycle costs of side-by-side seat aircraft, one manufacturer estimated higher cost for a single-engine aircraft while a second manufacturer estimated lower cost.

--For twin-engine aircraft, one manufacturer estimated the same production and life cycle costs for either seating arrangement while the other two manufacturers estimated higher production and life cycle costs for the tandem seat aircraft.

The cost data did not show any distinct advantage for any particular aircraft configuration. Therefore, operational considerations could be a significant factor in determining the NGT aircraft configuration.

HAS THE AIR FORCE COMPLIED WITH OMB CIRCULAR A-109?

(Questions 14, 15, 17, 18, and 19 from app. 1.)

Air Force requirements and actions effectively eliminated the T-34C from consideration for its primary trainer aircraft role and, in this one aspect, were not consistent with the intent of A-109. A-109 calls for eliminating alternatives, to the extent possible, within prescribed policies and procedures in a competitive environment in the acquisition process. In this case, however, the Air Force issued a request for proposals which effectively eliminated the T-34C from consideration before the competition started, because of its perceived handling and performance characteristics.

Request for study proposals was too restrictive

Although the MENS did not establish a requirement for a twin-engine, side-by-side seat aircraft, the request for proposals for the NGT concept exploration studies limited the aircraft configuration to twin engine and side-by-side seating, effectively eliminating the T-34C aircraft from consideration. Therefore, we believe that in this respect, the request for proposals did not fully comply with the intent of OMB Circular A-109.

OMB Circular A-109 states that agencies acquiring major systems should express needs and program objectives in mission terms, rather than in equipment terms, to encourage innovation and competition in creating, exploring, and developing alternative system design concepts. It also states that requests for alternative system design concepts will explain the mission need, schedule, cost, capability objectives, and operating constraints; and that each offeror should be free to propose its technical approach, main design features, subsystems, and alternatives to schedule, cost, and capability goals.

OMB Circular A-109 provisions are implemented by DOD Directive 5000.1 and Instruction 5000.2. Directive 5000.1 states that development of a new system may begin after assessment of alternative system concepts including use of existing military or commercial system or modification of an existing system. DOD Instruction 5000.2 states that alternative concept solutions to a mission need shall be obtained competitively unless the Secretary of Defense has approved a single concept in approving the MENS.

The MENS, approved June 26, 1979, did not specify an aircraft configuration, but it did address the use of the T-34C aircraft by stating specific reasons why it was considered unsuitable for Air Force primary training. The MENS was based on an Air Training Command requirements document, dated March 1978, which stated that side-by-side seating for optimum training techniques and two turbofan engines of fuel efficient design were mission essential requirements. In a February 15, 1980, directive, Air Force Headquarters directed the Air Force Systems Command to conduct a conceptual phase competition consistent with OMB Circular A-109 but stated that a twin-engine, side-by-side seating configuration was a fundamental requirement. The directive also stated that contractors should not be precluded from submitting alternate proposals containing new ideas and/or unique approaches.

On February 15, 1980, Air Force Systems Command issued a RFP for NGT concept exploration studies. The RFP stated:

> "* * * Aircraft configuration shall be limited to twin engine and side-by-side seating. The offerors must be responsive to this requirement to be considered as a candidate. However, if any offerer desires to submit an alternate design solution in addition to the stated requirement, the alternate will also be considered. Beyond this, it is the Government's intent to provide considerable flexibility for the contractor to identify solutions which balance system performance, system design, life cycle cost, supportability, and program risk."

The RFP outlined 15 tasks to be accomplished during the studies with the objective of determining the lowest life cycle cost approach to maintaining Air Force pilot training capability. The RFP also contained an analysis of 18 NGT operating requirements, such as speed, rate of climb, and altitude.

The Air Force solicited proposals from 33 companies. Nine companies submitted proposals to conduct the concept exploration studies. Although turbofan engines were originally envisioned, at least one proposal was for a concept that did not include turbofan engines. The Air Force found eight proposals to be technically acceptable and awarded study contracts to five companies. An official of Beech Aircraft Corporation, the T-34C aircraft manufacturer, advised Air Force officials that Beech would not submit a proposal because the proposal preparation and study would require expending a substantial

amount of company funds and the possibility of winning a development contract was rather limited.

