

## MV-22 Osprey

### Executive Summary

- VMX-22 Tiltrotor Test Squadron executed an adequate FOT&E to evaluate upgraded flight control software and enhancements to mission equipment and develop high-altitude and mountainous terrain tactics and procedures for the MV-22.
- The MV-22 demonstrated effectiveness in a wide range of approved high-altitude scenarios reflecting current Marine Corps operations. The enhanced chaff and flare system and the software improvements were effective. The aircraft's ability to operate in high-altitude, unimproved landing zones was limited by the lack of an effective braking system and the inability to perform rolling takeoffs or landings. The radar altimeter was unstable in cluttered environments and demonstrated limited capability in urban and shipboard environments.
- The MV-22 met or exceeded thresholds for all reliability and maintainability requirements, with the exception of repair times for aborts. This shortfall did not materially affect the ability of the aircraft to meet its flying demands. Additionally, the ice protection system was again demonstrated to be unreliable.
- The mission capable rate demonstrated during the FOT&E period was 57 percent (threshold requirement of 82 percent) and was consistent with the CV-22 IOT&E of 58 percent, but was less than the previous MV-22 IOT&E demonstrated value of 78 percent.
- The V-22 program should continue to pursue development of an effective braking system, rolling take-off/landing capability, enhanced radar altimeter, defensive weapon system, battle damage repair procedures, cold weather testing in conjunction with improvements to the ice protection system, improved wiring, and engine and drive-train subassembly reliability.

### System

- The MV-22 is a tilt-rotor aircraft capable of conventional wing-borne flight and vertical take-off and landing.
- The Marines are replacing the aging CH-46 and CH-53D helicopters with MV-22s.
- The MV-22 can carry 24 combat-equipped Marines and operate from ship or shore.



- It can carry an external load up to 10,000 pounds over 40 nautical miles ship-to-shore and return.
- It can self-deploy 2,267 nautical miles with a single aerial refueling.

### Mission

- Squadrons equipped with MV-22s will provide medium-lift assault support in the following operations:
  - Ship-to-Objective Maneuver
  - Sustained operations ashore
  - Tactical recovery of aircraft and personnel
  - Self-deployment
  - Amphibious evacuation
- Currently deployed squadrons are providing high-tempo battlefield transportation in Iraq and Afghanistan.

### Major Contractors

- Bell Helicopter – Amarillo, Texas
- The Boeing Company – Ridley Township, Pennsylvania

### Activity

- The Navy Commander, Operational Test and Evaluation Force/Marine VMX-22 Tiltrotor Test Squadron conducted a multi-phased follow-on integrated developmental and dedicated operational test. The IT-IIIIE integrated phase was accomplished from March 15, 2007 to July 10, 2009. The dedicated OT-IIIIE FOT&E phase was executed from May 26

to July 10, 2009. Data validation and analysis was completed in October 2009.

- All testing was conducted in accordance with the DOT&E-approved Test and Evaluation Master Plan and test plans. DOT&E observed the dedicated operational test phase. The integrated testing phase accomplished focused subsystem

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evaluations and developed tactics, techniques, and procedures for: fast-rope and parachute operations, airdrop of material and resupply, high altitude and mountainous operations (both day and night), defensive weapon system, countermeasures testing, shipboard compatibility, and assault zone tactics. The test venues included: Naval Air Stations in Fallon, Nevada; Yuma, Arizona; and China Lake, California, as well as shipboard operations aboard the USS *Ponce*, *Fort McHenry*, and *Bataan*.

- VMX-22 self-deployed four operationally representative aircraft from the Marine Corps Air Station New River, North Carolina, for dedicated FOT&E. Dedicated operational testing was staged from the deployed forward operating base at Kirtland AFB, New Mexico, with operationally realistic missions on the Fort Carson, Colorado, Range complex.
- The FOT&E evaluation addressed flight control software upgrades, the chaff/flare countermeasures upgrade, missile warning sensor, an aft cabin situational awareness upgrade for embarked troop commanders, enhanced ground refueling capability using the Osprey as the host donor for vehicle and aircraft refueling at austere locations, and mission planning system improvements. All missions were also designed to allow development of high altitude and mountainous operations tactics and to explore survivability enhancement tactics for assault operations.

## Assessment

- The testing was adequate to determine operational effectiveness and suitability of the MV-22 Block 20/B.
- VMX-22 flew 862 hours during the developmental/operational integrated testing period, and 145 hours of dedicated FOT&E. During the FOT&E, the Marines attempted 22 operational mission vignettes and successfully completed 20, representing a 91 percent success rate. The speed and range of the MV-22 Block B/10 were key contributors to overall mission success. The testing demonstrated effectiveness in the ability of the aircraft to perform parachute drops of both troops and materiel, personnel and equipment recovery, tactical insertion/extraction of combat Marines, and battlefield circulation/resupply.
- The aircraft demonstrated adequate high altitude performance in mountainous environments and the VMX-22 crews developed and validated assault tactics for high altitude operations and cooperative tactics with fixed and rotary wing escorts.
- The testing documented several limitations to employment that the program addressed by tactical procedures and operational workarounds. These limitations included: overwater prop rotor downwash effects on swimmers, remaining maneuvering

restrictions in helicopter mode, limitations on the effectiveness of the forward looking infrared sensor, radar altimeter instability in cluttered environments, and limits on operations in salt spray environments. Shipboard testing documented Osprey limitations to operations aboard the smaller ship classes due to heat loading of the deck plates; however, procedural workarounds ameliorated the effects.

- The suitability evaluation for the FOT&E period included reliability, maintainability, and availability metrics. The Osprey met or exceeded thresholds for all metrics except mean repair time for aborts and mission capable rate. Mean time to repair for aborts during the test period was 4.8 hours (threshold value 6.2 hours); however the shortfall did not affect the ability of the aircraft to meet the flight and mission demands of the test schedule. The mission capable rate demonstrated during the FOT&E period was 57 percent (threshold requirement of 82 percent) and was consistent with the CV-22 IOT&E of 58 percent, but was less than the previous MV-22 IOT&E demonstrated value of 78 percent.
- Major contributors to the low mission capable rate in this test period included cracking or prematurely failing hinges/access doors, engine and drive components within the nacelle structure, flight control system failures, wiring, swashplate actuators, and constant speed generators.

## Recommendations

- Status of Previous Recommendations. The program did not satisfactorily address the FY09 recommendation to continue integrated Marine Corps/Air Force development and testing of the following: realistic cold weather testing in conjunction with improved ice protection system reliability, weather radar integration into the MV-22, enhanced fire suppression systems, or development of battle-damage repair procedures. The program satisfactorily addressed the second FY09 recommendation.
- FY10 Recommendation. In addition to addressing the above, the program should:
  1. Aggressively continue integrated Marine Corps/Air Force development and testing of the following: an effective braking system, the capability for rolling take-off/landings on unimproved surfaces, a stable radar altimeter effective in cluttered environments, defensive weapon system, expansion of the defensive maneuvering and air-refueling altitude envelopes, and improved engine and drive-train subassembly reliability.