United States General Accounting Office

GAO

Testimony

For Release
on Delivery
Expected at
9:30 a.m. EDST
Tuesday
June 19, 1990

Status of the Air Force's C-17 Aircraft Program

Statement of
Nancy R. Kingsbury
Director, Air Force Issues
National Security and International Affairs
Division

Before the
Subcommittee on
Projection Forces and Regional Defense
Committee on Armed Services
United States Senate

048778 / 141616

GAO/T-NSIAD-90-48

Mr. Chairman and Members of the Subcommittee:

I am pleased to be here today to discuss GAO's concerns about cost increases, schedule problems, and the risks of concurrency in the C-17 aircraft program. In August 1989 we reported[1] that the program faced significant cost, schedule, and performance challenges. On April 26, 1990, the Secretary of Defense proposed to restructure the C-17 program significantly by reducing (1) the program from 210 to 120 production aircraft, (2) the pending fiscal year 1991 budget request from 6 to 2 aircraft in fiscal year 1991, and (3) advanced procurement funds from 12 to 6 aircraft in fiscal year 1992. We have continued to review the program, and our testimony provides current information on the status of the program.

RESULTS IN BRIEF

Even though some progress has been made in developing the C-17 aircraft, the program still faces significant cost and schedule challenges. For example, in the past year, before the Secretary's decision to reduce the number of C-17s, the cost estimate for the original 210 production aircraft program had increased 11 percent, from $37.5 billion to $41.8 billion. Also, the C-17's first flight date has slipped from August 1990 to June 1991, and further delays

---

[1]Military Airlift: C-17 Faces Schedule, Cost, and Performance Challenges (GAO/NSIAD-89-195, Aug. 18, 1989).

may occur because of continuing difficulties with aircraft assembly and avionics development and testing. In addition, the projected weight of the aircraft could still adversely affect whether the contract performance requirements can be met.

On the basis of current schedule delays and the resulting funding buildup, we believe that Congress should consider further reducing the proposed fiscal year 1991 buy of two C-17 aircraft and the advanced procurement funds for 6 aircraft in fiscal year 1992. This could provide an opportunity to further reduce concurrency in the program by having the Air Force limit production commitments until the critical elements of a realistic and achievable flight test program are completed and any identified problems resolved. DOD, Air Force, and contractor officials have told us that any further reduction in the fiscal year 1991 program could cause problems for the subcontractors. It is not our intention to cause difficulties for the subcontractors. However, even with the reduction to two aircraft in fiscal year 1991, there is still a high degree of concurrency risk in the program. Reducing the 1991 buy could reduce the risk of concurrency further.

BACKGROUND

The Air Force and Douglas Aircraft Company (Douglas), McDonnell Douglas Corporation, are developing the C-17 aircraft to modernize and improve the Air Force's intertheater (from one area of

operation to another) and intratheater (operations within the same area) airlift capability. The aircraft is expected to improve U.S. capability to rapidly project, reinforce, and sustain combat forces worldwide.

The C-17 will be a four-engine, wide-body aircraft with a three-person crew. It is being designed to airlift substantial payloads over long ranges without refueling. The C-17's projected ability to airlift the full range of military cargo directly into small, austere airfields distinguishes it from the other aircraft in the airlift force, such as the C-5, C-141, and C-130.

The Air Force planned to acquire 211 C-17 aircraft (1 test aircraft and 210 production aircraft) through fiscal year 1999. The program is currently in full-scale development and transitioning to concurrent development and low-rate initial production. The C-17's first flight was planned for June 1991. An Air Force test plan, that combined development, test, and evaluation and initial operational test and evaluation was scheduled to be completed by June 1993. Initial operational capability was also scheduled for June 1993.

On April 26, 1990, the Secretary of Defense testified before the House and Senate Committees on Armed Services on the results of a review of several major aircraft programs, including the C-17. During his testimony, the Secretary recommended that the C-17

program be reduced from 210 production aircraft to 120 production aircraft. The change was based, in part, on the results of the major aircraft review for the C-17. The recommendation is estimated to reduce the President's fiscal year 1991 budget request from about $2.7 billion for 6 aircraft in fiscal year 1991 and advanced procurement funds for 12 aircraft in fiscal year 1992 to about $1.7 billion for 2 aircraft in fiscal year 1991 and advanced procurement funds for 6 aircraft in fiscal year 1992. According to the Secretary, these reductions would allow more time for flight testing before the production rate increases. The cost to buy 120 aircraft was estimated to be about $29.9 billion, or about $11.9 billion less than the current estimate of $41.8 billion to buy 210 aircraft. The Air Force is refining the recommended reduction by calculating specific cost and schedule impacts.