OMB officials monitoring the NGT acquisition program said that the programing organization is responsible for determining its requirements, and that Air Force requirements for an aircraft with a twin-engine, side-by-side seating configuration were appropriate if validated by the Secretary of Defense. In discussions with Air Force officials, OMB officials expressed concern that the NGT requirements for twin engines and side-by-side seating had not been appropriately validated by the Secretary of Defense.

Since the approved MENS for the NGT program did not specify a requirement for a twin engine, side-by-side seat aircraft, the requirement in the NGT concept exploration studies RFP for such an aircraft was more restrictive. We believe the RFP language virtually eliminated any aircraft, like the T-34C, that did not have two engines and side-by-side seating. In generating nine proposals, the RFP did, however, generate competition--a primary A-109 objective.

Alternative development proposals will be evaluated

Although only the contractors who completed concept exploration studies will be solicited for full-scale development proposals, the Air Force will evaluate any proposal, whether solicited or unsolicited, that meets the proposal requirements for full-scale development. As requested in the August 1980 Conference Report of the Armed Services Committees, the Air Force will include the T-34C aircraft when evaluating the various alternatives.

The RFP for the NGT concept exploration studies advised the prospective offerors that competition for the follow-on effort may be limited to those contractors successfully completing the concept exploration studies. The Air Force revised the RFP on March 5, 1980, to read,

> "The contractors performing the concept definition studies will be the only sources from which the Air Force will solicit proposals for performance of the follow-on Full-Scale Engineering Development contractual efforts."

The Air Force contracts for conceptual studies awarded in June 1980 also contain this specific language. Air Force officials said OMB officials suggested the change.

APPENDIX II

The NGT Program Director said the Air Force will solicit proposals for full-scale development from only the five contractors who conducted the concept exploration studies. He also stated that under existing procurement procedures, the Air Force must evaluate any unsolicited proposals for full-scale development. All proposals, whether solicited or unsolicited, will have to meet the proposal requirements for full-scale development. In the August 1980 Conference Report, the Armed Services Committees requested that the Air Force restructure the NGT program to include the T-34C aircraft among the alternatives being evaluated as potential replacements for the T-37B. As of December 1980, Air Force officials were developing the criteria for evaluating all alternatives including the T-34C.

DOD Instruction 5000.1 states that development of a new system may begin after assessment of alternative concepts including existing systems. The Navy currently uses the T-34C aircraft as a primary trainer and plans to continue using it as a primary trainer with the Undergraduate Jet Flight Training System, an advanced trainer system now being acquired. The Air Force may replace its basic trainer, the T-38 aircraft, with the Undergraduate Jet Flight Training System. In view of this, the T-34C should be considered as a possible Air Force primary trainer. It must be noted, however, that the T-38 could remain in service until the late 1990s or beyond.

APPENDIX III

COMPARISON OF NEXT GENERATION TRAINER REQUIREMENTS

WITH T-37B AND T-34C CAPABILITIES

Design parameter	NGT requirement	T-37B capability	T-34C capability
Critical field length (note a)	5,000 ft.	7,500 ft.	2,500 ft.
Landing distance (note b)	5,000 ft.	3,200 ft.	1,500 ft.
Rate of climb--minimum (note c)	400 f.p.m.	0 f.p.m	No power
Rate of climb--full power (note d)	2,000 f.p.m	900 f.p.m.	450 f.p.m.
Final approach speed	90 to 110 KIAS.	100 KIAS.	80 to 100 KIAS.
Crosswind landing capability	25 kts.	13 kts.	15 kts.
Cruise speed (note d)	300 KTAS.	326 KTAS.	205 KTAS.
Cruise altitude	35,000 ft.	25,000 ft.	25,000 ft.
Sustained load factor (note d)	2.5 "G's"	2.5 "G's" at 15,000 ft.	2.5 "G's" at 15,000 ft.
Range	1.5 hours at 15,000 ft., missed approach to cruise altitude and 300 n.m. alternate with fuel reserve	1.8 hrs.	1.5 hours at 15,000 ft., missed approach and 225 n.m. alternate with fuel reserve
Anti-ice equipment	Pass through moderate conditions	None	None
Pressurization	e/35,000 feet	None	None
Oxygen supply system	Nongaseous	Gaseous	Gaseous
Ejection seats (note f)	Safe	Not safe	None
Windscreen bird impact	4-lb. bird at maximum level speed	4-lb. bird at 250 KIAS.	Not certified
Air-conditioning	Comfortable	Improvement needed	Comfortable
Crew seating	Side-by-side	Side-by-side	Tandem
Engines	Twin turbofan	Twin turbofan	Single turboprop

