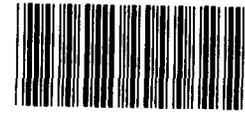


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NAVAL AVIATION: Status of V-22 Osprey
Full-Scale Development

Statement of
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Before the
Subcommittee on Research and
Development and
Subcommittee on Procurement and
Military Nuclear Systems
Committee on Armed Services
House of Representatives



Mr. Chairmen and Members of the Subcommittees:

I am pleased to be here today to discuss the development status of the V-22 Osprey. As you know, we are still conducting follow-on work to our October 12, 1990 report¹ which addressed the program's readiness for fiscal year 1991 production funding.

BACKGROUND

The V-22 is a tiltrotor aircraft being developed to perform various combat missions, including medium lift assault for the Marine Corps, combat search and rescue for the Navy and long-range special operations for the Air Force. The V-22 is intended to replace the CH-46 Sea Knight helicopter for the Navy/Marine Corps and to supplement existing aircraft for the Air Force.

In May 1986, the Navy awarded a fixed-price incentive contract to the team of Bell Helicopter Textron, Inc., and Boeing Helicopter Company to design and produce three ground test articles and six aircraft for flight testing. The contract target price is \$1.729 billion and the ceiling price is \$1.825 billion. The contract also included an option to buy 12 aircraft under pilot production. To date, four of the six flight test aircraft have been provisionally accepted by the Navy and are performing various developmental tests. The engine is being developed under a separate firm-fixed

¹(Naval Aviation: The V-22 Osprey -- Progress and Problems, GAO/NSIAD-91-45).

price contract with Allison Gas Turbine Division of General Motors. This contract had a firm-fixed price of \$76.4 million; but, as a result of contract modifications, was increased to \$105.7 million, as of March 13, 1991.

In an amended fiscal year 1990 budget submission, the Secretary of Defense deleted the V-22 program and instead requested funding for a new medium-lift replacement alternative. Congress denied that request and has continued to fund the V-22 program.

RESULTS IN BRIEF

In our October 1990 report, we identified engineering and testing concerns that adversely affected the schedule, performance and cost of the V-22 full scale development aircraft. While there has been progress in the last 6 months, many problems that we previously reported continue and could make the transition into production a high risk. Recent Navy program assessments in February and March 1991 showed continued developmental concerns with such areas as vibration, the flight control system, avionics, weight, slow software development and the non-availability or faulty functioning of hardware.

According to the program office, the contractors have identified fixes to resolve these problems and the program office considers the technical risk to be at an acceptable level. Accordingly,

program office officials believe that pilot production could be started in fiscal year 1992 if long-lead procurement funding is provided by July 1991.

In October 1990, we reported that the estimate to complete full-scale development was \$150 million over the contract ceiling price. Since then, the contractors have estimated costs at \$200 million over ceiling price, but the Defense Contract Audit Agency has estimated that the overrun would be \$242 million. The contractors must absorb any costs over ceiling. However, the program office believes continued program uncertainty will result in reduced contractor motivation to expeditiously complete program development and absorb increasing costs.

As a result of a later aircraft delivery schedule, the average unit recurring fly away cost is estimated to be \$28.2 million in 1990 dollars. This is \$6 million higher than the \$22.2 million estimate (in 1990 dollars) when the Department of Defense (DOD) deleted the program. Stated, in then-year dollars, which is what the Navy will actually pay for the aircraft when they are delivered, each aircraft is now estimated to cost over \$40 million.

Total program costs for the V-22 have increased from an estimated \$22.3 billion, when the program was deleted, to \$25.4 billion

(both figures are in 1990 dollars) for a combined Navy, Marine Corps, and Air Force buy of 657 aircraft.²

At this time, I would like to discuss the funding, program status and aircraft development issues and program cost.