PROGRAM COST

The Secretary's decision to reduce the number of aircraft in the C-17 program will reduce the estimated cost of the program. However, based on a history of significant cost growth in the program to buy 210 aircraft, DOD and the Air Force will have to take actions to ensure that the program to buy 120 aircraft does not also have rapid cost growth.

Total Program Cost Growth

When full-scale development of the C-17 began in 1985, DOD estimated the program acquisition cost would be $34.5 billion in then-year dollars. In 1989 the estimate increased by $3 billion to $37.5 billion. The most recent estimate for the 210 aircraft is $41.8 billion, an increase of $7.3 billion, or 21 percent, since 1985. As reported in DOD's December 31, 1989 Selected Acquisition Report, the latest increase of $4.3 billion was caused by increased projected inflation rates and delays in the program. The recommended reduction to 120 aircraft will reduce total program cost. The Air Force is still working on new estimates of program cost and schedule to reflect the recommended reduction.

Buildup of Funds

Delays in the production of C-17 aircraft have resulted in a buildup of unobligated funds for the program. The Congress appropriated $1.2 billion in fiscal year 1990 for the production of four C-17 aircraft. However, as of April 30, 1990 (the halfway point of this fiscal year), only about $172 million had been obligated. The contract award and release of procurement funds for the fiscal year 1990 buy of four aircraft is not scheduled to occur until after the test aircraft is completed in December 1990. Also, the Air Force does not plan to provide Douglas with the fiscal year

1991 production funds until September 1991, near the end of the fiscal year.

Research and Development Costs

You requested specifically that we review C-17 research and development costs to determine why these costs seemed proportionately high for an aircraft that employs few technologies that have not been used in other Air Force or commercial airplanes. Our review of this issue is ongoing, but we can provide you with a summary of our findings to date.

The Air Force estimate of C-17 research, development, test, and evaluation (RDT&E) costs is about $5.34 billion as of December 1989, or about 13 percent of the total cost for 210 aircraft. About $725 million of this is for initial tooling for the C-17. The October 15, 1986 Conference Report on Making Continuing Appropriations for Fiscal Year 1987 required that C-17 initial tooling be funded with RDT&E funds, rather than with production funds. Normally, RDT&E funds are used for engineering development, construction of the test aircraft, and testing.

Our analysis shows that the most significant contributors to RDT&E costs are related to integrating the component systems and structures into a workable aircraft, testing the component systems and structures to ensure that the aircraft will be able to meet

specific performance requirements, and procuring the developmental aircraft's engines and wing. Although the C-17 involves many technologies that have been used in other aircraft, Air Force and Douglas officials consider the C-17 to be a state-of-the-art transportation aircraft, and not significantly complex. However, these officials have emphasized that the design of a new military airframe and the integration of new components, even when the technologies are proven, is a sophisticated and expensive effort.

SCHEDULE

The first flight of the C-17 development aircraft has been delayed from August 1990 to at least June 1991. The delay was caused by continuing difficulties with aircraft assembly and avionics development and testing.

Assembly Delays

Since assembly began in August 1988, Douglas has continually missed major assembly milestones. For example, the milestone of joining the wing to the fuselage was originally scheduled to start in June 1989, but it started in March 1990, a delay of 9 months. Completion of assembly of the first aircraft was originally planned for January 1990, but Douglas currently plans to complete assembly by December 1990, a delay of 11 months. Because of production problems, at the end of 1989 the major milestones for the test

aircraft were rescheduled. According to the Program Director, this revised assembly schedule is being met. For example, Douglas started joining the development aircraft's wing and fuselage in March 1990. This met the revised assembly schedule program.

In 1989 we reported that slips in the assembly schedule were caused by late engineering drawings and late delivery of tools and parts. These problems still exist and have caused work that was planned to be completed early in the assembly process to be postponed and done further down the assembly line. Douglas' current plans do not show how the deferred work can be completed in time to support the planned June 1991 first flight date. As a result, we believe it is difficult to predict when the first flight of the C-17 will occur.

