

## MV-22 Osprey

### Executive Summary

- The Navy conducted cyber testing of the MV-22B Joint Mission Planning System – Maritime (JMPS-M) in August 2013 and FOT&E OT-IIIJ from September through October 2013.
- The Navy should implement stronger role-based access controls for JMPS-M to strengthen cybersecurity.
- OT-IIIJ demonstrated the utility of most system hardware and flight software improvements.
- Additional testing is needed to demonstrate the utility of the APX-123 Mode 5 Identification Friend or Foe (IFF) Transponder and the Integrated Waveform Satellite Communications performance, and the reliability of the GAU-21 Defensive Weapon System.
- The Navy should continue to execute the reliability growth program for the MV-22 fleet

### System

- There are two variants of the V-22: the Marine Corps MV-22 and the Air Force/U.S. Special Operations Command CV-22. The air vehicles for Air Force and Marine Corps missions are nearly identical, with common subsystems and military components sustainable by each Service's logistics system.
- The Marine Corps is replacing the aging CH-46 and CH-53D helicopters with MV-22s. The MV-22 is a tilt rotor aircraft capable of conventional wing-borne flight and vertical take-off and landing.
- 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 50 nautical miles, and can self-deploy 2,363 nautical miles with a single aerial refueling.
- Recent system upgrades include the following:
  - Enhanced Rapid Ground Refueling system
  - APX-123 IFF transponder (replaced the APX-118 IFF transponder to support Mode 5)
  - Generation 5 radios (replaced Generation 3 radios to support Integrated Waveform Satellite Communications (SATCOM))
  - GAU-17 Defensive Weapon System improvements (upgraded with a sensor-only mode that allows the gunner to use the electro-optical sensor when the gun turret is not being used)



- Modified aircraft flight control laws (granted pilots greater lateral control authority and increased thrust sensitivity)
- Increased Forward-Looking Infrared Sensor look down angle (expanded by a factor of six)
- Blue Force Tracker (BFT-1) mount and circuitry improvements

### 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 the U.S. Central Command Area of Responsibility.

### Major Contractors

Bell-Boeing Joint Venture:

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

### Activity

- The Navy, with assistance from the Marine Corp Information Assurance Red Team, conducted cyber testing of the MV-22B JMPS-M in August 2013. The JMPS-M provides a network-based mission-planning environment for the MV-22 aircraft, and is a potential cyber vulnerability for the MV-22B.
- The Marine Corps Operational Test and Evaluation Squadron 22 (VMX-22) conducted FOT&E OT-IIIJ from September through October 2013. This 89-flight hour dedicated operational test was preceded by 14 months and 627 flight hours of integrated testing (IT-IIID).

# FY14 NAVY PROGRAMS

- Operational pilots evaluated capabilities of the latest MV-22B enhancements: the enhanced Rapid Ground Refueling system, APX-123 IFF transponder, Generation 5 radios, GAU-17 Defensive Weapon System improvements, increased Forward-Looking Infrared Sensor look down angle, BFT-1 mount and circuitry improvements, and modified aircraft flight control software.
- VMX-22 conducted the OT-IIIJ missions using four production-representative aircraft (two Block C and two Block B) at Marine Corps Air Station New River, North Carolina, and Petersen AFB, Colorado. DOT&E observed all of the OT-IIIJ missions.
- OT-IIIJ was conducted in accordance with a DOT&E-approved Test and Evaluation Master Plan and Operational Test Plan.
- Overheating prop-rotor gearboxes and flight control actuator failures were noteworthy sources of OT-IIIJ aircraft downtime and maintenance effort.
- Reliability improvements to the Icing Protection System (IPS) have been demonstrated on CV-22 aircraft, but the full set of IPS upgrades has not been implemented on the MV-22B test aircraft. The reliability of MV-22B IPS could not be accurately measured because of unresolved IPS reliability failures on the OT-IIIJ test aircraft.
- Information generated by the JMPS-M is vulnerable to alteration by malicious or unwitting users who gain access to administrative functions. Otherwise, JMPS-M information protections successfully prevented unauthorized access by internal and external cyber threats.

## Assessment

- Units equipped with the MV-22B remain operationally effective, suitable, and survivable as previously reported.
- OT-IIIJ demonstrated the utility of most software version B5.01/C2.01 and hardware enhancements.
  - As a mobile-refueling platform, the MV-22 can now deliver twice as much fuel at twice the previous refueling rate during ground refueling operations.
  - The software version B5.01/C2.01 improvements aided mission management as intended, but created minor increases in pilot workload with nuisance warnings and uncommanded resets.
- Improvements to the GAU-17 Defensive Weapon System, the APX-123 Mode 5 IFF, and the Integrated Waveform SATCOM were not adequately demonstrated during OT-IIIJ; following successful developmental testing, these will be tested in OT-IIIK in 2015.
  - Only 1,500 rounds were fired with the GAU-17 Defensive Weapon System; too few rounds to observe the effects of the improvements.
  - Mode 5 IFF interrogators were not employed during operational testing.
  - The new capability of the Generation 5 radio was the Integrated Waveform SATCOM, but this waveform did not work at all in developmental or operational testing of the radio on MV-22 aircraft.
- Reliability improvements were evident in the OT-IIIJ test aircraft and MV-22B fleet, but recurring problems continue to degrade non-deployed fleet and test aircraft availability.

## Recommendations

- Status of Previous Recommendations. The Navy has made progress on the FY11 recommendation to improve reliability of the IPS. While the Navy has not implemented the full set of IPS upgrades on all the MV-22 aircraft, it has demonstrated reliability improvements to the IPS on CV-22 aircraft, which is identical to the system used on MV-22. The Navy should continue to make reliability improvements through execution of its reliability growth program. The Navy did not field the Traffic and Collision Avoidance System as DOT&E recommended in FY12.
- FY14 Recommendations. The Navy should:
  1. Maintain the V-22 program's focus on reliability growth, parts provisioning, and reduction of repair time for gearboxes and flight control components.
  2. Implement role-based access controls for authorized JMPS-M users and investigate the operational effects of cyber penetration of this and other interfacing systems on the MV-22B.
  3. Conduct additional operational testing of the GAU-17 Defensive Weapon System and Integrated Waveform SATCOM.
  4. Include MV-22 in the next Joint Operational Test Approach testing of Mode 5 IFF, currently scheduled for FY16.
  5. Provide appropriate warnings when fielding MV-22B software versions B5.01 and C2.01. In future software development, address nuisance warnings and uncommanded resets.