FY 2010
Annual Report

In my first report to you last year, I discussed four initiatives I was undertaking as Director of Operational Test and Evaluation. In this Introduction, I describe the progress I have made during the past year in executing those initiatives.

PROGRESS ON INITIATIVES

1. Field new capability rapidly. My first initiative is to field new capability rapidly. This has also been the top priority for the Secretary of Defense. We must get the capabilities needed by our fighting forces to them as quickly as possible. This initiative remains a challenge. While we want to move technology to the operating forces quickly, we must assure that the added capability is an improvement and that it does not create added risk in the field. In this effort, the operational testers must rely heavily upon the results of developmental testing. This includes the incorporation of field conditions into developmental tests and the early assessment and achievement of reliability growth. Here, innovation and teamwork among the entire test community are essential. My staff continually reviews programs to identify candidates for early fielding or accelerated testing. DOT&E reviewed acquisition programs on DOT&E oversight that have not have started engineering and manufacturing development. Nearly half of these early programs have had or plan to have some type of realistic operational assessment in 2010 or 2011 prior to their Milestone B decision.

Rapid fielding does not mean we bypass testing. One consequence, however, is that systems can be committed to combat operations before Initial Operational Test and Evaluation and full-rate production. Under that circumstance, Congress requires DOT&E to submit Early Fielding Reports. In FY10, DOT&E delivered a report on the Littoral Combat Ship in compliance with Title 10, Section 2399 of U.S. Code. We submitted another report to the Secretary of Defense concerning the National Capitol Region Integrated Air Defense System. Early Fielding Reports are also provided to the Services to support their fielding decisions and to the Combatant Commanders to make our joint forces aware of the systems' capabilities and limitations. In addition, we are striving to make all our operational test and evaluation reports more readily available to the end users of the equipment. Our reports are now available through the Defense Technical Information Center (DTIC). We have established points of contact within each Combatant Command, and we have a classified website that is accessible throughout the DoD. We are exploring other options to ensure the information is provided not only to decision makers but to the fighting forces as well.

Last year I reported on the successful rapid acquisition of the Mine Resistant Ambush Protected (MRAP) Combat Vehicles. DOT&E played an important role in the success of the MRAP deployment. I delivered my assessment of the test and evaluation of the MRAP Family of Vehicles to Congress in March. As described in that report, testing revealed a need for improvements to selected MRAPs; those improvements were developed and implemented rapidly.

DOT&E utilized lessons learned from initial MRAP testing to generate a plan for testing the MRAP All-Terrain Vehicle (M-ATV). The plan incorporated features to identify and mitigate potential vulnerabilities early in the test program, enabling the Department to rapidly procure vehicles providing Service members with both the mobility and protection required for combat operations in Afghanistan.

The Army intends to improve the survivability of the Stryker family of vehicles deployed to Afghanistan by the development of an improved hull design, referred to as the Double-V Hull (DVH). DOT&E has supported this rapid acquisition with a test program enabling an assessment of DVH survivability and protection prior to the vehicles' positioning in Afghanistan in 2011. The T&E program will compare the performance of the new Double-V design with the baseline, fielded Stryker vehicles to ensure that the new hull design improves survivability afforded to soldiers against under-vehicle Improvised Explosive Devices, while maintaining other aspects of Stryker effectiveness and suitability, particularly its mobility.

The Joint Test and Evaluation (JT&E) program, established in 1972, continues to provide rapid solutions to operational problems identified by the joint military community. DOT&E manages the JT&E program and executes it in partnership with the Combatant Commanders. Products of the program include improved tactics, techniques, and procedures (TTPs) and training packages. In addition to seven joint tests, the JT&E program conducted 12 quick reaction tests and two special projects this past year. The Hostile Fire Indicator (HFI) special project developed TTPs to improve rotary wing aircraft survivability against unguided munitions. Our recent rotorcraft survivability study showed that unguided ballistic weapons such as rocket propelled grenades, rockets, small arms, and automatic weapons have been the most prevalent threats to helicopters since 2002 in both Operation Enduring Freedom and Operation Iraqi Freedom. The Services are currently adapting existing warning systems and countermeasures used to defeat infrared and radio frequency-guided weapons to also defeat unguided weapons. Tactics development has been very important for using these HFI systems to improve the overall survivability of flights of single and multiple aircraft. The JT&E special project also recommended that the Services add an HFI training capability to their existing helicopter simulators used for training and tactics development.

