Tiltrotor Times

Bell Boeing Team Production

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Coyle testimony provides OT-IID test insights

Excerpt from the testimony of
The Honorable Philip E. Coyle
Director, Operational Test and Evaluation
Before The Senate Armed Services Committee

As a result of OT-IID, conducted during September and October 1998, we now have considerably greater understanding of the V-22's inherent capabilities and limitations in its intended operating environment. Because the three previous Early Operational Assessments involved only limited flights of the prototype aircraft from the Full-Scale Development program of the early 1990s, the most recent test took advantage of an expanded flight envelope with the current EMD program aircraft to assess the operational effectiveness of the V-22 in a variety of mission tasks. OT-IID consisted of 63 flights lasting a total of 143 hours, operating from Patuxent River, Md.; Eglin AFB, Fla; and MCAS New River, N.C. The test results mitigated some earlier concerns, demonstrated some remarkable performance capabilities, and raised some new concerns regarding reliability, which must be addressed in the formal IOT&E later this year.

The V-22's combined speed, payload, and range far exceed the capabilities of current medium-lift helicopters. These parameters are a strong factor in the advantage the V-22 has shown over competing helicopters in numerous comparative analyses performed over the last decade, and the test results indicate that the MV-22 will support the Navy/Marine Corps concept of amphibious operations from over the horizon. During the recent testing, operational pilots were able to begin to combine the performance capabilities inherent in the V-22 with realistic new tactics. Some of the results indicate that the V-22 will provide impressive new capabilities. For example, the speed with which the V-22 can lift off from a landing site and accelerate away from the threat area far exceed the comparable capabilities of existing medium-lift rotary-wing aircraft. The V-22 also performed very well in rugged terrain takeoffs and landings, and predictions based on test results for self-deployment range and speed exceeded operational requirements.

Relative to Vietnam-era helicopters it replaces, the V-22 exhibits far greater survivability when hit by hostile small-arms and anti-aircraft fire; estimates range as high as a factor of 10 reduction in the probability of kill given a hit. This results not only from a reduction in vulnerable area, but from considerable survivability engineering features designed into the aircraft from the outset of development. One area of concern remains from recent live fire testing—the sponson fuel tank, when subjected to direct hits from medium-caliber fire, exhibits vulnerability to hydraulic ram damage, potentially exposing troops in the cabin to fire/explosion hazards and requiring extensive battle damage repair. A more robust fuel bladder that reduces the fire/explosion hazards has been successfully tested, but because of weight concerns, the decision to install these bladders is still pending. Engineering study continues on this.

Because the V-22 is still in development, numerous limitations to the realism of the test were imposed for reasons of safety or logistics....

OT-IID, just completed, afforded us considerable insight into the capabilities of this unique aircraft, and uncovered no apparent showstoppers. Continued management attention is needed to improve the reliability and maintainability of the aircraft as early as possible to minimize impact on the first training and operational squadrons. A considerable challenge for the program remains the successful integration of avionics systems and other equipment unique to the CV-22 version for the Special Operations Forces.

My office will closely monitor the final planning for and conduct of IOT&E. We expect that IOT&E will provide opportunity for the operational testers to fully examine the effectiveness and suitability of the V-22, including numerous subsystems, equipment, and operational environments which have not yet been fully tested. I will forward my assessment to Congress as to the adequacy of testing and the meaning of the results following completion of IOT&E.

The Honorable Philip E. Coyle, taken from SASC testimony, public record.

155 mm Howitzer is carried during external load tests, April 1999

V-22 EMD Flight Test Status as of April 30, 1999

A/C #	Total EMD Hours	Total EMD Flights
7	301	146
8	364	208
9	274	124
10	270	111
Totals	**1,209**	**589**

Total V-22 Flight Time	2,393 hrs
Maximum Airspeed Attained	342 kt
Maximum Altitude Attained	25,000 ft
Max Take-Off Gross Weight	60,500 lb
Maximum Load Factor	3.9 Gs

During its recent sea trials, V-22 aircraft number 10 successfully completed 325 landings aboard the USS Saipan. The helicopter carrier cruised in the Atlantic off the coast of Norfolk, Va. providing the test aircraft a variety of wind-over-deck and deck motion conditions.

Aboard the USS Saipan with the V-22

Multi-function displays save millions

A technology used in laptop computers and flat screen television sets finds its way into the cockpit of the MV-22 Osprey later this year resulting in substantial savings to the program, according to USMC Col. Nolan Schmidt, V-22 program manager.

Active Matrix Liquid Crystal Display (AMLCD), commonly known as flat panels, are slated to replace older technology Cathode Ray Tube (CRT) displays. CRTs are used in the V-22 Multi-Function Displays (MFD). There are four MFDs in the V-22 cockpit that provide pilots with primary flight symbols used to control and navigate the aircraft. They display video imagery, such as Forward Looking Infrared (FLIR) and digital map data. "This change in MFDs is expected to save approximately $500 million in procurement savings alone over the life of the program, which extends out to 2020," said Schmidt.

