V-22 Osprey Tilt-Rotor Aircraft: Background and Issues for Congress

Ronald O'Rourke
Specialist in Naval Affairs

June 10, 2009

Congressional Research Service
7-5700
www.crs.gov
RL31384

Summary

The V-22 Osprey is a tilt-rotor aircraft that takes off and lands vertically like a helicopter and flies forward like an airplane. Department of Defense (DOD) plans call for procuring a total of 458 V-22s—360 MV-22s for the Marine Corps; 50 CV-22 special operations variants for U.S. Special Operations Command, or USSOCOM (funded jointly by the Air Force and USSOCOM); and 48 HV-22s for the Navy.

Through FY2009, a total of 181 V-22s have been procured—155 MV-22s for the Marine Corps, and 26 CV-22s for USSOCOM. These totals include several V-22s that have been procured in recent years through wartime supplemental funding that has been provided in addition to DOD's regular (aka "base") budget.

The proposed FY2010 budget requests about $2.3 billion funding for the procurement of 30 MV-22s for the Marine Corps and about $575 million in funding for the procurement of five CV-22s for USSOCOM.

For FY2010, the V-22 program poses potential a number of potential oversight issues for Congress, including the aircraft's reliability and maintainability.

As part of its proposed FY2009 supplemental appropriations bill (H.R. 2346/S. 1054), the administration requested $1.83 million in procurement funding and $3.9 million in research and development funding for the V-22 program. The House Appropriation Committee's report on H.R. 2346 (H.Rept. 111-105 of May 12, 2009, pages 19 and 26) recommends rejecting both of these funding requests. The Senate Appropriation Committee's report on S. 1054 (S.Rept. 111-20 of May 14, 2009, pages 39 and 48) recommends approving both of these funding requests.

On May 21, 2009, a hearing before the House Oversight and Government Reform Committee to review the V-22 program was adjourned after a few minutes with the intent of being resumed in about two weeks. This report will be updated as events warrant.

Contents

Figures

Tables

Appendixes

Contacts

Introduction

The V-22 Osprey is a tilt-rotor aircraft that takes off and lands vertically like a helicopter and flies forward like an airplane. V-22 are currently being procured by the Marine Corps and (in smaller numbers) by the Air Force. The V-22 has been the Marine Corps' top aviation priority for many years.

The proposed FY2010 budget requests funding for the procurement of 30 MV-22s for the Marine Corps and five CV-22s for the Air Force.

As part of its proposed FY2009 supplemental appropriations bill (H.R. 2346/S. 1054), the administration requested $1.83 million in procurement funding and $3.9 million in research and development funding for the V-22 program. The House Appropriation Committee's report on H.R. 2346 (H.Rept. 111-105 of May 12, 2009, pages 19 and 26) recommends rejecting both of these funding requests. The Senate Appropriation Committee's report on S. 1054 (S.Rept. 111-20 of May 14, 2009, pages 39 and 48) recommends approving both of these funding requests.

On May 21, 2009, a hearing before the House Oversight and Government Reform Committee to review the V-22 program was adjourned after a few minutes with the intent of being resumed in about two weeks.

Background

The V-22 In Brief

The V-22 Osprey is a tilt-rotor aircraft that takes off and lands vertically like a helicopter and flies forward like an airplane. For taking off and landing, the aircraft's two wingtip-mounted engine nacelles are rotated (i.e., tilted) upward, so that the rotors function like a helicopter's rotor blades. For forward flight, the nacelles can be rotated 90 degrees forward, so that the rotors function like an airplane's propellers. The Navy states that the V-22 "performs VTOL [vertical takeoff and landing] missions as effectively as a conventional helicopter while also having the long-range cruise abilities of a twin turboprop aircraft."[1]

The MV-22 is designed to transport 24 fully-equipped Marines at a cruising speed of about 250 knots (about 288 mph), exceeding the performance of the Marine Corps CH-46 medium-lift assault helicopters that MV-22s are to replace. The CV-22 has about 90% airframe commonality with the MV-22; the primary differences between the two variants are in their avionics. The CV-22 is designed to carry 18 troops, with auxiliary fuel tanks increasing the aircraft's combat radius to about 500 miles.

Figure 1 shows a picture of an MV-22 with its engine nacelles rotated at about a 45-degree angle, or roughly half way between the upward VTOL position and the forward-flight position.

[1] U.S. Navy Fact File, "V-22A Osprey tilt rotor aircraft," available at http://www.navy.mil/navydata/fact_display.asp?cid=1200&tid=800&ct=1&page=1.

Figure 1. MV-22 Osprey

Source: Military-Today.com: http://www.military-today.com/helicopters/bellboeing_v_22_osprey.jpg.

Intended Missions

The V-22 is a joint-service, multi-mission aircraft. The Navy, which is the lead service for the V-22 program, states that "the Marine Corps version, the MV-22A, will be an assault transport for troops, equipment and supplies, and will be capable of operating from ships or from expeditionary airfields ashore. The Navy's HV-22A will provide combat search and rescue, delivery and retrieval of special warfare teams along with fleet logistic support transport. The Air Force CV-22A will conduct long-range special operations missions."[2] Specific CV-22 missions include "long range, high speed infiltration, exfiltration, and resupply to Special Forces teams in hostile, denied, and politically sensitive areas."[3]

Marine Corps leaders believe that the MV-22 provides significant operational advantages compared to the CH-46, particularly in terms of speed in forward flight. The V-22 has been the Marine Corps' top aviation priority for many years.[4]

[2] U.S. Navy Fact File, "V-22A Osprey tilt rotor aircraft," available at http://www.navy.mil/navydata/fact_display.asp?cid=1200&tid=800&ct=1&page=1.

[3] United States Special Operations Command, Fiscal Year (FY) 2009 Budget Estimates, February 2008, Procurement, Defense-Wide, Exhibit P-40 Budget Item Justification Sheet, page 1 of 13 (overall document page 59 of 192).

[4] See, for example, Department of the Navy, *Highlights of the Department of the Navy FY 2010 Budget*, May 2009, p. 5-11

Key Contractors

The V-22 was developed and is being produced by Bell Helicopter Textron of Fort Worth, TX, and Boeing Helicopters of Philadelphia, PA. The aircraft's engines are produced by Allison Engine Company of Indianapolis, IN, a subsidiary of Rolls-Royce North America. Fuselage assembly is performed in Philadelphia, PA. Drive system rotors and composite assembly is performed in Fort Worth, TX, and final assembly and delivery is performed in Amarillo, TX.

Total and Annual Procurement Quantities

Department of Defense (DOD) plans call for procuring a total of 458 V-22s—360 MV-22s for the Marine Corps; 50 CV-22 special operations variants for U.S. Special Operations Command, or USSOCOM (funded jointly by the Air Force and USSOCOM); and 48 HV-22s for the Navy.[5]

Through FY2009, a total of 181 V-22s have been procured—155 MV-22s for the Marine Corps and 26 CV-22s for USSOCOM. These totals include several V-22s that have been procured in recent years through wartime supplemental funding that has been provided in addition to DOD's regular (aka "base") budget. No HV-22s have yet been procured for the Navy.

Table 1 shows annual procurement quantities of MV-22s and CV-22s funded through DOD's regular (aka "base") budget. The table *excludes* the several V-22s that have been procured in recent years through wartime supplemental funding as replacements for legacy helicopters lost as a result of wartime operations.

[5] Like some other tactical aviation, the total number of V-22 aircraft planned for procurement has decreased over time. In 1989 the Defense Department projected a 663-aircraft program with six prototypes and 657 production aircraft (552 MV-22s, 55 CV-22s, and 50 HV-22s). As projected in 1994, however, the program comprised 523 production aircraft (425 MV-22s, 50 CV-22s, and 48 HV-22s). The Quadrennial Defense Review (QDR), released May 19, 1997, recommended accelerated procurement of 458 production aircraft.