2. Engage early to improve requirements. One of the key problems facing testers and developers is requirements that are not testable or technically feasible. Unless programs start with clear, sensible, and rationalized requirements, the program and its testing suffer. To help address this issue, DOT&E action officers participate in the requirements generation process to help ensure the DoD gets them right.

A recent example of DOT&E's involvement in early review of requirements is the Army's Ground Combat Vehicle (GCV). I conducted an assessment in which I compared the GCV's requirements to those for the Future Combat System (FCS) Manned Ground Vehicle (MGV) and the M2A3 Bradley. I found that in terms of mobility and transportability, there were no significant design constraints. However, other requirements such as survivability, reliability, and command, control, and communications (C3) were problematic. In particular, the reliability requirement was twice that of the Bradley, and has yet to be demonstrated by any heavy tracked vehicle. In addition, the C3 requirements were ambiguous, leaving to the contractor the responsibility to develop both hardware and software to implement the battle command network, with no mention of integrating government furnished equipment such as Blue-Force tracker or the Joint Tactical Radio System. At the direction of the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD (AT&L)), the Army has re-structured the GCV request for proposals to assure the vehicle's design requirements reflect essential combat capabilities that can be achieved within five to seven years.

Another example involves the Navy's Advanced Hawkeye (E-2D). The E-2D program is integrating Cooperative Engagement Capability (CEC) hardware and software onto the aircraft. The reliability requirement for the CEC components was written for the shipboard system, which operates continuously. However, the aircraft reloads the software prior to each flight, implying the need for a less stringent reliability requirement than for shipboard operations. Nonetheless, the initial E-2D CEC reliability requirement of 450 hours was about 50 times higher than the corresponding requirement for the aircraft's radar. DOT&E questioned the Navy about this requirement and the Service agreed it was unrealistic. The Navy has now adopted a more realistic reliability requirement for the E-2D radar.

As another example of early involvement, I provided the USD (AT&L) an operational assessment of the Joint High Speed Vessel (JHSV) prior to the Milestone B decision point. The Army and Navy are procuring the JHSV to provide for rapid intra-theater transport of medium-sized Army and Marine Corps payloads. The JHSV is a modified version of an existing commercially-available catamaran. Classified as a non-combatant, the JHSV will be constructed to American Bureau of Shipping standards and will not be required to meet Navy survivability standards. I reported in my assessment that the Army and Navy plans for employing the JHSV did not match the capabilities that were being built; additionally, the system would not satisfy the Joint Integration Concept for Sea-basing. As a result of our early involvement, the Department's leaders made decisions resolving the mismatch between JHSV's capabilities and the Services' plans for using the vessel. Both Services revised their concept of operations once they understood the technical and design limitations of the JHSV.

DOT&E seeks opportunities to be involved in reviewing requirements whenever possible. For each project under oversight, we strive to identify operational and testing concerns to program offices and the Department's leadership at the earliest possible time so that issues can be resolved in a timely manner. As part of the T&E working group, we assure developers and the operational community share a clear, common understanding of the planned Concept of Operations (CONOPS) or identify inconsistencies in those views. If the CONOPS is not available, we work to assure a representative set of CONOPS is included in the development of the Test Strategy.

3. Integrate developmental, live fire, and operational testing. This initiative encourages all testers – contractor, developmental, operational, and live fire – to plan an integrated test program, seeking an efficient continuum. Each test type has a different objective, but data from each test can provide insight into others. Our goal is to have an efficient test program that is not duplicative.

In Figure 1, a notional test program shows increasing operational realism earlier in the program may help decrease testing further on. We want to test early in a mission context and in realistic operational environments – even for component testing – to discover problems early. Evaluators must plan to use all test data to support their evaluations to the extent possible. But, dedicated operational testing is still required.