PROGRAM FUNDING

From fiscal years 1986 through 1991, Congress appropriated about \$2.7 billion for the V-22 program. The majority of the funding -- \$2.2 billion -- was for research, development test, and evaluation. In addition, almost \$500 million in procurement funds was appropriated for long-lead pilot production efforts.

Even though the program was adequately funded, the Secretary of Defense, in an amended fiscal year 1990 submission, deleted the program due to its high cost relative to what he termed was its fairly narrow mission, which he said could be performed by helicopters. The Secretary directed that all efforts pertaining to V-22 production be terminated and that \$200 million of fiscal year 1989 procurement funds be deobligated.

²These estimates were derived from an August 1990 Navy cost model updated to reflect escalation (February 1991). According to the program office, new estimates can not be made available until a production program is defined and most likely the estimates will increase.

The Secretary has since requested that \$165 million appropriated in fiscal year 1991 be transferred from procurement to research, development, test and evaluation to continue development of V-22. The Secretary has indicated that he does not believe the V-22 is ready for production and is continuing the development program in an effort to produce a production representative aircraft. The program office indicates that about \$165 million will be needed to continue V-22 development in fiscal year 1992.

The Secretary has also requested about \$51 million in fiscal year 1992 research and development funds for a medium-lift alternative to the V-22. The exact configuration of this helicopter has yet to be determined.

Impoundment

Under the Impoundment Control Act of 1974 our Office of the General Counsel is currently preparing a deferral report on the \$165 million in fiscal year 1991 advance procurement funds. DOD says the funds are being withheld pending Congressional approval to transfer the funds to the Navy Research, Development, Test and Evaluation account to be spent on additional research and development for the V-22.

Regarding the \$200 million in fiscal year 1989 advance procurement funds, the President, in his Third Special Impoundment Message for

fiscal year 1991, proposed that the funds be rescinded because the V-22 is not sufficiently developed to enter production. Under the Impoundment Control Act, the President would have to release these funds by May 9, 1991 unless Congress approves the rescission. However, as you know, the Dire Emergency Supplemental Appropriations Act for Fiscal Year 1991 in effect rejects the rescission by directing that the \$200 million be obligated for the V-22 program no later than 60 days from enactment of the Act. The Act also extends availability of the \$200 million until the funds are expended on the V-22 program.

Long-lead Production Termination

Prior to DOD deleting the V-22 program, long-lead procurement funds had been provided the contractors. When DOD terminated long-lead procurement, Bell/Boeing retained funds to cover termination costs. Currently, they have \$78 million. These funds are not included in their estimate to complete the full-scale development effort and according to the program manager, about \$62 million may be recovered.

Likewise, Allison Gas Turbine has \$50.8 million in fiscal year 1989 long-lead procurement funds. So far, Allison has made claims of about \$17.5 million for economic adjustments and the government's termination of the production phase. These claims have not yet been settled.

PROGRAM STATUS

The V-22 full scale development effort is 2 years behind its original Milestone IIIA (pilot production) decision point of December 1989. This delay is a result of developmental problems and testing schedule slippages. According to the program office, the uncertainty about V-22 production funding caused the contractors to slow their efforts.

The full-scale development contract requires the contractors to deliver six aircraft for flight testing and three ground test articles. To date, four aircraft for flight testing have been provisionally accepted pending completion of flight tests and installation of additional equipment. Construction of aircraft number five is nearing completion and is scheduled to begin flight testing in May 1991. One ground test article has been completed, another has been delayed and work has been stopped on the third.

After DOD deleted the program, the contractors stopped work on aircraft number six and the fatigue test article to minimize costs. The Navy expressed dissatisfaction with this action and continued to request that the contractors perform in accordance with the contract. Subsequently, the contractors proposed to the Navy that (1) the full-scale development test program be changed from six aircraft to five aircraft and (2) the sixth aircraft be used as a transition vehicle to demonstrate certain pilot

production changes. In March 1991, the Navy formally told the contractors they could stop work on aircraft number six and the fatigue test article for 90 days, while they considered the contractors' proposal. According to the program office, if the proposal is accepted it may result in a cost rebate to the Navy.