Table 1. Annual V-22 Procurement Quantities

(Excludes V-22s procured through wartime supplemental funding)

FY	MV-22	CV-22	Total
1997	5	0	5
1998	7	0	7
1999	7	0	7
2000	11	0	11
2001	9	0	9
2002	9	0	9
2003	11	0	11
2004	9	2	11
2005	8	3	11
2006	9	2	11
2007	14	2	16
2008	19	5	24
2009	30	6	36
2010 (requested)	*30*	*5*	*35*

Source: Prepared by CRS based on DOD data.

Notes: Figures shown exclude several additional V-22s procured in recent years with wartime supplemental funding.

Multiyear Procurement (MYP) for FY2008-FY2012

V-22s are currently being procured under a $10.4-billion, multiyear procurement (MYP) arrangement covering the period FY2008-FY2012. The MYP contract , which was awarded on March 28, 2008, covers the procurement of 167 aircraft—141 MV-22s and 26 CV-22s. DOD expects the multiyear contract to save $427 million when compared to the use annual contracting.[6]

Estimated Total Program Cost

DOD in February 2008 estimated the total acquisition cost of a 458-aircraft V-22 program at about $53.3 billion in then-year dollars, including about $9.9 billion for research and development, about $43.1 billion for procurement, and $262 million for military construction (MilCon). The program was estimated to have a program acquisition unit cost, or PAUC (which is total acquisition cost divided by the number of aircraft), of about $116.3 million and an average procurement unit cost, or APUC (which is procurement cost divided by the number of aircraft), of about $94.5 million.

[6] Christopher J. Castelli, "Navy Awards $10.4 Billion V-22 Multiyear Deal," *Inside Washington Publishers*, March 28, 2008, online at http://www.insidedefense.com.

When translated into constant FY2009 dollars, these figures become about $54.8 billion in total acquisition cost, including about $12.5 billion for research and development and about $42.0 billion for procurement. The PUAC is about $119.5 million, and the APUC is about $92.1 million.

The figures in the preceding two paragraphs are "objective" cost figures, meaning lower costs that DOD hopes to achieve. There are also higher "threshold" cost figures, meaning costs that DOD hopes to not exceed. The threshold cost figures for the program, when translated into constant FY2009 dollars, become about $60.0 billion in total acquisition cost, including about $13.7 billion for research and development and about $46.2 billion for procurement. The PUAC is about $131.5 million, and the APUC is about $101.4 million.[7]

Prior-Year Funding

In then-year dollars, the V-22 program from FY1982 through FY2008 received a total of about $25.7 billion in funding, including about $9.5 billion for research and development, about $15.9 billion for procurement, and about $191 million for MilCon. These figures *exclude* wartime supplemental funding that has been provided in addition to DOD's regular (aka "base") budget. As mentioned earlier, this supplemental funding has, among other things, funded the procurement of several V-22s.

FY2010 Funding Request

The proposed FY2010 budget requests funding for the procurement of 30 MV-22s for the Marine Corps and another 5 CV-22s for USSOCOM.

Request for MV-22s

Procurement funding for the MV-22s is in the Aircraft Procurement, Navy (APN) appropriation account, which funds the procurement of Navy and Marine Corps Aircraft.

The Navy estimates the procurement cost of the 30 MV-22s requested for FY2010 at $2,359.0 million, or an average of about $78.6 million each. These 30 aircraft have received $143.2 million in prior-year advance procurement funding, leaving another $2,215.8 million requested in the APN account for FY2010 budget to complete their cost. The APN account also requests $84.3 million in advance procurement funding for V-22s that the Navy wants to procure in future fiscal years, and $35.8 million in funding for initial spares for MV-22s, bringing the total FY2010 APN funding request for MV-22s to $2,335.6 million.

[7] Source: DOD Acquisition Program Baseline (APB) report for V-22 program, February 29, 2008. Figures translated into constant FY2009 dollars by CRS using DOD's budget authority deflator for procurement excluding pay, fuel, and medical, as presented in Table 5-7 (page 43) of the DOD document *National Defense Budget Estimates for FY 2009.*

Request for CV-22s

Procurement funding for CV-22s is divided between the Aircraft Procurement, Air Force (APAF) appropriation account and the USSOCOM portion of the Procurement, Defense-Wide (PDW) appropriation account.

The Air Force estimates the APAF-funded portion of the procurement cost of the five CV-22s requested for FY2010 at $460.4 million, or an average of about $92.1 million in APAF funding for each. These five aircraft have received $23.1 million in prior-year APAF advance procurement funding, leaving another $437.3 million request in the APAF account for FY2010 to complete the APAF-funded portion of their cost. The APAF account also requests 13.8 million in advance procurement funding for CV-22s that the Air Force wants to procure in future fiscal years, and $123.7 million in initial spares for CV-22s, bringing the total FY2010 APAF funding request for CV-22s to $574.8 million.

The FY2010 DPW account requests an additional $114.6 million in procurement funding for CV-22s. If this $114.6 million is added to the $460.4-million estimated APAF cost from the previous paragraph, it would bring the total procurement cost of the five aircraft to $575 million, or an average of $115 million each.

Program History in Brief

The V-22 program began in the early 1980s.[8] The aircraft experienced a number of development challenges relating to affordability, safety, and program management. Crashes of prototypes occurred in June 1991 (no fatalities) and July 1992 (seven fatalities). Two additional crashes occurred in April 2000 (19 fatalities) and December 2000 (4 fatalities). The V-22's development challenges were a topic of considerable oversight and debate during the 1990s.

The acquisition program baseline (APB) for the V-22 has been revised numerous times over the program's history. The V-22 program has undergone restructuring to accommodate recommendations from outside experts and DOD managers.

The George H.W. Bush administration proposed terminating the V-22 program in 1989 as part of its proposed FY1990 budget, and continued to seek the cancellation of the program through 1992. Congress rejected these proposals and kept the V-22 program alive. The Marine Corps' strong support for the program was a key reason for Congress's decision to keep the program going.

[8] The V-22 is based on the XV-15 tilt-rotor prototype which was developed by Bell Helicopter and first flown in 1977. The Department of Defense began the V-22 program first under Army leadership, but with the Navy and Marine Corps later taking the lead. The V-22 program was given Milestone 0 approval in December 1981 as the Joint Services Aircraft program, and Milestone I approval in December 1982, at which time the program's acquisition strategy was approved. A preliminary design contract for the aircraft was awarded in April 1983 to a Bell-Boeing industry team, which was the only competitor for the program. The aircraft was designated the V-22 Osprey in January 1985. The program was given Milestone II approval in April 1986, initiating system development and demonstration. A full-scale development (FSD) contract was awarded in May 1986.

The MV-22 achieved Initial Operational Capability (IOC) in June 2007. The first deployment of MV-22s began in September 2007, with the deployment of 10 aircraft to Al Anbar province in Iraq.[9]

The first deployment of CV-22s, which involved four aircraft sent to Mali, was completed in December 2008. The CV-22 achieved IOC in March 2009.[10]

For a longer discussion of the history of the V-22 program, see **Appendix A**.

Deployment to Iraq

In September 2007, the Marine Corps deployed 10 MV-22s from VMM-263, a Marine Medium Tiltrotor Squadron, to Al Anbar province in Iraq. During the first three months of deployment, the squadron had completed more than 2,000 air support requests while logging more than 2,000 combat flight hours and maintaining an average mission-capable rate[11] of 68%.[12] The Marine Corps has lauded the extended range, speed, and payload that the Osprey possesses in comparison to helicopters it is intended to replace as instrumental to the success of time-critical interdiction and medical evacuation missions during the deployment.[13]

In December 2008, four CV-22s returned from their first operational deployment, participating in a multinational in the African country Mali. Those involved in this deployment report successfully self-deploying the squadron to a remote and austere location and conducting simulated long-range, air-drop, and extraction missions.[14]

[9] The first MV-22 prototype flow in helicopter mode in March 1989. The first forward-facing flight occurred in September 1989. The MV-22 completed Critical Design Review (CDR) in December 1994. The first low-rate initial production (LRIP) contract was awarded in June 1996, and the first delivery of an LRIP aircraft occurred in May 1999. Technical evaluation (TECHEVAL) began in July 1999 and was completed in September 1999. Operational evaluation (OPEVAL) began in November 1999 and was completed in July 2000.

