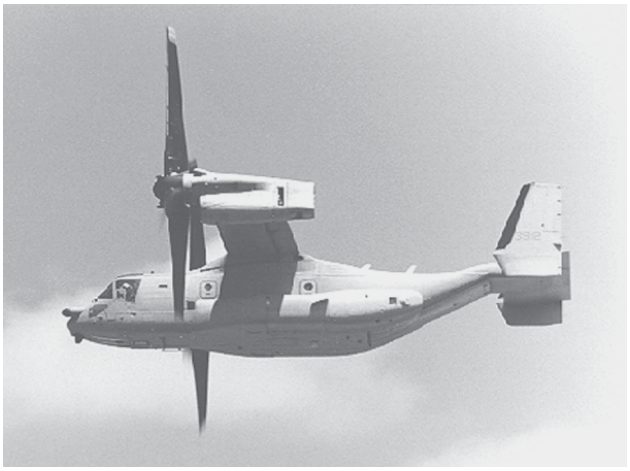
V-22 Osprey

SUMMARY

- Since returning to flight in 2002, the event-based test program has flown over 1,700 hours in developmental and operational testing.
- The program operates in an environment of open communication among all participants.
- The tiltrotor Operational Test and Evaluation (OT&E) squadron, VMX-22, is finalizing planning and training for a second phase of IOT&E called Operational Evaluation (OPEVAL) II.



OT-IIF demonstrated several encouraging aspects of the V-22 Block A configuration.

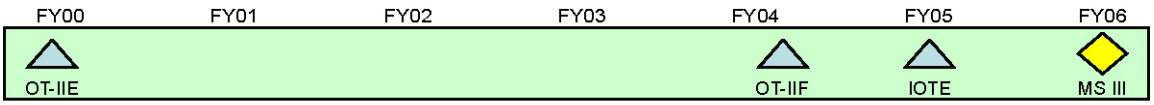
SYSTEM DESCRIPTION AND MISSION

The V-22 Osprey is a tilt-rotor vertical/short takeoff and landing multi-mission aircraft developed to fill multi-Service combat operational requirements. The MV-22 will replace the current Marine Corps medium-lift assault helicopters (CH-46E and CH-53D). The Air Force intends the CV-22 to provide a long-range vertical takeoff and landing insertion and extraction capability and to supplement the Special Operations Forces MC-130 aircraft. The tilt-rotor design combines the vertical flight capabilities of a helicopter with the speed and range of a turboprop aircraft, permits aerial refueling, and allows for worldwide self-deployment. The current design also affords a greater degree of survivability than existing medium lift helicopters.

DOT&E completed an independent evaluation of test adequacy, operational effectiveness, suitability, and survivability and submitted the required OT&E and Live Fire Test and Evaluation (LFT&E) reports to the Secretary of Defense and congressional defense committees in November 2000. Based in part on the findings in these reports, the Navy delayed its planned Milestone III decision. All V-22 flying was halted following the V-22 mishap in December 2000.

During the non-flying period, the program conducted complete design reviews of all critical V-22 systems. Simultaneously, the Integrated Test Team designed an extensive developmental and operational test program to address concerns raised by several high-level independent review panels and to support the fleet's return to flight. DOT&E participated in these reviews and approved a revised Test and Evaluation Master Plan.

TEST AND EVALUATION ACTIVITY



The first MV-22 returned to flight on May 29, 2002. To date, a ten-aircraft developmental flight test program has amassed over 1,800 flight hours plus extensive ground test and simulation. The approach to return the V-22 to operational flight continues to be event-based; each block of testing begins only upon completion of the necessary preceding test events. After a thorough ground-test of the flight control software in laboratories and simulators and flight validation, the first priority was high-rate of descent (HROD) flight-testing to investigate vortex ring state (VRS). In addition, limited testing of low-speed maneuvering flight and simulated all-engines inoperative, airplane-mode entry and stabilized descent were conducted to validate an emergency landing profile.

On August 28, 2003, the Marine Corps activated a new tilt-rotor test squadron, VMX-22. The squadron, which reports to the Navy's Commander, Operational Test and Evaluation Force, was to plan and conduct OT&E and develop tactics, techniques, and procedures for the operational employment of the V-22. VMX-22 conducted an operational assessment (OT-IIF) under a DOT&E-approved test plan in May-June 2004. OT-IIF served two purposes:

- To assess whether the design changes to the Block A configuration degraded previously demonstrated performance.
- For VMX-22 to rehearse procedures and communications to be employed in a major operational test.