The program office is developing contingency plans to execute the program if it is allowed to continue. According to the program office, the development schedule could be extended 18 months to acquire 10 production representative aircraft. This would be accomplished in two phases: 4 aircraft in 1992 and 6 in 1993. According to the program office, this would extend the initial operating capability to 1995 or beyond.

AIRCRAFT DEVELOPMENT ISSUES

Weight reduction, vibration, and display latency (the time interval between the onset of motion and the aircraft's recognition and sensing of that stimulus), remain primary issues concerning potential aircraft performance. As can be expected in any development program, contractor's fixes to deficiencies detected in government testing may require retesting and qualification, which will affect both schedule and cost.

Weight Reduction

Aircraft weight is a primary concern if the V-22 is to perform its mission. That is, the required payload and range cannot be achieved if the aircraft is overweight. Initially, the development contract linked aircraft mission performance with weight specifications to provide the government with a double guarantee. However, a special clause in the contract allows the contractors to submit a weight reduction plan at the end of development if they are unable to meet the weight guarantee. The effect of this contract clause shifts most costs associated with weight reduction efforts -- design, testing, and implementation -- to a follow-on production effort rather than the development contract.

As of March 25, 1991, the V-22 was expected to be about 3,000 pounds over the required empty weight of 31,955 pounds. The contractors have been working on this issue and expect to eliminate about 1,600 pounds during pilot production. A proposal, is to upgrade the drive system's current continuous shaft horsepower rating from 4200 to 4570. This will help compensate for the 1,400 pounds of remaining excess weight through increased lifting power. This proposal has not yet been approved by the Navy.

Vibration

Early government developmental testing identified unacceptable vibration levels during flight. In response, the contractors have designed a preliminary vibration reduction package consisting of fin weights, pendulum absorbers, a wing fence, and a computer driven suppressor unit. According to the contractors, tests have demonstrated that these fixes have reduced vibrations in the passenger and crew areas. However, these tests were conducted at 2.4 Gs and have not yet been tested at the required 4.0 Gs level. It is also expected that tail area vibration will increase which will require additional development effort to meet performance and production standards.

Flight Control System

According to the contractors, the V-22's flight control system's ability to implement complex control commands necessary to fly the dual mode vehicle (vertical takeoff and horizontal flight) and to achieve the system redundancy required to meet mission reliability, survivability and vulnerability specifications is crucial to meeting performance requirements. Limited government testing and other monitoring efforts have identified concerns with flight control systems that have not yet been resolved.

Avionics software

Avionics software development is at a very preliminary functional stage. Further, independent government validation and verification of the contractors avionics software efforts has just begun. Navy officials acknowledge that concurrency between laboratory software and system-level testing could have an adverse affect on the program schedule if problems occur during testing.

Display Latency

According to the Navy, there continue to be unacceptable levels of multi-functional display latency. This concerns integrated pilot and machine precision control tasks where the displays are used as the primary source of flight information (i.e., in poor weather, night flying, and shipboard approaches). This equipment is not functioning properly, and a decision has been made to go to a new subcontractor for the equipment. When a new subcontractor is selected and the equipment delivered, it must be fully tested. Consequently, replacement equipment will not be available for operational testing in fiscal year 1991.

Navy officials said that the latency issue became a concern about 2 years ago. At that time, the contractors estimated that the aircraft would have a latency factor of about 380 milliseconds, and predicted that a safety of flight issue would exist at that level.

According to the Navy, current estimates for display latency at 211 milliseconds eliminate only the flight safety concern in basic operations. Significant probability exists that with a latency greater than 150 milliseconds, acceptable handling qualities cannot be achieved without additional development efforts.

A March 15, 1991 government-directed, contractor study of latency concludes that changes to the avionics are required. The contractors have identified and implemented some of these changes but state that additional changes are still needed and must be fully tested.