In January 2001, an MV-22 squadron commander was relieved of duty after admitting to falsifying maintenance records, and three Marines were found guilty of misconduct in September 2001. In April 2001, a blue ribbon panel formed by Secretary of Defense William Cohen recommended continuing with the V-22 program in restructured form.

Phase II of the MV-22's OPEVAL began in March 2005 and was completed in June 2005. The program was given Milestone III approval, permitting full-rate production, in October 2005.

[10] In August 1995, the V-22 contract was modified to include the CV-22 as a special operations version of the aircraft. The CV-22 completed CDR in December 1998. CV-22 flight testing began in February 2000 and was completed in October 2007. A production contract for long lead items for the CV-22 was awarded in June 2000. CV-22 Initial Operational Test and Evaluation (IOT&E) began in June 2006.

[11] An aircraft's mission capable rate is the percentage of time an aircraft is available for to fly scheduled sorties.

[12] Gareth Jennings, "USMC Details Osprey Operational Availability Rates in Iraq," *Jane's Defense Weekly*, February 20, 2008, online at http://www.janes.com.

[13] Michael Fabey, "Ospreys Proving Mettle in Counter-IED, Medevac Missions," *Aerospace Daily & Defense Report*, January 31, 2008, p. 4.

[14] 1st Lt. Lauren Johnson. "CV-22s Complete First Operational Deployment." *Air Force News*. December 3, 2008.

Anticipated 2009 Deployment to Afghanistan

In April 2009, it was reported the Marine Corps anticipates shifting the MV-22 squadron currently deployed in Iraq to Afghanistan sometime in 2009.[15]

Foreign Military Sales

To date, there have been no sales of the V-22 to foreign military forces. The Marine Corps' deployment of MV-22s to Iraq, however, has reportedly sparked interest in the V-22 among Norway, Israel, and Japan.[16]

Issues For Congress

For FY2010, the V-22 program poses potential a number of potential oversight issues for Congress, including the aircraft's reliability and maintainability.

Aircraft Reliability and Maintainability

A March 2009 Government Accountability Office (GAO) report on major DOD acquisition programs stated the following in its entry on the V-22 program:

> The V-22 is being procured in blocks. The program office considers the MV-22 critical technologies to be mature and its design stable. However, MV-22 Block B aircraft, the full-rate production configuration deployed to Iraq, have experienced reliability problems. These aircraft fell short of their mission capability goal (the ability to accomplish any one mission), due in part to component reliability problems with parts such as gearboxes and generators. The aircraft fell well short of its full-mission capability goal (the ability to accomplish all missions), primarily due to a complex and unreliable de-icing system. During the Iraq deployment, the V-22's less than 400 hour engine service life fell short of the 500-600 hours estimated by program management. The program office noted that the contract does not require a specific service life to be met. Also, pending modifications to the program's engine support contract with Rolls Royce could result in increased support costs in the future. [17]

At a May 19, 2009, hearing on Navy and Marine Corps aviation procurement programs before the Seapower and Expeditionary Forces subcommittee of the House Armed Services Committee, Navy and Marine testified that:

> The MV-22B Osprey is now combat-tested and ready for deployment anywhere throughout the world. As our premier medium lift assault support platform, the Osprey brings unprecedented range, speed and survivability to the Warfighter, in a platform that far exceeds

[15] Dan Taylor, "Marines: V-22 Ospreys Leaving Iraq for Good in Coming Weeks," *Inside the Navy*, April 20, 2009. See also and Zachary M. Peterson, "Conway: Marines, V-22 Osprey Ready to Move to 'Fight' in Afghanistan," *Inside the Navy*, March 16, 2009.

[16] Unattributed, "What's Ahead in Aerospace & Defense: Osprey Export," *Aerospace Daily & Defense Report*, Vol. 226, No. 35, May 19, 2008, p. 1.

[17] Government Accountability Office, *Defense Acquisitions[:] Assessments of Selected Weapon Programs*, GAO-09-326SP, March 2009, p. 142.

> the capabilities of the CH-46E it is replacing. The MV-22B has been supporting our Marines in combat continuously since October 2007, with the third successive squadron recently completing a highly successful seven month rotation in support of Operation IRAQI FREEDOM just last month. In Iraq, Osprey squadrons have logged over 9,000 flight hours, carried over 40,000 passengers, and lifted over two million pounds of cargo while flying every mission profile assigned by the Multi-National Force-West Commander.
>
> As we continue to explore the tremendous capabilities of tilt-rotor aircraft and look forward to employing Osprey both aboard ship and in new theaters of operation, we are learning valuable lessons with respect to reliability and maintainability. Like other types of aircraft in the early operational phase of their lifecycles, the MV-22 has experienced lower-than-desired reliability of some components and therefore higher operations and support costs. With the cooperation and support of our industry partners, we are tackling these issues head on, with aggressive logistics and support plans that will increase the durability and availability of the parts needed to raise reliability and concurrently lower operating costs of this aircraft.[18]

A May 2009 defense trade press article based on Marine Corps testimony at an earlier (May 14) hearing before the House Armed Services Committee stated:

> Reliability issues with the V-22 Osprey tiltrotor aircraft remain a top concern for Navy officials, but the Marine Corps' top general said last week that the aircraft's availability is not any worse than any other new aircraft program.
>
> "We have had ... some reliability issues in terms of the availability of the aircraft," Marine Commandant Gen. James Conway told the House Armed Services Committee May 14, "but I would suggest not greater than other new aircraft, especially new aircraft that [operate in] such an austere environment."
>
> In January, Lt. Gen. George Trautman, deputy commandant for aviation, *told Inside the Navy* that V-22 availability is currently below 70 percent, which is "not where I want it to be." He said he would like to see the aircraft top 80 percent readiness.
>
> However, Conway said the V-22 has been performing well and the Marine Corps was "pleased" with what it was seeing in Iraq, and that availability problems would be worked out in time.
>
> "We're working those issues, and we are very optimistic about the future of this aircraft," he said. [19]

An April 2009 trade press article stated:

> A recent Government Accountability Office report claims that the engines of V-22 Osprey titlrotor aircraft in Iraq are managing a service life of 400 flight hours, but the program manager told *Inside the Navy* last week that, since the report was completed, crews have

[18] Statement of Vice Admiral David Architzel, USN, Principal Military Deputy, Research, Development and Acquisition, LTGEN George J. Trautman III, USMC, Deputy Commandant for Aviation, [and] RADM Allen G. Myers, USN, Director of Warfare Integration, before the Seapower and Expeditionary Warfare [sic: Forces] Subcommittee of the House Armed Services Committee [hearing] on [The] Department of the Navy's Aviation Procurement Program, May 19, 2009, pp. 7-8.

[19] Dan Taylor, "Conway to HASC: V-22 Availability Levels Need Improvement," *Inside the Navy*, May 18, 2009. Bracketed material as in the original.

found a way to add 100 hours to the service life by using pressure washers to remove sand and grit from the motors.

The March 30 report, titled: "Defense Acquisitions: Assessment of Selected Weapons Programs," states that V-22s in Iraq achieved engine service lives that "fell short of the 500-600 hours estimated by program management."

However, Col. Matt Mulhern, the program manager, told *Inside the Navy* in an April 7 phone interview that the program knew going in that the engines would have a shortened service life because of the harsh conditions in theater, and regular washing of the sand and grit from the engines has bumped up the service life closer to 500 hours.

"We knew they were going to have a hard time over there because every engine over there has a hard time," he said. "We instituted some compressor washers and some high-pressure turbine washers, so we bought back about 100 hours just by doing that. We went from about 380 hours on wing to about 480 hours on wing."

He noted that the V-22 fleet as a whole is averaging about 600 hours, and they would be averaging about 1,300 hours if the 12 V-22s in Iraq were removed from the equation....