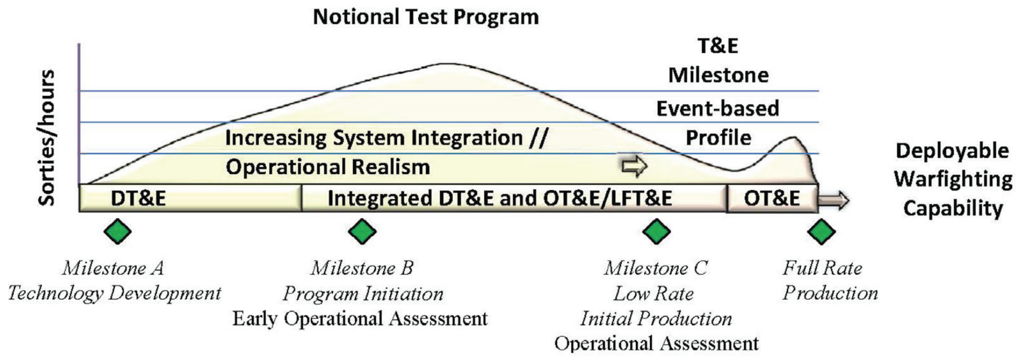

FIGURE 1. NOTIONAL INTEGRATED TEST CONTINUUM

Our test resources are limited. For example, in some cases our test ranges are not large enough to conduct full-scale tests. We also have limited time available for testing and the number of test articles is limited – either by cost or by the time to produce them. To overcome these constraints, we must use statistical tools. Stochastic simulations provide synthetic forces to supplement the use of operational units and also supplement field tests for conditions that cannot be replicated in the field. Statistical methods also facilitate rigorous assessments of systems when only small samples of test data are available.

To deal with many of the foregoing testing constraints, we are promoting the use of Design of Experiments (DOE), which is a structured and rigorous statistical tool. We are working to make DOE commonly used throughout the test community for test planning, execution, and evaluation. DOE will help develop an integrated developmental and operational test program providing confidence that the performance of a system is understood. In May 2009, DOT&E and the Operational Test Agencies (OTAs) signed a joint letter endorsing the use of DOE. I provided further guidance on the application of DOE that I expect to see in Test and Evaluation Master Plans (TEMPs) and detailed Test Plans. We have engaged in joint training with the Director, Developmental Test and Evaluation (DDT&E) on the use of DOE. With DDT&E, the OTAs, and other Service parties, we are developing a roadmap for the institutionalization of scientific test design and statistical rigor by using DOE in test planning and evaluation. To develop the roadmap, we will assess the current state of analytic capabilities within each of the Services and OSD and develop options for providing the support that Services and Agencies will need to increase the rigor of test design.

4. Substantially improve suitability before IOT&E. My office has made improving suitability, particularly reliability, a priority for many years. The importance of Reliability and Maintainability for reducing life cycle costs is gaining recognition throughout DoD. Numerous studies on the subject indicate there are solid returns on investments made for reliability ranging from about 7:1 up to as much as 50:1 if reliability testing is incorporated early in a program's life cycle. Over the past two years, DOT&E and USD (AT&L) have worked together to achieve improvements in system reliability. Examples include:

- Updated policy in DoDI 5000.02 to require reliability growth
- Approved a new industry standard for best practices for reliability – ANSI/GEIA-STD-0009: Reliability Program Standard for Systems Design, Development, and Manufacturing
- Published sample RFP and contract language to assure reliability growth is incorporated in system design and development contracts
- Updated the DoD *Reliability, Availability, Maintainability & Cost (RAM-C) Manual*
- Sponsored development of the Reliability Investment Model; and
- Began drafting the *Reliability Program Handbook*, HB-0009
- Prepared a draft Directive Type Memorandum "Reliability, Analysis, Planning, Tracking, and Reporting"