Avionics Development and Testing

In 1989 we reported that subcontractors were behind schedule in developing mission computer software and electronic flight control system hardware and software. These delays caused Douglas to change its software development strategy and delivery schedules.

The C-17's mission computer provides the primary electronic communications link for the aircraft's avionics systems, controls the pilot displays, and facilitates other mission-related functions. Mission computer software is critical to completing

the integration of the C-17's avionics systems before the first flight test of the development and production aircraft.

The Air Force originally planned to have all of the mission computer's software available for the first flight test of the development aircraft. The software currently available for the first flight test will perform about 40 percent of the required functions and support the first 6 months of flight testing. Current plans call for most of the software to be available before the first production aircraft flight test, currently scheduled for September 1991.

To support avionics integration, mission computer software is being delivered in segments between February and October of this year. Fully qualified flight software is scheduled for delivery in October and fully tested hardware and software in early December. Douglas officials told us that first flight would be jeopardized if the software is late and that, even if deliveries are on time, the integration test schedule is ambitious. According to Douglas officials, recent software deliveries have been on time and the integration test schedule is typical of new development programs.

The electronic flight control system is a key element that must be integrated with the mission computer. The electronic flight control system directs and controls the movement of the aircraft.

Progress has been made with this system since our last report. In 1989 Douglas selected a new subcontractor, centralized flight control system development in a new organization, and added managers and engineers with experience in electronic flight control system development. To date, the subcontractor is ahead of schedule, but completing and qualifying the first version of electronic flight control system software by October 31, 1990, remains a challenge.

Concurrency

In 1989, we expressed concern over the concurrency that was planned in the C-17 program, that is, the extent to which development and production overlapped. We noted that concurrency can be an effective technique to expedite fielding a system. However, it must be well planned and managed or it can cause cost, schedule, and performance problems.

Under the program to buy 210 aircraft, concurrency would have increased. For example, delays in the flight test program had increased the program's concurrency to the point that procurement of 52 aircraft, or about 25 percent of the total production, would have been requested before flight testing would be completed. Even with the Secretary's recommendation to reduce the number of aircraft from 210 to 120 and the fiscal year 1991 buy from 6 to 2 aircraft, concurrency still exists.

If flight testing is completed as scheduled in June 1993 and the 1991 buy is carried out as proposed by the Secretary, funds for 30 C-17 aircraft, which is still 25 percent of the revised buy of 120 aircraft, could be authorized before flight testing is completed. However, if no aircraft are authorized in fiscal year 1991, 2 aircraft are authorized in fiscal year 1992, and 4 in fiscal year 1993, funds for only 16 aircraft would be authorized for production before flight testing is scheduled to be completed in fiscal year 1993. This would result in significantly less concurrency. The Air Force is still working on a new production schedule.

CONTRACTOR PERFORMANCE

The Air Force Plant Representative Office (AFPRO) assigned to Douglas is responsible for determining whether Douglas' performance in areas such as engineering and design management, manufacturing operations, quality assurance, and subcontractor management is effective. Over the last 2 years, the AFPRO has identified problems with manufacturing, software development, quality assurance, scheduling, cost estimating, and subcontractor management. The AFPRO believes Douglas does not have the systems in place to effectively manage these areas. As a result, the AFPRO believes that Douglas cannot produce the C-17 to either budgeted cost or planned schedule. GAO's observations on the C-17 program support the AFPRO's assessment.

According to the AFPRO, Douglas' lack of cohesive and organized systems resulted in late drawings, parts shortages, late supplier deliveries, and unacceptable quality. The AFPRO believes these are the reasons that the C-17 is behind schedule and over budgeted cost. The AFPRO advised Douglas that upper-level management oversight, planning, and integration are needed. Douglas is developing plans to address these issues. The AFPRO believes that Douglas cannot produce the C-17 cost-effectively, with acceptable quality, and on a predictable schedule until these areas of deficiency are corrected.

Recently, the Assistant Secretary of the Air Force for Acquisition ordered a review of contractor problems identified by the AFPRO. As a result of the review, Douglas and Air Force officials have established an executive level Quality Council to resolve these system problems. In addition, the Deputy President for Douglas told us McDonnell Douglas Corporation is committed to correcting the problems in the program, as shown by the numerous senior managers and engineers the corporation has transferred to Douglas. As we continue assessing the C-17, we will evaluate the impact of these changes.