Addressing the recent brief grounding of the V-22 fleet due to loose bolts discovered in six Ospreys—all but one were stationed in Iraq—Mulhern said he is "comfortable" the program has the problem under control, although the case is not closed until an investigation determines why it happened.

"We've developed an inspection so we can catch this before it's a safety item," he said. "We're going to run engineering investigations on them. That's still ongoing and probably will be for a while, and depending on what we find there, we've got to work out the fix. The fix could be something on the production line on the way we build it, it could be a redesign of some nature, it could be a technique we apply on the flight line or something."

He said it was "hard to say" how long the investigation would take, but the program will have a good idea of the findings in a few weeks after getting all the parts back, which are expected in the next week or so.[20]

Other Potential Issues

The March 2009 GAO report quoted above also stated that:

> Planned upgrades to the aircraft could affect the aircraft's ability to meet its requirements. A limited-coverage, ramp-mounted defensive weapon was installed on aircraft deployed to Iraq. The program plans to incorporate a mission-configurable, belly-mounted defensive weapon system that will provide fuller coverage. For missions requiring the new weapon, however, the interior space needed to integrate the system will reduce the V-22's troop carrying capability below its key performance parameter of 24 troops, as well as reduce its internal cargo capacity. The program also plans to integrate an all-weather radar into the V-

[20] Dan Taylor, "Mulhern: Program Adds 100 Flight Hours to Osprey Engine Life in Iraq," *Inside the Navy*, April 13, 2009. An internet site on military and space affairs that calls itself "G2mil," and which states that it is "authored by Carlton Meyer, a former Marine Corps officer" (http://www.g2mil.com/) includes a section (http://www.g2mil.com/scandal.htm) with more than 25 postings dating back to 2001 that are highly critical of the V-22 program. A posting dated June 2009 (http://www.g2mil.com/V-22repairs.htm) contains highly critical comments regarding the maintainability of the V-22 program.

> 22. This radar and an effective de-icing system are essential for self-deploying the V-22 without a radar-capable escort and deploying the V-22 to areas such as Afghanistan, where icing conditions are more likely to be encountered. However, expected weight increases from these and other upgrades, as well as general weight increases for heavier individual body armor and equipment may affect the V-22's ability to maintain key performance parameters, such as speed, range, and troop carrying capacity.
>
> While the program office reports a stable design, changes can be expected in order to to integrate planned upgrades. Issues with the aircraft's internal cargo handling capability were identified during Iraq operations and led to significant delays. Program officials state that revised techniques and procedures reduced these delays. External cargo carriage missions were rarely assigned to V-22s in Iraq, as mission tasking during this period required minimal external lift support. In addition, most external loads cannot be carried at speeds that leverage the high-speed capability of the V-22. The program is adding forward firing countermeasures to enhance the aircraft's survivability; modifying the engine air particle separator to prevent engine fires and enhance system reliability; and improving the environmental control system.
>
> The Navy and Marine Corps conducted training for the V-22's shipboard deployment and identified challenges related to this operating environment. Design changes are already being made to some of the ships on which the V-22 will deploy to help ensure effective operations on the flight deck and in the hangar deck during maintenance. The changes will also provide increased space for V-22 spare parts.
>
> **Production Maturity**
>
> In March 2008, the V-22 program signed a $10.4 billion multiyear production contract with Bell Boeing for the production of 167 aircraft through 2012, even though aircraft continue to be conditionally accepted with deviations and waivers relating to components such as brakes, landing gear, hydraulic hoses, de-icing systems, and radar altimeters. The demand for spare parts for deployed aircraft and the acceleration of CV-22 production could both pose challenges for ramping up V-22 production from 11 in 2005 to 36 in 2009. For example, lessons learned from the initial Iraq deployment stated that the lead time for and lack of availability of MV-22 repair parts led to high cannibalization rates.[21]

An April 2009 trade press article stated that Colonel Matt Mulhern, the V-22 program manager, did not agree with GAO's assessment regarding challenges the V-22 program would face in increasing the program's production rate to 36 aircraft in 2009:

> "I'm not sure I agree with that conclusion," he said. "The acceleration that we had of CVs—we added five CVs as part of the [FY-09 supplemental war spending bill]—we have found places in the production line to accommodate those. They shouldn't have a huge impact on the production line."
>
> Regarding the spare parts, the GAO said that "the lead time for and lack of availability of MV-22 repair parts led to high cannibalization rates."
>
> Mulhern agreed there has been "cannibalization" or the removal of parts from an aircraft for use on another that needs them, but said it was to be expected in a young program.

[21] Government Accountability Office, *Defense Acquisitions[:] Assessments of Selected Weapon Programs*, GAO-09-326SP, March 2009, p. 142.

> "That's true, we didn't have all the parts we wanted, so in some cases we'd cannibalize," he said. "But it wasn't to the point that we had to stop operating."
>
> He pointed out that 85 percent of the total flight hours have come in the last four years of the program, and "the supply system lags typically about two years," he said.
>
> "The fact that we're flying 700-hour months with 12 airplanes there means we got most of them right," the colonel said. "We didn't get them all right. We recognize we've got some challenges that we've got to work on. That's fairly normal in the life of a program. I think we've been a lot more successful than a lot of people thought we would be."
>
> He said there are "programs in place" to improve component reliability.[22]

A May 2009 trade press article stated that:

> The V-22 Osprey, which is due to deploy to Afghanistan this fall, remains largely untested in its tactical assault support role, Marines who used the tiltrotor aircraft in Iraq told service officials five months ago, according to internal documents.
>
> The assault support mission calls for moving people and supplies in and around the battlefield. Marine Commandant Gen. James Conway and Lt. Gen. George Trautman, the service's top aviation official, have recently touted the Osprey's assault support capabilities.
>
> "Our third tiltrotor squadron just wrapped up successful combat operations in Iraq while we were still there," Conway told reporters at an April 29 press conference. "The squadrons performed as we expected. They did it without incident or fanfare and through every type of assault support mission required."
>
> In a May 6 teleconference from Iraq, Trautman told bloggers and reporters the V-22 "completed every assigned mission and it did so flying faster, farther, and with safer flight profiles than any other assault support aircraft in the history of military operations."
>
> But Marines who used the V-22 in Iraq have told the Marine Corps Center for Lessons Learned that the Osprey has not yet cut its teeth in the assault support mission. In December, the center interviewed members of the third squadron to use the V-22 in Iraq, VMM-266, at Al Asad airbase in Iraq. Personnel from supporting units were also interviewed. Inside the Pentagon reviewed a summary of the findings, dated this month.
>
> "However, Osprey operators also expressed the view that the tiltrotor capability has not been fully explored or exploited in [Operation Iraqi Freedom] due to the lack of opportunities to participate in assault support missions at the tactical level," the summary states. "The current low level of insurgent activity has contributed to the lack of rigorous testing of the aircraft's assault support role."
>
> "I think that this is nothing more than Marines being Marines and wanting to do everything, but when the situation on the ground has changed so drastically, there is a bit of frustration," said Marine spokesman Maj. Eric Dent. But the service "can readily accept" that kind of frustration, which is tied to peace in Anbar province, he said.

[22] Dan Taylor, "Mulhern: Program Adds 100 Flight Hours to Osprey Engine Life in Iraq," *Inside the Navy*, April 13, 2009. Bracketed material as in the original.

"We don't 'create' missions or tactical opportunities to get a check in a particular box," he said.

A Pentagon official who supports the V-22 described Marine generals' comments about assault support missions as a bit of "spin." There is a difference between doing logistics missions like transporting howitzer munitions from one location to another and flying 24 Marines into an attack, though both roles are considered assault support, the official said. A true battle test of the V-22 has not happened yet, the official said. But the official concurred that is due to low levels of insurgent activity in Iraq.

In Iraq, the only weapon the V-22 sported was a small-caliber machine gun mounted on its rear ramp. But the Marines plan to give it heavier firepower before it deploys to Afghanistan, where armed insurgents hide in mountains and hills. Troutman said the service is upping the ramp-mounted gun to a 50-caliber while also working with Air Force Special Operations Command and BAE Systems to develop a 360-degree gun to hold off unexpected threats in an objective area. The new fire-suppression weapon would fire tracers to put the enemy's head down, letting the V-22 use its "incredible" speed, power and acceleration to leave threat area, he said.

