

GAO

Report to the Ranking Minority
Member, Committee on Armed Services,
House of Representatives

October 1990

NAVAL AVIATION

The V-22 Osprey— Progress and Problems



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**National Security and
International Affairs Division**

B-240825

October 12, 1990

The Honorable William L. Dickinson
Ranking Minority Member
Committee on Armed Services
House of Representatives

Dear Mr. Dickinson:

As you requested, we are updating certain information in our December 1989 report on the V-22 Osprey tiltrotor aircraft.¹ You expressed particular interest in the status of program testing, funding requirements to complete testing and development, and readiness of the V-22 program for production funding in fiscal year 1991. On October 2, 1990, we briefed your Committee staff and the staffs of the Senate Armed Services Committee and Representative Weldon on the results of our work. This report summarizes that presentation.

Background

The V-22 is a tiltrotor aircraft designed to take off and land vertically like a helicopter and to fly like an airplane by tilting its wing-mounted rotors to function as propellers. The V-22 is 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 Marine Corps and to supplement existing aircraft for the Air Force.

The Navy is developing the aircraft under a fixed-price incentive contract with Bell Helicopter Textron, Inc., and Boeing Helicopter Company. The full-scale development contract was awarded in May 1986 and requires the two contractors to produce six aircraft for flight testing and three for ground testing. It included an option to buy 12 aircraft under pilot production. The engine is being developed under a firm fixed-price contract by the Allison Gas Turbine Division of General Motors.

The program was adequately funded through fiscal year 1989. In fiscal year 1989, \$333.9 million in advance procurement funding was appropriated for the pilot production long-lead efforts. However, in an amended fiscal year 1990 budget submission, the Secretary of Defense deleted the program due to its high cost relative to its fairly narrow

¹Defense Acquisition Programs: Status of Selected Systems (GAO/NSIAD-90-30, Dec. 14, 1989).

mission, which could be performed by helicopters. Subsequently, Congress restored research and development funds through fiscal year 1990 but delayed a decision on production funding. As a result, the V-22 program office developed a contingency plan to proceed into production.

The Department of Defense's fiscal year 1991 budget request did not include any funds for the V-22 program. Instead, it requested research and development funds for a medium-lift helicopter to replace the V-22. The Congress is again debating whether to accept the administration's decision to cancel the V-22 program.

Results in Brief

In our December 1989 report, we identified engineering and testing concerns that adversely affected the schedule, performance, and cost of the V-22 aircraft. Our current work indicates that the V-22 program is continuing to experience developmental problems that could make the transition to production a high risk. In early 1989 V-22 production readiness reviews, the Naval Air Systems Command concluded that program risk was high due to concurrent full-scale development testing and pilot production of aircraft. The Command identified concerns regarding the suitability of composite materials for production processes and a lack of software development that is essential to the proper functioning of the flight control system. Navy quarterly technical progress reports, from October 1989 through June 1990, showed that these problems had not been resolved. For example, the Navy reported continued major concerns with vibration, composite materials, flight controls, avionics, and environmental control systems. Although development and production of weapon systems can be done concurrently to expedite a program, such concurrency often involves high risk. Our analyses of several major concurrent weapon systems show that the systems may not perform as intended and/or may require significant funds to correct deficiencies.

Although the V-22 is a highly concurrent program and Navy production readiness reviews indicated continuing problems that affect full-scale development testing and could affect producibility, the program office considers the technical risk to be at an acceptable level. The program office believes that pilot production could be started in fiscal year 1992 and that long-lead procurement funding would be needed in fiscal year 1991.

Even if Congress decides to continue the V-22 program, the program's status and high concurrency make it impossible to know at this point

whether it will be ready for production in fiscal year 1992 as the program office plans. If fiscal year 1991 long-lead funds are approved, we believe that before obligating any funds the Secretary of Defense should certify that the risks of concurrency are being managed and that the V-22 program schedule is being met.

