# CV-22 Osprey

## Executive Summary

- Air Force Special Operations Command (AFSOC) conducted CV-22 testing to evaluate Tactical Software Suite (TSS) 20.2.02/20.2.03, which is a compilation of software and hardware packages.
- The Mission Computer Obsolescence Initiative (MCOI) upgrade portion of TSS allowed pilots to use MCOI-compatible planning tools to create and load mission plans into the aircraft systems.
- Both pilots and maintainers commented that the training provided for MCOI was not sufficient and more was required.
- The Color Helmet-Mounted Display (CHMD) system degraded pilot situational awareness during both day and night flights and was not reliable.
- The Generation 5 radios did not provide an improvement to CV-22 communications capabilities and did not resolve workload problems.

## System

- The CV-22 is the AFSOC variant of the V-22. It replaced Special Operations Forces MH-53 helicopters in 2008. The tilt-rotor design provides the speed and range of a conventional fixed-wing aircraft and vertical take-off and landing capabilities of a helicopter.
- The CV-22 has terrain-following/terrain-avoidance radar, an advanced multi-frequency radio communication suite, an integrated electronic defense suite, and aerial refueling capability, allowing it to augment the AFSOC MC-130 fleet.
- The CV-22 electronic defensive suite includes the Suite of Integrated Radio Frequency Countermeasures (SIRFC) and the Directional Infrared Countermeasures (DIRCM) system with the AAR-54 Missile Warning Sensor, Small Laser Transmitter Assembly jammer, and the ALE-47 Countermeasure System capable of dispensing both flares and chaff. The Dedicated Electronic Warfare Display provides an integrated threat picture to the crews from SIRFC and DIRCM.

- The CV-22 can carry 18 combat-ready Special Operators 538 nautical miles and return. It can self-deploy up to 2,100 nautical miles with one aerial refueling.
- The Advanced Ballistic Stopping System (ABSS) is an optional protective armor kit that CV-22 squadrons can install for certain mission scenarios. The ABSS kit weighs 825 pounds.
- Bell-Boeing has delivered 51 of 52 purchased aircraft which includes one combat loss and one training loss. The final aircraft is expected to be delivered by the end of 2016.

## Mission

Commanders employ AFSOC squadrons equipped with the CV-22 to provide high speed, long-range insertion and extraction of Special Operations Forces to and from high-threat objectives.

## Major Contractors

- Bell-Boeing Joint Venture:
  - Bell Helicopter – Amarillo, Texas
  - The Boeing Company – Ridley Township, Pennsylvania
- The Protective Group, Inc. – Miami Lakes, Florida

## Activity

- AFSOC's Operational Test Squadron, the 18th Flight Test Squadron (FLTS), conducted operational testing on the CV-22 TSS 20.2.02/20.2.03, which is a compilation of software and hardware upgrades, between October 1, 2015, and February 19, 2016. The 18th FLTS conducted the testing in accordance with the DOT&E-approved test plan.
- The 18th FLTS evaluated the updated TSS, which includes MCOI upgrades, JVX [Joint Services Advanced Vertical Lift Aircraft] Application System Software (JASS), a CHMD system, a Generation 5 AN/ARC 210 radio, and MCOI-compatible mission planning tools. The MCOI brings increased processor speed and capacity, will be included as the standard mission computer in all new-build V-22 aircraft, and will eventually be retrofitted into all V-22s. This testing updated the findings on the TSS 20.2.01 deficiencies reported in FY15.
- The Joint Live Fire test program completed supplemental testing of the ABSS armor in July 2016. The testing evaluated one additional threat type, additional obliquity angles, edge performance, and installed armor performance. This

additional testing was in response to gaps identified with the initial testing performed in 2014.
- AFSOC completed a portion of the upgraded SIRFC software version 8 tests in February through March 2015 at China Lake and the Nevada Test and Training Range to address CV-22 SIRFC active countermeasure deficiencies. AFSOC completed the remaining testing of the SIRFC software in October 2015.
- The Air Force's 46th Test Squadron in cooperation with the 18th FLTS conducted a Cooperative Vulnerability and Penetration Assessment of CV-22 cybersecurity protections and vulnerabilities in September 2016. This testing included the first investigations of Military Standard 1553 data bus cybersecurity on any V-22 aircraft. The data and results from this testing will be available in FY17.

**Assessment**
- The CHMD Color Display Day Module degraded CV-22 pilots' situational awareness and was not reliable during testing.
- The CHMD Color Display Night Module degraded CV-22 pilots' situational awareness while they were operating in brightly illuminated areas such as populated shorelines and urban areas.
- Pilots commented that they did not receive sufficient training on CHMD use and that they needed more training flights using the CHMD.
- CV-22 pilots were able to use the MCOI-compatible mission planning tools to create mission plans and load them onto the CV-22 aircraft systems. Pilots reported that the requirement to manually load hazard data was time-consuming, cumbersome, and increased mission-planning time by up to an hour.
- CV-22 maintenance personnel commented that they were not provided sufficient training to troubleshoot or repair the new MCOI mission computer.
- The Generation 5 radios did not provide an improvement to CV-22 communications capabilities and did not resolve workload problems identified in IOT&E.
- During TSS testing, operational test pilots reported frequent faults in the Icing Protection System (IPS).
  - AFSOC examined their fleet-wide data on the IPS, which revealed a mean time between failure of 37 hours for the period of March 2015 to February 2016. Availability of the fully-capable IPS systems across AFSOC was 43 percent with the highest availability among those units who have the highest potential for flight in icing conditions.
  - IPS failures affect other aircraft components. For example, 15 percent of failures charged to proprotor blades were caused by failure of IPS components on the blade. Poor IPS reliability increases sustainability costs and affects CV-22 employment in known or suspected icing. It can cause safety-of-flight issues if inadvertent icing is encountered.
  - Low availability/reliability of the IPS is a change from performance observed in 2013 IPS tests and could affect CV-22 suitability.
- Preliminary findings indicate the ABSS armor demonstrated better coupon performance than the 2014 testing. Aircraft shielding enhances the armor's performance and mitigates previously identified problems.
- Preliminary data analyses suggest that the active countermeasure component of the SIRFC 8.02 system did not address the subsystem deficiencies. Consistent with previous results, the subsystem does not meet most survivability requirements.
- AFSOC will publish the cybersecurity test results and analysis in FY17.

**Recommendations**
- Status of FY15 Recommendations. The Navy completed operational testing of SIRFC and conducted the recommended live fire testing.
- FY16 Recommendations. The Navy and AFSOC should:
  1. Investigate the causes of poor performance and reliability failures of the CHMD, reduce the time required to load mission data, improve maintenance training for MCOI maintainers, and continue efforts to improve air-to-ground communications.
  2. Investigate IPS reliability and determine if additional design changes are needed to increase IPS availability and reduce CV-22 supportability costs.