"As all of you know, assault support airplanes are not offensive platforms," Troutman added. "They take a defensive posture when they encounter a threat." This interim defensive weapon system is going to be "precisely ... what makes sense in the Afghan environment," he said.

The Marines interviewed in December said the V-22 repeatedly demonstrated how its range and speed can "shrink the battlefield," a point Conway underscored in his press conference. "One of my commanders in Iraq compared it [to] being able to turn Texas into a place the size of Rhode Island," Conway said.

Infantrymen also suggested that they needed additional practice deploying on and off the aircraft during periods of brownout caused by the tiltrotor's powerful downwash, according to the summary.

Marines interviewed also called for more avionics technicians in the maintenance department, due to the technical complexity of the V-22 compared with old CH-46 helicopters. On a related note, it was recommended the rotation of deployed aircraft not exceed one year. If this rotation time line is not possible, the maintenance officer advocated establishing a depot-level type maintenance capability in theater.

VMM-263 originally deployed with 10 aircraft. Later, two more aircraft were deployed to bring the squadron up to its full complement of 12. The squadron commander told interviewers that 12 was the right number to accomplish the assigned mission in Iraq.

The squadron generally praised the Desert Talon training exercise, which is set in the Arizona desert and used to prepare for the Iraq deployment.

In addition to touting the V-22's speed and range, the squadron was pleased with the Osprey's ability to maintain communications with controlling agencies at greater ranges than lower flying helicopters. "The ability to maintain line of sight communications facilitated the command and control capabilities of the controlling agency," the summary says. But Marines in the V-22 must use satellite communications due to the aircraft's increased operational range, the squadron told interviewers.

> Several squadron leaders also told interviewers that injured Marines could receive quicker medical care if the V-22 were assigned a casualty evacuation mission, in addition to its assigned mission of standby tactical recovery of aircraft and personnel.[23]

Legislative Activity in 2009

FY2009 Supplemental Appropriations Bill (H.R. 2346/S. 1054)

As part of its proposed FY2009 supplemental appropriations bill (H.R. 2346/S.1054), the administration requested $1.83 million in procurement funding and $3.9 million in research and development funding for the V-22 program. The **House Appropriation Committee's report** on H.R. 2346 (H.Rept. 111-105 of May 12, 2009, pages 19 and 26) recommends rejecting both of these funding requests. The **Senate Appropriation Committee's report** on S. 1054 (S.Rept. 111-20 of May 14, 2009, pages 39 and 48) recommends approving both of these funding requests.

FY2010 Defense Authorization and Appropriation Bills

The administration's proposed FY2010 defense budget was submitted to Congress in early May. The FY2010 defense authorization and appropriation bills may be marked up in June and July.

May 21, 2009, Hearing on V-22 Program

A May 21, 2009, hearing before the House Oversight and Government Reform Committee to review the V-22 program was adjourned after a few minutes with the intent of being resumed in about two weeks. The chairman of the committee, Representative Edolphus Towns, stated the following:

> Good morning. Thank you all for being here.
>
> We had hoped to conduct today a thorough examination of the Defense Department's V-22 Osprey, an aircraft with a controversial past, a troubled present, and an uncertain future.
>
> However, the Defense Department has evidently decided to stonewall our investigation. On May 5, 2009, I wrote to Secretary of Defense Gates to request information on the Osprey, including copies of two reports on the performance of the Osprey in Iraq, called "Lessons and Observations." I also requested a list of all V-22 Ospreys acquired by the Defense Department, including their current locations and flight status.
>
> However, to this date, the Defense Department has failed to provide this information, despite repeated reminders from the Committee. This is simply unacceptable.
>
> General Trautman, I want you to carry this message back to the Pentagon: We will pursue this investigation even harder than we have so far. We will not be slow-rolled. We will not be ignored.

[23] Christopher J. Castelli, "Marines Tout V-22, But See It As Untested in Tactical Assault Support," *Inside the Pentagon*, May 14, 2009. Bracketed material as in the original.

> I intend to conduct a full investigation of the Osprey, not just an investigation of the information that you want me to see. We hope you will provide it voluntarily, but if you do not, we will compel your compliance.
>
> To ensure a thorough investigation and to allow the Defense Department additional time to provide us with these records, we will continue this hearing in two weeks and I am asking the witnesses to return to present their testimony at that time. This hearing is now adjourned, to be resumed in two weeks at the call of the chair.
>
> Thank you.[24]

On May 22, 2009, it was reported that:

> The Pentagon is denying the House Oversight and Government Reform Committee's accusations that it is stonewalling lawmakers' requests for information about the V-22 Osprey.
>
> "The Department of Defense coordination process is highly complex," Pentagon spokeswoman Cheryl Irwin told *InsideDefense.com*. "We are diligently working to fulfill this request and will have it to the proper officials in order that the hearing process can continue."
>
> House Oversight Committee Chairman Edolphus Towns (D-NY) yesterday accused the Pentagon of stonewalling his request for V-22 documents and vented his displeasure by abruptly ending a hearing after mere minutes, telling a three-star Marine Corps general to return in two weeks.
>
> Towns said the panel had hoped to conduct a "thorough examination" of the V-22 program, which he said has "a controversial past, a troubled present, and an uncertain future." But the Defense Department has "evidently decided to stonewall our investigation," he complained.
>
> The panel's ranking Republican, Rep. Darrell Issa (CA), also complained about DOD's failure to provide the documents, stressing the committee needs such information well in advance of any hearing. In a statement released later, he faulted a "bureaucratic failure of the Office of the Secretary of Defense," not the Marine Corps.
>
> After about three minutes, Towns ended the hearing. He said it would be continued in two weeks to give DOD additional time to provide the records. The witnesses were not invited to speak during the brief hearing nor did they attempt to do so. After the hearing, Lt. Gen. George Trautman, the Marine Corps' top aviation official and one of a handful of witnesses who had been scheduled to testify, declined to speak to reporters.
>
> Later that day, Marine Corps spokesman Maj. Eric Dent told *InsideDefense.com* the service understands Towns' decision to postpone the hearing. But the Marine Corps was

[24] Source: Text of opening statement of Representative Edolphus Towns, as posted on the committee's website. http://oversight.house.gov/documents/20090521101314.pdf. The listed witnesses for the hearing were Mr. Mike Sullivan, Director of Acquisition and Sourcing Management, Government Accountability Office; Mr. Dakota L. Wood, Senior Fellow, Center for Strategic and Budgetary Assessments; Lieutenant General George Trautman, Deputy Commandant for Aviation, U.S. Marine Corps; and Lieutenant Col Karsten Heckl, Commander, Marine Medium Tiltrotor Squadron 162 (VMM-162). See also Christopher J. Castelli, "Committee Accuses DOD of Stonewalling on V-22 Documents, Ends Hearing Abruptly," *InsideDefense.com (DefenseAlert – Daily News)*, May 21, 2009; and Geoff Fein, "House Oversight Committee Chair Claims DoD 'Stonewalling' V-22 Investigation," *Defense Daily*, May 22, 2009: 2-3.

disappointed "that we did not get the opportunity to discuss with the committee the Osprey's remarkable performance in Iraq over the past 19 months," he added. The V-22 program has nothing to hide, according to Dent.

"As we were today, we remain prepared to discuss every aspect of the Osprey program with Congress," he said. "We are fully committed to openness and transparency; in fact, we've been working hand-in-hand with the Government Accountability Office for the past year in its own review of the Osprey program."...

Dent insisted the Marine Corps is making a good-faith effort to address the request.

"We forwarded, at the committee's request, more than 500 pages of maintenance records, after-action reports, and additional information on every MV-22 we have," he said. "Essentially, this was an aircraft-by-aircraft daily record of location and maintenance discrepancies. Collecting this information was a monumental task. Although we cannot speak to why the committee did not receive the information the Marine Corps prepared, we must emphasize that we have a process by which information, including classified material that was asked for by the committee, must be vetted before being released."