Program Status

The V-22 program is in the full-scale development phase of the acquisition process. This effort will extend through fiscal year 1994 if program funding continues. To date, four of the six aircraft for flight testing have been provisionally accepted by the Navy pending completion of flight tests and installation of equipment such as the Automatic Flight Control System and the Vibration Structural Life Engine Diagnostic System. Aircraft number five is still under construction, and work on number six has been deferred.

According to the program office, construction of aircraft number five is about 80 percent complete and number six is about 60 percent complete. However, in its June 30, 1989, Selected Acquisition Report, the Department of Defense indicated that none will be "fully configured end items" because, due to termination, they will not meet the "Test Aircraft Delivery Configuration Requirements" of the full-scale development contract. Additionally, there have been more than 130 contract modifications and numerous aircraft specification waivers. The pilot production design has not been finalized, and the contractor has submitted about 800 specification changes.

Under the new contingency plan, a decision for pilot production is scheduled for December 1991. If approved, 10 aircraft could be contracted for in two phases: 4 aircraft in 1992 and 6 in 1993. According to the program office, the change to 10, rather than 12, pilot production aircraft as originally planned was a response to higher contractor costs and anticipated reductions in the Marine Corps' program funding. Prior to the Secretary of Defense's decision to terminate all production-related contracts, the Navy had exercised the full-scale development contract option to buy 12 pilot production aircraft at a maximum price of \$900 million. According to the program office, this option was lost when the Defense Department terminated the program. If the program is allowed to enter pilot production, the contract will need to be renegotiated. Because there is no binding contract, the definitive cost on the proposed 10 pilot production aircraft is not known.

According to the program office, if the program is reinstated, \$238 million will be needed in fiscal year 1991 for research, development, testing, and evaluation (RDT&E) and \$490 million will be needed for long-lead procurement. Although additional RDT&E funding will be needed through fiscal year 1994, the program office is uncertain of the dollar amounts needed for each of the out years. The program office believes that \$465 million of the long-lead procurement funds requirement can be met with \$165 million in new appropriations; \$200 million in fiscal year 1989 appropriated, but unobligated, long-lead funds; and \$100 million in recoupment of usable work or unexpended funds previously paid to the contractor for long-lead work efforts.

The proposed program stretches out procurement. By 2002, only 218 aircraft will be procured versus the 552 originally planned for the Marine Corps. However, the Marine Corps' requirement remains at 552.

Development Issues

Vibration and weight reduction remain primary issues concerning potential aircraft performance. Changes to the current design to correct deficiencies already detected in testing, such as vibration, or those discovered later may aggravate efforts to reduce the weight or introduce other complications in a production V-22.

Vibration

Early tests identified unacceptable vibration during flight. The contractor has designed a preliminary three-stage vibration reduction package consisting of fin weights, pendulum absorbers, and a computer driven suppressor unit. Whether these fixes prove workable for production aircraft will not be known until they are tested.

Weight Reduction

As of August 3, 1990, the V-22 was expected to be about 2,822 pounds over the required weight. The contractor expects to eliminate about 1,600 pounds during pilot production. This leaves about 1,200 pounds of excess weight. If full weight reduction is not realized, the contractor is proposing that the drive system be certified to handle an increase in the current continuous shaft horsepower from 4,200 to 4,570 to meet the aircraft's performance requirements. This change, however, may also add weight and/or reduce range.

Flight Test Status

Although several tests pertaining to the drive system and overall aircraft performance demonstrations have not been done, program officials

expect that 80 percent of the flight test events will be completed by the planned pilot production decision date of December 1991. The flight testing program was estimated to have a requirement of 4,110 hours. As of October 9, 1990, only 214 hours, or 5 percent, had been completed. Nevertheless, program officials are optimistic and believe the number of flight test hours needed to accomplish the test program may be reduced to about 3,000. Under the contingency plan, initial operational testing is scheduled to begin in May 1991.