Flight test status

The original flight test program called for about 4,110 hours of flight tests. As a result of transferring some government operational testing to the pilot production effort, the flight hour estimate was reduced to 3,877 hours. In October 1990, when we issued our last report, 214 hours had been completed. As of April 4, 1991, 463 hours have been flown. Testing included flying qualities, performance, and shipboard compatibility. Although the scope of tests conducted have been more limited than originally planned, the contractors have demonstrated items such as external load and speed (4,000 pounds at 200 mph), single engine operation, reaching an altitude of 21,500 feet, and flying with the automatic flight control system. Although the contractors estimate that 34

percent of the flight envelope expansion has been completed, testing includes other areas and the program office says only about 15 percent of the entire test program has been completed.

To date, testing has been more limited than initially intended because of, among other things, vibration concerns. Most of the 86 deficiencies noted during the March and April 1990 government development tests remain open with about 33 in the priority one category, which means they adversely affect aircraft airworthiness, primary or secondary mission capability, crew effectiveness or safety. According to the Navy, the contractor has identified some solutions and is working on others. Preliminary results from the December 1990 shipboard compatibility tests show that 27 of 69 deficiencies identified were categorized as priority one. Operational testing is now scheduled for July and August 1991 instead of May 1991 as we previously reported. The contractors estimate that all flight envelope expansion events will be completed by December 1991. However, the program office considers this to be a high risk schedule.

Vibration Structural Life Engine Diagnostic (VSLED)

According to the Navy, the V-22 cannot be introduced into the fleet without the Vibration Structural Life Engine Diagnostic (VSLED) system which is the aircraft diagnostic and maintenance monitoring system. This system will monitor the vital functions of

the aircraft such as vibration, engine, structural life and rotor track and balance. The data generated will be used to quickly identify components in need of maintenance or repair so that they can be removed and fixed earlier than under the customary planned maintenance schedule process. According to the program office, this system will lower operation and support costs.

Currently, the system is 3 years behind schedule and has impacted V-22 development. Hardware problems have prevented the VSLED from participating in the V-22 flight test program and has hindered the development of airborne processing. A flight capable unit will not be available for initial operational testing in July 1991, however the contractors plan to use surrogate equipment.

Discussions with the vendor are continuing and the Navy expects a fully functional unit to be available for the second phase of operational testing scheduled for the second quarter of 1993.

PROGRAM COST

The program continues to experience cost growth. This growth is a result of increased labor costs to address flight test fixes, unanticipated aircraft modification periods and economic adjustments. The target price of the full scale engineering development effort by the Bell/Boeing team is \$1.729 billion and

the ceiling price is \$1.825 billion.³ As of March 1991, Bell/Boeing was estimating the cost to complete full scale development at \$2.025 billion. This is about \$200 million over ceiling and a \$50 million increase over the \$150 million cost growth we reported in October 1990. The Defense Contract Audit Agency has recently estimated the overrun at \$242 million.

The government pays all costs up to the target price and shares in costs between target and ceiling on a 60 percent government/40 percent contractor share ratio. The contractors are liable for all costs over ceiling. As of April 1, 1991, the government had paid \$1.386 billion against the contractors' reported incurred expenditures of \$1.763 billion.

In summary, while the contractors have made progress in developing the V-22 and have conducted functional tests such as flying qualities and external lift capability, development issues remain to be resolved before the aircraft is ready for pilot production. Because of delays in the program, the total estimated procurement cost for 657 aircraft (Navy/Marine Corps and Air Force) has grown from \$20.3 billion when the Defense Department said the V-22 was not affordable, to \$23.3 billion today. When received, each V-22 is now estimated to cost over \$40 million.

³These figures exclude both the cost of the engines, which were provided as government furnished equipment to Bell/Boeing and the government's cost to manage the program.

Mr. Chairman, that concludes my prepared remarks. I will be happy to respond to any questions.

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