Appendix A. V-22 Program History

This appendix discusses the history of the V-22 program, particularly with regard to the development of the V-22 and management of the V-22 program.

Early Development

The first of six MV-22 prototypes was flown in the helicopter mode on March 19, 1989, and as a fixed-wing airplane on September 14, 1989. Prototype aircraft numbers three and four successfully completed the Osprey's first Sea Trials on the USS Wasp (LHD-1) in December 1990.

The fifth prototype crashed on June 11, 1991, on its first flight, because of incorrect wiring in a flight-control system; the fourth prototype crashed on July 20, 1992, while landing at Quantico Marine Corps Air Station, VA, killing seven people and destroying the aircraft. This accident was caused by a fire resulting from hydraulic component failures and design problems in the engine nacelles.[25]

Flight tests were resumed in August 1993 after changes were incorporated in the prototypes. Flight testing of four full-scale development V-22s began in early 1997 when the first pre-production V-22 was delivered to the Naval Air Warfare Test Center in Patuxent River, MD. The first Engineering and Manufacturing Development (EMD) Flight took place on February 5, 1997. The first of four low-rate initial production (LRIP) aircraft, ordered on April 28, 1997, was delivered on May 27, 1999. Osprey number 10 completed the program's second Sea Trials, this time from the USS Saipan (LHA-2), in January 1999.

Operational evaluation (OPEVAL) testing of the MV-22 began in October 1999 and concluded in August 2000. On October 13, 2000, the Department of the Navy announced that the MV-22 had been judged operationally effective and suitable for land-based operations. On November 15, 2000, the Marine Corps announced that the Osprey had successfully completed sea trials and had been deemed operationally effective and suitable for both land and sea-based operations.

Successfully completing OPEVAL should have cleared the way for full rate production. This decision was to have been made in December 2000, but was postponed indefinitely, because of a mixed report from DOD's director of operational test and evaluation, and two fatal accidents.

On April 8, 2000, another Osprey crashed near Tucson, Arizona, during an exercise simulating a noncombatant evacuation operation. All four crew members and 15 passengers died in the crash. An investigation of the accident found that the pilot was descending in excess of the recommended flight envelope which may have caused the aircraft to experience an environmental condition known as "power settling" or "vortex ring state." According to Lt. Gen. Fred McCorkle, the pilot was descending more than a thousand feet per minute. The recommended descent rate is

[25] Former Secretary of Defense Cheney tried to terminate the program in 1989-92, but Congress continued to provide funds for development of the V-22. The George H. Bush Administration's FY1990 budget requested no funds for the program. In submitting that budget to Congress on April 25, 1989, Defense Secretary Cheney told the House Armed Services Committee that he "could not justify spending the amount of money ... proposed ... when we were just getting ready to move into procurement on the V-22 to perform a very narrow mission that I think can be performed ... by using helicopters instead of the V-22."

800 feet per minute." Following a two-month suspension of flight testing, the Osprey recommenced OPEVAL in June 2000, with pilots flying a slightly tighter flight envelope. A July 27, 2000 report by the Marine Corps Judge Advocate General (JAG) (which had access to all non-privileged information from the safety investigation) confirmed that a combination of "human factors" caused the crash.

> This mishap appears not to be the result of any design, material or maintenance factor specific to tilt ... rotors. Its primary cause, that of an MV-22 entering a Vortex Ring State (Power Settling) and/or blade stall condition is not peculiar to tilt rotors. The contributing factors to the mishap, a steep approach with a high rate of descent and slow airspeed, poor aircrew coordination and diminished situational awareness are also not particular to tilt rotors.[26]

A DOD Inspector General study concluded that the V-22 would not successfully demonstrate 23 major operational effectiveness and suitability requirements prior to the December 2000 OPEVAL Milestone III decision to enter full rate production in June 2001[27]. The Marine Corps agreed with DOD's assessment of the deficiencies, but said that they had been aware of these deficiencies before the beginning of OPEVAL. Furthermore, the Marine Corps said that they had an approved plan designed to resolve the deficiencies prior to the Milestone III decision.

On November 17, 2000, DOD's Director of Operational Test and Evaluation issued a mixed report on the Osprey; saying although "operationally effective" the V-22 was not "operationally suitable, primarily because of reliability, maintainability, availability, human factors and interoperability issues." The report recommended that more research should be conducted into the V-22's susceptibility to the vortex ring state blamed for the April 8, 2000 crash.

On December 11, 2000, an MV-22 Osprey crashed near Jacksonville, NC, killing all four Marines on board. This was the fourth Osprey crash since 1991 and the third lethal accident. The aircraft's pilot, Lt. Col. Keith M. Sweeney was the program's most experienced pilot and was in line to command the first squadron of Ospreys. The aircraft's copilot, Maj. Michael Murphy was second only to Sweeney in flying time on the Osprey.[28] The Marine Corps grounded the Osprey fleet pending a mishap board investigation. On April 5, 2001, the Marine Corps reported that the crash was caused by a burst hydraulic line in one of the Osprey's two engine casings, and a software malfunction that caused the aircraft to accelerate and decelerate unpredictably and violently when the pilots tried to compensate for the hydraulic failure.[29] The Marine Corps report called for a redesign of both the hydraulics and software systems involved.[30]

---

[26] V-22 JAGMAN Executive Summary, United States Marine Corps, Division of Public Affairs, July 27, 2000, p.1.

[27] *Audit Report: V-22 Osprey Joint Advanced Vertical Aircraft*. Report No. D-2000-174. Office of the Inspector General. Department of Defense. August 15, 2000.

[28] James Dao, "Marines Ground Osprey Fleet After Crash Kills Four," *New York Times*, December 12, 2000.

[29] An un-redacted version of JAG investigation into the April 2000 V-22 crash indicates that investigators found three "noteworthy" maintenance "areas of concern", including the Osprey's hydraulics system. A Naval Safety Center presentation to the Blue Ribbon Panel brought to light several previously unreported maintenance problems—including hydraulics failures—that caused engine fires or other problems during the Osprey's operational testing.

[30] Mary Pat Flaherty, "Osprey Crash Blamed on Leak, Software," *Washington Post*, April 6, 2001.

Maintenance and Parts Falsifications

In December 2000, an anonymous letter was mailed to the media by someone claiming to be a mechanic in the Osprey program. The letter claimed that V-22 maintenance records had been falsified for two years, at the explicit direction of the squadron commander. Enclosed in the letter was an audio tape that the letter's author claimed was a surreptitious recording of the squadron commander directing maintenance personnel to lie about the aircraft until the V-22 LRIP decision was made. On January 20, 2001, it was reported that the V-22 squadron commander admitted to falsifying maintenance records. The Marine Corps subsequently relieved him of command and reassigned him to a different position. At a May 1, 2001 hearing, members of the Senate Armed Services Committee expressed their concern that false data might impede DOD's ability to accurately evaluate the V-22 program and identify problem areas and potential improvements. The Department of Defense's Inspector General (IG) conducted an investigation. On September 15, 2001, it was reported that three Marines were found guilty of misconduct and two were reprimanded for their actions.

In June 2005, a U.S. grand jury indicted a company that had supplied titanium tubing for the V-22 program. The indictment charged the company with falsely certifying the quality of the tubes. The V-22 test program was halted for 11 days in 2003 because of faulty tubes. Replacing deficient tubes cost the V-22 program $4 million. Navy officials do not believe that these deficient tubes caused fatal mishaps.[31]

Reviews and Restructuring

On April 19, 2001, a Blue Ribbon panel formed by then-Secretary of Defense William Cohen to review all aspects of the V-22 program, reported its findings and recommendations.[32] These findings and recommendations were also discussed during congressional testimony on May 1, 2001. The panel recommended that the program continue, albeit in a restructured format. The panel concluded that there were numerous problems with the V-22 program—including safety, training and reliability problems—but nothing inherently flawed in basic tilt-rotor technology. Because of numerous safety, training, and reliability problems, the V-22 was not maintainable, or ready for operational use.