The new flat panel displays will bring several benefits to the Osprey. The displays will be cheaper, lighter, and have better performance than the CRT display. The flat panel displays will also correct a nighttime *glow* problem that exists with the current CRT MFDs. Background *glow* decreases the pilot's night visibility outside the cockpit when Night Vision Goggles are not being worn.

"By installing the AMLCD we can not only resolve the technical deficiency, but we can also achieve other benefits, such as increased contrast and better sunlight readability," said Cdr. Don Mueller, former V-22 avionics system project officer (ASPO) and current deputy program manager for Systems Integration. "Better in the day and better at night, a combination difficult to achieve with CRT technology."

Affordability and reliability are also major forces behind the drive to flat panels. "For the cost of one CRT display we will be able to buy 10 flat panels and have change left over," said Mueller. The flat panels will be more reliable than the CRTs, which are prone to frequent tube and power supply failures. The difference in reliability means that the predicted mean time between failure will be on the order of 4500 hours for the new flat panels compared with 2000 hours for the CRT system. CRTs have life limiting components and require periodic adjustment. Additionally, the flat panel displays are about 50 percent lighter than the CRTs, which weigh in at about 40 pounds each.

While AMLCD technology has been available for laptop computers and other commercial devices for several years, it was not practical to install a flat panel MFD in the V-22 during the Engineering and Manufacturing Development (EMD) phase which began in 1994. However, the Osprey team did choose to use flat panel technology for other displays, such as the Standby Flight Display and the Engine Instrument Crew Alerting System, which do not have the vigorous performance requirements of the MFD.

"In 1994 flat panel displays (for aircraft) were relatively new. While they looked adequate for computer applications, which are relatively static, they did not have the clarity and color depth to display moving video such as the Forward Looking Infrared system the V-22 pilots will use. In addition, the MFD needed square AMLCD glass verses the rectangular glass that was used in laptops," said James Negro, systems engineer supporting the Controls and Displays Integrated Product Team for the Navy.

There was also the concern that early AMLCDs would be vulnerable to the Electro-Magnetic Interference (EMI) generated in a shipboard environment. Not having the EMI capability, crisp resolution, or enough suppliers to make the flat panel displays accessible and affordable are a few reasons that this technology would not have helped the program five years ago, according to Mueller. Today, this technology is mature and affordable, and flat panels will be installed in all the Marine MV-22 aircraft beginning in FY-99 and in the Air Force variant CV-22 starting in FY-01. A total of 410 Ospreys will be outfitted with the flat panel displays. The new flat panel MFDs are being manufactured by EFW of Fort Worth, Texas.

"This change means increased savings, increased reliability and decreased weight, a triple treat because it does not happen

very often," said Cdr. Michael Ahern, V-22 deputy program manager for Business.

The Bell Boeing Tiltrotor Team, comprised of Bell Helicopter Textron, Inc., in Fort Worth, Texas, and The Boeing Company in Philadelphia, developed the V-22 tiltrotor for the U.S. Marine Corps, Navy and U.S. Special Operations Command. Bell Helicopter Textron, Inc., is a wholly owned subsidiary of Textron, Inc. of Providence, R. l. (Story courtesy Gidge Dady, NAVAIR Public Affairs, NAS Patuxent River.)

V-22 stories published since February

Naval Aviation News January-February - *CNO Flies V-22* by Wendy Karppi
National Defense, February- *Advanced Aircraft Bolster* by Greg Alan Caires
Inside the Navy, February 22-*Navy Examines V-22 Flight Control Problem, but sees only 'Low Risk'* by Christopher Castelli
Marine Corps Times, February 22- *Osprey just the kind of future military needs*
Defense Daily, February 22-*Forces Early End to V-22 Sea Trials*
Inside the Navy, February 23-*V-22 potential deemed 'Impressive' For Osprey, Pentagon Tester Cites Downwash, Need for Pilot Training* by Christopher Castelli
Jane's International Defense Review, March 199-*Hardware evolves for U.S. air special operations forces* by Mark Hewish & Bill Sweetman
The Associated Press, March 5-*Air Force Cuts Special Operations force to get ready for V-22*
Inside the Navy, March 2-*Navy Approves LRIP III Decision for MV-22 Osprey Tiltrotor* by Christopher J. Castelli
Inside the Pentagon, March 25-*Navy Official: MV-22 Cost Concerns 'Misplaced'*
Aviation Week & Space Technology, March 29-Editorial Story by Loren Thompson & Jim Courter
National Defense, April-*Special Ops Modernization $500M Short* by Sandra Erwin
Rotor & Wing, April-*Osprey Completes First Phase of Sea Trials*
Armada, April, *Switching from Rotor to Wing* by Roy Braybrook
Delaware County Times (Pa.), April 6, - *V-22 Osprey to undergo combat tests by Marines* by Joe Monchecourt
Aerospace Daily, April 8, - *V-22 ready for ballistic survivability testing*
Defense Daily, April 20, - *V-22 to Integrate flat panel displays*
Defense News, April 26, - Marine Instructors get MV-22 Trainer
Defense Week, April 26-*Marine Aviation Chief Faces Tough Budget Battles*

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