OT-IIF consisted of 45 missions and 123 flight hours, primarily at Marine Corps Air Station New River, North Carolina.

Training flights and planning are under way for a second phase of IOT&E (OPEVAL II, or OT-IIG) to address most of the issues raised in the November 2000 OT&E report (testing not conducted, waived items, and correction of deficiencies). Overall degree of mission accomplishment by a sea-based Marine Expeditionary Unit equipped with MV-22 aircraft will be evaluated in OPEVAL Phase Two, planned to begin in February 2005. Following OT-IIG, DOT&E will submit its beyond low-rate initial production report containing an assessment of test results and the design changes.

TEST AND EVALUATION ASSESSMENT

Based on developmental tests since returning to flight, DOT&E has increased confidence that the V-22 characteristics involving VRS are understood and knowledge of VRS consequences is widespread in the V-22 community. These factors tend to reduce the likelihood of another mishap caused by VRS:

- Extensive HROD testing has confirmed the V-22 VRS envelope with much more fidelity. The flight conditions necessary to enter VRS are close to what had been predicted early in development.
- Published operating limitations appear adequate for normal conditions and the program is investigating an expanded operating envelope.
- In HROD maneuvering testing inside the VRS region, pilot control inputs delayed roll-off and did not precipitate it.
- The flight simulators and flight syllabus emphasize avoiding VRS.
- Flight manual cautions, warnings, and advisories were amended.
- A HROD warning system is present for both pilots and appears functional.
- Readability is improved for the pilots' vertical speed indicator.
- Nacelle tilt is a powerful VRS recovery tool, demonstrated and understood.

For any rotorcraft, including the V-22 tiltrotor, the ability to save the aircraft – or at least ensure the survival of its occupants – in the event of a single or dual engine failure must be determined. In either the airplane or helicopter mode, the recommended procedure in the event of an engine failure is to convert to airplane mode, proceed immediately to a suitable landing spot, convert back to helicopter mode, and land as soon as possible.

The ability of the V-22 to perform single-engine landings is better than the helicopters it replaces. In the event of either sudden dual-engine failures, or a single failure of one engine coupled with a failure of the interconnecting drive train - while the aircraft is in either conversion or in the helicopter mode, the recommended method to recover is to tilt the nacelles down and attain the best glide speed available, then flare to a survivable landing.

Although testing of this procedure all the way to landing is not practicable, limited testing has confirmed that, while the aircraft can perform an autorotative descent, it cannot autorotate to a safe landing. The approach to safety adopted by the program long ago has been to minimize the possibility of such disastrous occurrences through system design.

OT-IIF demonstrated several encouraging aspects of the V-22 Block A configuration:

- Improved performance:
  - Self-deployment and assault mission range.
  - Short takeoff distance.
  - Cruise airspeed.
  - External lift of the prototype lightweight 155 mm howitzer.
  - Excellent handling qualities.
- Formation flight and two-ship approaches to a landing zone, and superior ingress and egress performance.
- Significant improvements in fasteners used in the airframe.

- Improved displays in the cockpit, and better aircrew alerts.
- Better outward-opening cockpit door.

Some concerns remain following OT-IIF:

- The scope of OT-IIF was insufficient for high confidence conclusions regarding reliability, maintainability, and availability. However, using the VMX-22 operational flight hours does give a reasonable amount of data (over 800 fight hours), and also suggests only marginal mean flight hours between aborts and availability.
- Communications in anti-jam mode and long-range communications.
- Environmental comfort in the cabin.
- Defensive maneuvering was not fully demonstrated because of flight clearance limitations based on testing to date.
- During confined area landings in desert environments, dirt and debris in the cockpit and throughout the aircraft remains an issue.

Detailed planning is under way for OT-IIG (OPEVAL II) in 2005. That test will support a complete evaluation of Block A effectiveness and suitability in realistic operations, and will support the Secretary's certification of effectiveness under Section 123 of the FY02 Defense Authorization Act. Most of the operational tasks required under Section 123 have been performed satisfactorily in developmental or combined developmental test/operational test.