The panel recommended cutting production to the "bare minimum" while an array of tests were carried out to fix a long list of problems they identified with hardware, software, and performance. Cutting near-term production was hoped to free up funds to pay for fixes and modifications. Once the changes had been made and the aircraft was ready for operational use, the Panel suggested that V-22 out-year purchases could be made in large lots using multi-year contracts to lower acquisition costs. Program officials estimated that the minimal sustainable production rate is 12 aircraft per year, which would be less than half the Ospreys once planned for FY2002.[33] In P.L. 107-107 Sec.123, Congressional authorizers codified the Blue Ribbon Panel's

[31] Louise Story. "Maker of Tubes for Osprey Aircraft is Indicted." *New York Times.* June 8, 2005. Christopher J. Castelli. "Former Supplier of Hydraulic Tubing for V-22 Osprey Faces Indictment." *Inside the Navy*. June 13, 2005.

[32] This panel was chaired by retired Marine General John R. Dailey and included retired Air Force General James B. Davis, Norman Augustine, and MIT professor Eugene Covert.

[33] Adam Hebert, "Minimal Sustainable Rate Will Dramatically Cut Near-Term V-22 Buys," *Inside the* Air Force, April 20, 2001.

recommendation to produce V-22s at the minimum sustainable rate until the Secretary of Defense can certify that the Osprey is safe, reliable, maintainable, and operationally effective.

DOD appears to have taken managerial and budgetary steps to incorporate the Blue Ribbon Panel's recommendations. For example, DOD's FY2001 supplemental funding request asked for a reduction of $475 million in procurement and an increase of $80 million in R&D funds. The additional R&D funding was to be used to support initial redesign and testing efforts to address deficiencies, logistics, flight test, and flight test support for V-22 aircraft. The reduction in procurement funding reflected the need to reduce production to the minimum rate while the aircraft design changes are being developed and tested.

Secretary of Defense Rumsfeld's FY2002 budget amendment, unveiled June 27, 2001, included a request for the procurement of 12 Ospreys. DOD comptroller Dov Zakheim and Marine Corps Commandant Gen. James Jones both stated that the procurement of 12 aircraft in FY2002 would allow them to sustain the V-22 subcontractor base while simultaneously addressing the Osprey program's needs.[34] V-22s were procured at a rate of 11 per year from FY2002 to FY2006.

Following the Blue Ribbon panel's recommendations, former DOD Undersecretary for Acquisition Edward "Pete" Aldridge assumed acquisition authority for the V-22 program. Undersecretary Aldridge changed the V-22 program's status from an ACAT 1C program—which gives the Department of the Navy the highest required authority for production decisions—to an ACAT 1D program. Under the latter category, the Defense Acquisition Board (DAB) will decide if and when the program is ready to enter full rate production. Other ACAT 1D programs, for example, include the F-22 Raptor and the now-cancelled RAH-66 Comanche helicopter.[35]

A NASA-led review of the V-22 program, released November 6, 2001, concluded that there were no known aero-mechanical phenomena that would stop the tilt-rotor aircraft's development and deployment. The study focused on several aero-mechanics issues, including Vortex Ring State, power problems, auto-rotation, and hover performance.[36]

In a December 21, 2001 memo to the Secretaries of the Air Force and the Navy, and the Commander, Special Operations Command, Undersecretary of Defense Aldridge gave his authorization for the V-22 to resume flight testing in the April 2002 time frame. Secretary Aldridge expressed support for range, speed, and survivability goals of the V-22. He noted, however that the program still had numerous technical challenges to overcome, and emphasized that the V-22 must demonstrate that "1) it can meet the needs of the warfighter better than any other alternative, 2) it can be made to be reliable, safe, and operationally suitable, and 3) it is worth its costs in contributing to the combat capability of U.S. forces." Secretary Aldridge approved the flight test program under the condition that the production rate be slowed to the minimum sustaining level, that it be comprehensive and rigorous, and that the restructured program is fully funded in accordance with current estimates.[37] Undersecretary Aldridge

[34] DOD News Briefing, Wed. June 27, 2001, 1:30PM and Kerry Gildea, "New V-22 Plan Sustains Lower Tier Contractors, Jones Reports," Defense Daily, May 15, 2001.

[35] "Navy Loses Osprey Authority," Washington Post, May 22, 2001 and Hunter Keeter, "Aldridge Maneuvers V-22 Acquisition Authority Away from Navy," *Defense Daily*, May 22, 2001 and Linda de France, "V-22 Osprey Production Authority Transferred from Navy to DoD," *Aerospace* Daily, May 22, 2001.

[36] Christopher Castelli, " NASA Review Panel Endorses Resumption of V-22 Flight Tests," InsideDefense.com,. November 14, 2001.

[37] "Text: Aldridge Memo on V-22," *Inside the Navy*, January 7, 2002.

estimated that the V-22 would require at least two years of flight testing before DOD could conclude that the aircraft is safe, effective, and "worth the cost."[38]

Mechanical adjustments slowed the V-22 test schedule, and the MV-22 took its first test flight on May 29, 2002. The Air Force CV-22 resumed flight tests on September 11, 2002. Flight tests were designed to explore both technical and operational concerns. Technical concerns include flight control software and the reliability and robustness of hydraulic lines. Operational concerns explored included whether the Osprey is too prone to Vortex Ring State to make it a safe or effective aircraft, whether this potential problem is further exacerbated by multiple Osprey's flying in formation, and how well the V-22 handles at sea.[39]

The principal differences between the aircraft that were grounded in 2000 and the aircraft that began testing 17 months later (called "Block A" aircraft) are re-routed hydraulic lines, and an improved caution and warning system.[40] Technical glitches were experienced during tests. Hydraulic failures, for example, continued during the reinstated flight test program, once on August 4, 2003, (due to a mis-installed clamp) and again on September 5, 2003. In June 2004 a V-22 was forced twice to make an emergency landing. During one landing, the aircraft suffered a "Class B" mishap (one causing between $200,000 and $1 million in damage).[41] An investigation revealed that the V-22 suffered from widespread problems with an engine component that required replacement every 100 flight hours.[42]

In conjunction with resuming flight testing, the Navy Department modified certain V-22 requirements. For instance, the V-22 is no longer required to land in helicopter mode without power (also known as "autorotation"), protection from nuclear, chemical and biological weapons has been eliminated. The V-22 is no longer required to have an "air combat maneuvering" capability; instead it must demonstrate "defensive maneuvering." Also, the requirement that troops be able to use a rope or rope ladder to exit the cabin at low altitudes has been eliminated.[43] Also concurrent with the resumption of V-22 flight testing, DOD began an in-depth study of alternatives to pursue in case the aircraft does not pass muster. Options reportedly include purchasing the S-92, or upgrading CH-53, or EH101 helicopters.[44]

After one calendar year and 466 hours of flight testing, DOD reviewed the Osprey's progress. On May 15, 2003, Thomas Christie, DOD's Director of Operational Test and Evaluation (DOT&E), graded Bell-Boeing's improvements to the Osprey's hydraulics as "reasonable and appropriate" and "effective."[45] Christie also at that time approved of the testing that had been completed and was satisfied with what had been learned about the V-22's susceptibility to Vortex Ring State. On

[38] Tony Capaccio, "Textron-Boeing V-22 Needs Two years of Testing, Aldridge Says," *Bloomberg.com*, October 16, 2001.

[39] Thomas Ricks, "V-22 Osprey to Face Make or Break Tests," *Washington Post*, December 25, 2002, p. 14.

[40] Jefferson Morris, "Pilot: Resumption of V-22 Testing To Be Treated Like First Flight," *Aerospace Daily*, April 29, 2002.

[41] Christopher Castelli. "Navy Convenes Mishap Board to Investigate Latest V-22 Incident." *Inside the Navy*. July 5, 2004.

[42] Christian Lowe. "V-22 Ospreys Require New Engine Component Every 100 Hours." *Navy Times*. July 16, 2004.