The first phase of government flight testing was conducted from March 17 to April 23, 1990, 2 months behind schedule. Although a final test report has not been prepared, as of August 8, 1990, about 86 deficiencies had been noted, 33 of which were categorized as adversely affecting aircraft airworthiness, primary or secondary mission capability, crew effectiveness, or safety. Although program officials consider 86 deficiencies to be a low number for a developmental program, government testing has been more limited than initially intended because of aircraft vibration problems.

Program Costs

The program has experienced cost growth. The full-scale development contract's target price is \$1.729 billion with a ceiling price of \$1.825 billion. As of June 1990, the Navy's estimated cost to complete the full-scale development contract was about \$1.975 billion. This is \$150 million over the contract ceiling price, and the contractors would be liable for these costs. The cost growth is attributable to manufacturing problems, ground test articles, and failed or unavailable equipment, for example, multifunctional displays and mission computer. As of May 1990, contractor billings totaled about \$1.6 billion; as of July 1990, government payments totaled about \$1.4 billion. Under the contract progress payment schedule, only 88.5 percent of cost is paid until all contract terms are fulfilled.

Readiness for Production Funding

The Defense Department's production management policy (DOD Directive 4245.6) requires production readiness reviews to support pilot production decisions. These reviews are done to validate design readiness, determine if production engineering problems have been resolved, and assess the state of planning for the transition to production. In preparation for the previously scheduled pilot production decision of December 1989, the Navy conducted several of these reviews between January and June 1989. The Navy gave the program an overall rating of high

risk² because of the high degree of concurrency between full-scale development and pilot production. In reviews concerning the wing/nacelle and the fuselage/airframe, the Navy cited composite laminates, the use of honeycomb, and inconsistencies between the program plan and the production schedule as major problem areas. Evaluations of the flight control system, infrared suppressors, and environmental control system were given an overall risk rating of medium³ because of incomplete qualification testing and noncompliance with specification requirements. Many of these same concerns remained unresolved in subsequent Navy technical quarterly progress reports.

Recommendation

Even if the Congress decides to continue the V-22 program, the program's status and high concurrency make it impossible to know at this point whether it will be ready for production in fiscal year 1992 as the program office plans. As a result, we recommend that prior to obligating the fiscal year 1991 long-lead funds the Secretary of Defense certify that the risks of concurrency are being managed and that the V-22 program schedule is being met.

Our work was performed from July to October 1990 in accordance with generally accepted government auditing standards. Information was gathered through Navy and contractor program documents; interviews with Navy, Marine Corps, Air Force, and contractor officials; and visits to primary contractor sites and the Naval Air Test Center. We did not verify cost data provided by the contractor or program office. As requested, we did not obtain official written agency comments. However, we did discuss the results of our work with Navy officials, and their comments were incorporated, as appropriate.

As agreed with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of this report. At that time, we will send copies to the Chairmen, Senate and House Committees on Appropriations and on Armed Services; Senate Committee on Governmental Affairs; and House Committee on Government Operations, and the Secretaries of Defense

²A high risk is associated with events that require rescheduling or high manpower application to prevent an impact on production schedules or cost.

³A medium risk is associated with scheduled events that are not completed and that require increased management attention to prevent affecting production, for example, the need for an additional facility that is scheduled but not under construction.

and the Navy. Copies will be made available to other interested parties upon request.