PROJECTED AIRCRAFT WEIGHT

Aircraft weight is a principal factor that determines whether an aircraft can meet payload, range, and takeoff and landing performance requirements. The program office believes that the current estimated weight of the C-17 will cause it to fall short of contract requirements. The program office does not intend to reduce this contract requirement and is working with Douglas to improve aircraft performance and revitalize Douglas' weight savings program. According to the Commander-in-Chief, Military Airlift Command, the C-17's performance will be improved by changing the jet fuel the aircraft would use.

REDUCTION IN REQUIREMENTS

When the Secretary of Defense recommended a reduction in the program buy from 210 to 120 aircraft, he acknowledged that airlift requirements had been reduced. He noted that, until recently, the possibility of a major conflict in Europe coupled with simultaneous action in another region had driven the demand for military air transport capacity. He added that although changes in Europe have reduced these requirements, the most effective means to deter crises in other regions is to be able to react with a rapid buildup of combat power. According to the Secretary, the C-17 remains the most effective transport aircraft for meeting

airlift goals because of its ability to utilize the shorter runways typical of third world countries and deliver outsized cargo.

In December 1989, the Secretary of Defense directed a review of four aircraft programs including the C-17. The House Committee on Armed Services has requested that we evaluate the Secretary's review of the C-17. We have just begun our work, but we can provide you with some initial information. A DOD steering group and four working groups were established to review the four aircraft programs, including one for the C-17. The groups were to examine (1) the capabilities needed that are not provided on current aircraft, (2) the extent to which the aircraft under review would provide the needed capabilities, and (3) the fiscal and acquisition strategy considerations, including cost, schedule, and performance. The group reviewing the C-17 developed and analyzed seven alternatives involving mixtures of different airlift aircraft. Resulting airlift capacity and total acquisition cost were calculated for each alternative. According to DOD officials, the Secretary considered this analysis and other information when making his recommendation to reduce the number of aircraft in the C-17 program.

IMPACT OF REDUCING FISCAL YEAR 1991 PROGRAM FURTHER

The President's fiscal year 1990 budget requested 10 C-17 aircraft in fiscal year 1991, but the fiscal year 1991 budget submission reduced the fiscal year 1991 request from 10 to 6 aircraft. The Secretary of Defense has proposed a further reduction to two aircraft in fiscal year 1991 and advanced procurement funds for only six aircraft. Preliminary DOD estimates show that these reductions in aircraft would reduce funding requirements in fiscal year 1991 from $2.7 billion to $1.7 billion. According to the Secretary of Defense, this reduction should also allow more time for flight testing before production is increased.

As discussed above, the program is experiencing schedule delays--completion of assembly of the first aircraft has slipped 11 months. Also, funding for the program is building up--over 85 percent of the fiscal year 1990 funds had not been obligated halfway through the fiscal year. Contributing to the funds buildup problem is the fact that contract award and release of funds for the fiscal year 1990 program will not occur until after December 1990 which is in fiscal year 1991. Even with the Secretary's proposed reduction, concurrency would still be a problem. Given these circumstances, we believe that Congress should consider reducing the fiscal year 1991 C-17 program further. This would provide an opportunity to revise the production schedule, reduce

the amount of program funds that are unobligated, and reduce concurrency in the program further by allowing additional time to perform flight tests before production is increased.

On the other hand, delaying the procurement of the C-17 could increase total acquisition costs because of inflation, unless significant production efficiencies are achieved. Air Force and Douglas officials have told us that eliminating one year's production, while continuing research and development and advanced parts procurement, would send the wrong signal to subcontractors. They said that the subcontractors may then decide to delay purchasing or not to invest in equipment they would need to increase C-17 production. They also told us that a delay could result in the cancellation of some subcontracts. It is not our intention to cause problems for the subcontractors. However, even with the fiscal year 1991 reduction there is still a great deal of concurrency risk in the program. Additional reductions in funding for the fiscal year 1991 program could reduce concurrency risk further. Therefore, we believe that the possible negative effects of reduced production funding in 1991 would be offset by benefits from a less concurrent program.

The Air Force is currently developing a new production schedule for the C-17. Now would be a good time for the Air Force to develop a program plan that reduces concurrency risk as much as possible.

Further reductions in the fiscal year 1991 program could be a part of a new program that reduces concurrency.

This concludes my prepared statement, Mr. Chairman. I will be happy to answer any questions you may have.