[43] Joseph Neff, "Eased Standards 'Fix' Osprey," *Raleigh News & Observer*, May 19, 2002, p.1.

[44] "Aldridge Makes Progress Check on MV-22 at NAS Patuxent River," *Defense Daily*, February 11, 2003.

[45] Tony Capaccio, "Boeing-Textron B-22 Gets Favorable Review From Pentagon Tester," *Bloomberg.com*, May 19, 2003.

May 20, 2003, the Defense Acquisition Board also reviewed the program and approved of the flight test program's progress.

Marine Corps officials recommended increasing the production rate in FY2006 from the minimum sustainable rate of 11 to 20 aircraft. However, in an August 8, 2003, memorandum, Undersecretary of Defense for Acquisition Michael Wynne announced that this acceleration "presents more risk than I am willing to accept." Instead, Wynne restructured the planned procurement, reducing the FY2006 purchase to 11 aircraft. "For subsequent years' procurement planning, production rates should increase by about 50% per year for a total of 152 aircraft through FY09," according to the August 8th memo. Wynne directed that the savings resulting from the reduced procurement (estimated at $231 million) be invested in improving the V-22's interoperability, by funding the Joint Tactical Radio System, Link 16 and Variable Message Format communication. Wynne also directed that a multi-year procurement (MYP) of the V-22 be accelerated. While some suggest that this restructuring will more quickly deliver high-quality aircraft to the Marines and Special Operations Forces, others fear that slowing procurement will inevitably raise the platform's cost.

In December 2004 the V-22 budget and schedule were restructured again. Program Budget Decision 753 (PBD-753) cut 22 aircraft from the V-22's production schedule and $1.3 billion from the budget between FY2006 and FY2009.

On June 18, 2005, the MV-22 program completed its second round of operational evaluation (OPEVAL) flight. The test program was marked by two emergency landings, a Class B mishap, a small fire in an engine compartment, and problems with the prop-rotor gear box. However, Navy testers recommended that DOD declare the V-22 operationally suitable, and effective for military use. This recommendation was based, in part, on observations that the MV-22 had complied with the objectives of P.L. 107-107 Sec.123: hydraulic components and flight control software performed satisfactorily, the aircraft was reliable and maintainable, the MV-22 operated effectively when employed with other aircraft, and the aircraft's downwash did not inhibit ground operations.[46]

On September 28, 2005, the V-22 program passed a major milestone when the Defense Acquisition Board approved it for military use and full rate production.[47] The MV-22 continues testing to assess survivability and to develop tactics. The CV-22 is in developmental test and evaluation. The program continues to experience technical and operational challenges, and mishaps. For example, an inadvertent takeoff in March 2006 caused wing and engine damage in excess of $1 million. An engine component has been replaced because its failure in flight has caused seven unexpected flight terminations. In October 2005, a V-22 experienced engine damage during flight due to icing. An engine compressor failure during the V-22's first overseas deployment (July 2006) forced the aircraft to make a precautionary landing before reaching its destination. An engine fire on December 7, 2006, caused more than $1 million to repair, and the Marine Corps grounded all of its V-22s in February 2007 after it was found that a faulty computer chip could cause the aircraft to lose control during flight.

[46] "Letter of Observation in Support of MV-22 Program Compliance with Section 123 of the National Defense Authorization Act for Fiscal Year 2002." Commander, Operational Test and Evaluation Force. Department of the Navy. February 18, 2005.

[47] Andy Pasztor. "Pentagon Clears Full Production for Osprey Aircraft." *Wall Street Journal.* September 29, 2005.

Appendix B. General Arguments Made by Supporters and Opponents of the V-22

This appendix presents general arguments by supporters and opponents of the V-22.

Arguments Made By Supporters

Supporters of the V-22 could argue one or more of the following:

- The V-22 is needed to replace aging military helicopters that are costly to maintain and operate safely and effectively. While there may be new helicopters that could replace and improve on today's military helicopters, none of them would match the Osprey's capabilities.
- When landing on hostile shores in a third-world conflict (typically lacking important infrastructure such as airfields and roads), the V-22 would be critical for the transport of Marines from ship to shore. Senior DOD officials have testified that the V-22 would have, for example, made a significant contribution to the war on terrorism in Afghanistan.
- The Osprey has been rigorously tested and its accident rate is consistent with other aircraft development programs. While some technical problems have been encountered, leading experts have testified that there are no technological barriers to the employment of tilt-rotor technology. Engineering-level modifications have put the Osprey program back on track. The completed OPEVAL demonstrates that the V-22 program has resolved all of the concerns expressed by the Blue Ribbon Panel and by Congress.
- The V-22 also has potential value for civil aviation, law enforcement, and foreign sales by the U.S. aerospace industry.[48] The development of tilt-rotor aircraft for the armed services could have significant spin-off effects for civil aviation and U.S. technology, giving the U.S. aerospace industry a major competitive advantage in the international market.[49]

Arguments Made by Opponents

Opponents of the V-22 could argue one or more of the following:

[48] Sen. Ted Stevens et al., "Continuation of the V-22 Aircraft Program," remarks in the Senate, *Congressional Record*, daily edition, April 19, 1989, pp. S4507-S4509.

[49] The potential civil application of tilt-rotor technology is also considered by some a good reason to pursue the V-22 program. A February 1988 study by the FAA and NASA concluded that tilt-rotors could help relieve airport congestion by diverting commuters and short-distance passengers to vertiports in urban centers. The importance of U.S. production of a tilt-rotor aircraft for civilian purposes was the subject of a hearing on July 17, 1990, by the House Committee on Science, Space, and Technology's Subcommittee on Transportation, Aviation, and Materials. In 1992, Congress enacted legislation (H.R. 6168) directing the Secretary of Transportation to establish a "civil tilt-rotor development advisory committee" to evaluate the feasibility and viability of developing civil tilt-rotor aircraft and infrastructure necessary to incorporate tilt-rotor aircraft into the national transportation system.

- For the kinds of ship-to-shore operations in which the Marines are most likely to be involved in coming years, the V-22's greater speed and range will often not be critical. Consequently, these ship-to-shore operations can be performed adequately by less expensive helicopters. Although the Osprey can lift three times more dead weight than can the CH-46, the Osprey is three times heavier and five times more expensive than the CH-46. The V-22's performance, moreover, should be compared to that of contemporary helicopters such as the EH-101, rather than to the performance of the CH-46, which is a 1970s-era helicopter. When compared to contemporary helicopters, the capabilities of the V-22 are not as impressive.[50]
- Marine assault missions in an opposed landing would coordinating V-22 operations with the operations of aircraft having less speed and range, which in practice will reduce the V-22's advantages in these two areas. The Osprey's hypothetical contribution to the war in Afghanistan is questionable due to the high altitude of that country and the Osprey's inability to improve greatly over helicopter performance in high-altitude operations.
- The Osprey's operational capabilities and operational concepts are open to question. A January 12, 2001, presentation by the Government Accountability Office (GAO) to the V-22 Blue Ribbon Panel, for example, said that the V-22's cabin may not be large enough to carry 24 combat-equipped Marines, and that the severe rotor down wash might impede the ability of troops to exit the aircraft and move into combat positions. Also, to avoid entering Vortex Ring State, Osprey's will have to descend slowly, which will make them vulnerable to ground fire in combat situations.
- Studies suggest that tilt-rotor aircraft are more susceptible than traditional helicopters to airflow instabilities that can cause Vortex Ring State.[51] Our understanding of the kinds of airflow anomalies that have caused mishaps in V-22 flight testing is still very immature.

Author Contact Information

Ronald O'Rourke
Specialist in Naval Affairs
rorourke@crs.loc.gov, 7-7610

[50] See, for example, Everest Riccioni, "Osprey or Albatross?," *Defense News*, January 27, 2004.

[51] Michael Dornheim, "Tiltrotor Wake 'More Complex' Than Classic Vortex Ring State," *Aviation Week & Space Technology*, July 15, 2002.