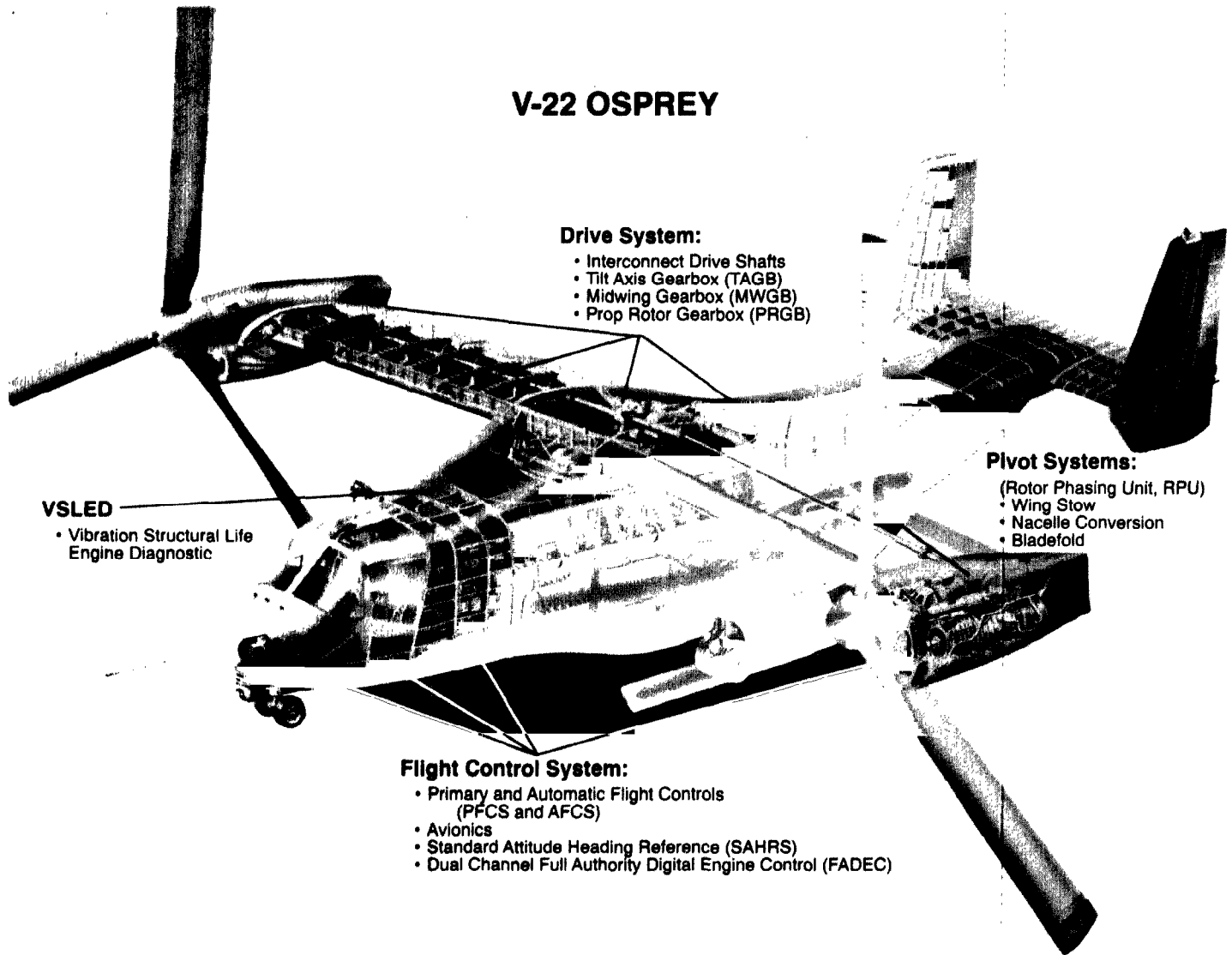
Please contact me on (202) 275-6504 if you or your staff have any questions concerning this report. An illustration of the V-22 Osprey and its major systems is shown in appendix I. Major contributors to this report are listed in appendix II.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Martin M. Ferber", with a long horizontal flourish extending to the right.

Martin M Ferber
Director, Navy Issues

The V-22 Osprey and Its Major Systems



Major Contributors to This Report

**National Security and
International Affairs
Division, Washington,
D.C.**

Brad Hathaway, Associate Director
William C. Meredith, Assistant Director
Clem H. Rasberry, Evaluator-in-Charge
Pauline F. Nowak, Evaluator



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