Legend: lb. - pound; n.m. - nautical mile; kts. - knots; KTAS. - knots true airspeed; ft. - feet; KIAS. - knots indicated airspeed; f.p.m. - feet per minute; "G" - gravitational force: one "G" equals the pull of Earth

a/Maximum runway length necessary.

b/Maximum over a 50-ft. obstacle with wet runway and normal braking.

c/With one engine out and landing gear down.

d/At 25,000 ft.

e/Maintained at or below 18,000 ft. cockpit altitude.

f/Safe ejection during normal approach until capable of glide to runway.

APPENDIX IV

LIFE CYCLE COMPARISON

FOR PRIMARY UPT PROGRAM

Description	Alternate primary phase aircraft (note a)				
	T-37 (note b)	T-37 modification (note c)	T-37D (note d)	T-34C (note e)	NGT (note f)
Syllabus hours (primary)	74.4	74.4	74.4	100.0	74.4
Required airframes	456	401	401	473	381
	(dollars in millions--FY 1980)				
20-year life cycle cost:					
Acquisition cost	$ 33.3	$ 348.9	$ 457.3	$ 204.0	$ 569.8
Research and development	-1.4	-72.8	-72.8	-	-130.0
Production	-31.9	-276.1	-384.5	-204.0	-439.8
Air Force test and evaluation	5.0	14.4	14.4	14.4	26.0
Initial operation and support	-	84.5	93.2	50.8	142.4
Life cycle operation and support	1,795.0	1,483.9	1,491.2	1,566.6	1,500.5
Fuel cost ($1.17 per gal.)	1,066.6	533.4	533.4	287.6	474.1
Total	$2,899.9	$2,465.1	$2,589.5	$2,123.4	$2,712.8
Percent of current program life cycle cost	100.0	85.0	89.3	73.2	93.5
Fuel consumption (millions of gal.)	912	456	456	246	405
Percent of current program fuel consumption	100.0	50.0	50.0	27.0	44.4

a/Includes both student and instructor pilot training.

b/Minimum modification to extend service life.

c/Reengine and other modifications to meet NGT RFP.

d/New T-37 per NGT RFP.

e/Off-the-shelf T-34C.

f/New design aircraft.

LIFE CYCLE COMPARISON FOR TOTAL UPT PROGRAM

Description	Alternative primary phase aircraft (note a)				
	T-37 (note b)	T-37 modification (note c)	T-37D (note d)	T-34C (note e)	NGT (note f)
Syllabus hours:					
Primary	74.4	74.4	74.4	100.0	74.4
Basic	101.0	101.0	101.0	126.0	101.0
Total	175.4	175.4	175.4	226.0	175.4
Required airframes	456	401	401	473	381
	----------(dollars in millions--FY 1980)---------				
20-year life cycle cost:					
Acquisition cost	$ 33.3	$ 348.9	$ 457.3	$ 204.0	$ 569.8
Research and development	-1.4	-72.8	-72.8	-	-130.0
Production	-31.9	-276.1	-384.5	-204.0	-439.8
Air Force test and evaluation	5.0	14.4	14.4	14.4	26.0
Initial operation and support	-	84.5	93.2	50.8	142.4
Life cycle operation and support	5,556.5	5,245.4	5,252.7	6,085.4	5,262.0
Fuel cost ($1.17 per gal.)	3,972.7	3,439.5	3,439.5	3,857.1	3,380.1
Total	$9,567 5	$9,132.7	$9,257.1	$10,211.8	$9,380.3
Percent of current program life cycle cost	100.0	95.5	96.8	106.7	98.0
Fuel consumption (millions of gal.)	3,395	2,940	2,940	3,297	2,889
Percent of current program fuel consumption	100.0	86.6	86.6	97.1	85.1

a/Includes both student and instructor pilot training. The Northrop T-38A is used for the basic training phase in all options.

b/Minimum modification to extend service life.

c/Reengine and other modifications to meet NGT RFP.

d/New T-37 to meet NGT RFP.

e/Off-the-shelf T-34C.

f/New design aircraft.

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