The Weapon Systems Acquisition Reform Act (WSARA) of 2009 also added emphasis on reliability by specifying responsibilities for the Director of Systems Engineering and the DDT&E. Nevertheless, our data show that nearly 25 percent of the programs we reported on in 2010 were not suitable because of poor reliability. Results of operational testing over 25 years of DOT&E's existence show a steady decrease in the percentage of systems rated as suitable until about 2006. This encompasses the bulk of the period of "Acquisition Reform" in which the Department gave up many of its previous roles in the acquisition process including the promulgation of standards and the oversight of quality control, systems engineering, reliability, and developmental testing. In the 2005-2006 time period, we implemented several initiatives to improve system reliability before systems entered their Initial Operational Test and Evaluation. The initial fruits of this effort may be seen in the slight upturn in the number of systems assessed as suitable since 2006, as shown in Figure 2.

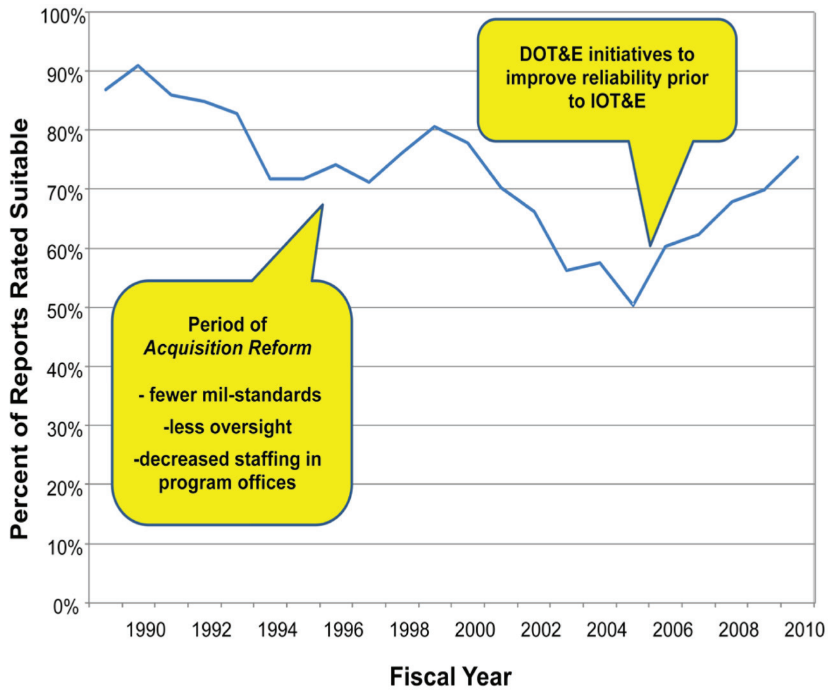

FIGURE 2. FRACTION OF REPORTS WITH FINDINGS RATED SUITABLE (5-YEAR MOVING AVERAGE)

A review of TEMPs submitted for formal review in FY10 showed increased inclusion of reliability considerations from 2009. As shown in Figure 3, in 2009, only eight percent of TEMPs reviewed included reliability growth curves compared with 24 percent of TEMPs reviewed in FY10. Sixty-five percent of FY10 TEMPs documented a reliability strategy (35 percent of those included a growth curve), while only 20 percent of FY09 TEMPs had a documented reliability strategy. Further, three TEMPS were disapproved, citing the need for additional reliability documentation, and four other TEMPS were approved with a caveat that the next revision must include more information on the program's reliability growth strategy.

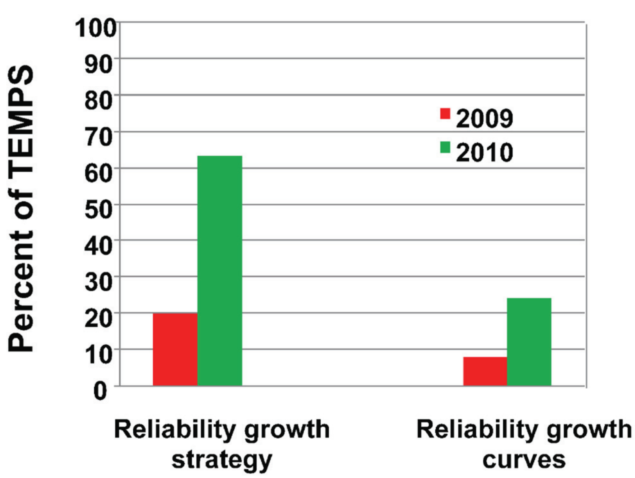

FIGURE 3. PERCENTAGE OF TEMPS WITH RELIABILITY GROWTH STRATEGIES/CURVES

However, a great deal remains to be done. To remedy this, I proposed to the USD (AT&L) that we take action in three areas:

- Clarify and strengthen Department policy and require more complete and uniform compliance,
- Add workforce resources and upgrade the Department's educational programs, and
- Introduce more rigor and objectivity into planning reliability test programs.

To this end, the USD (AT&L) has tasked the Reliability Senior Steering Group to "…assess existing reliability policy, and … propose actions for [his] approval that will improve effectiveness." The steering group established three working groups to examine changes with respect to policy, practices and personnel. A Directive-Type Memorandum (DTM), which implements changes to the Department's policies meant to improve the reliability of weapon systems, should be signed soon.

OTHER INTEREST AREAS

Test and Training Ranges. The Department's test and training ranges continue to face the challenge of maintaining mission capability while remaining compatible with external factors such as environmental concerns, urban sprawl, frequency spectrum usage, and renewable energy initiatives. These external pressures increasingly are limiting factors for conducting realistic operational tests. A noteworthy limitation for operational test and evaluation is the decreased access to frequency spectrum. Worldwide demand for frequency spectrum access is increasing and DoD spectrum requirements are following suit. I will remain vigilant in encouraging DoD to address these challenges.

Body Armor. As indicated in last year's report, protecting our Soldiers is a critical mission. Last year, in response to the Government Accountability Office recommendation to conduct an outside review of the Department's procedures to conduct body armor testing, I engaged the National Academies and their experts to review the Army's body armor testing. The academies have rendered two interim reports and will issue their final report in January of 2011. I can report that the experts from the National Academies confirmed the validity of the Department's testing methods and procedures and provided a range of recommendations to improve body armor testing. I support these recommendations and have obtained funding to implement them. One key recommendation, to implement a statistically based test protocol, has been accomplished. The study committee also applauded DOT&E for assuming a National leadership role in the body armor test community.

Active Protection Systems. In response to FY08 legislation, DOT&E continues to direct testing of active protection systems with the potential of protecting tactical vehicles. Presently, six manufacturers (two foreign, two domestic, and two combined foreign/domestic) are participating in this program. Testing will continue through 2QFY11. Upon completion, DOT&E will provide reports to Congress and the Department's acquisition leadership. This effort will determine the capabilities of current active protection system technology and guide future acquisition decisions regarding the incorporation of that technology in combat vehicles.

Missile Defense. We are developing methods to quantify confidence in the performance of ballistic missile defenses using all available data. The available data include flight tests, ground tests, modeling and simulation, and evaluations by subject matter experts. In performing this analysis, we are utilizing Bayesian methods to rigorously aggregate these disparate information sources. The techniques we are using have shown good results in certifying the performance of both medical equipment and the U.S. nuclear stockpile.

Helmets. The Department continues to test new designs of combat helmets. This year the Marine Corps began developmental testing the new Enhanced Combat Helmet (ECH), which seeks to provide increased ballistic protection over current helmet designs. The Marine Corps has worked hard to address this technically challenging effort, and I anticipate the first of several ECH designs will begin rigorous live-fire testing under DOT&E oversight in early 2011.

Joint Trauma Analysis and Prevention of Injury in Combat (JTAPIC). As a result of our MRAP report, the Secretary directed that actions be taken to improve the availability of combat casualty data coming from the Joint Trauma Analysis and Prevention of Injury in Combat (JTAPIC) Program Office. These data are necessary to assess how well vehicles are performing in theater, both in comparison to test events, as well as to identify any new or unusual trends in threat or vehicle response that may require additional testing and/or exploitation. We led the effort, in collaboration with the Army Surgeon General, to initiate and implement a Lean Six Sigma process with the JTAPIC Program Office, as well as JTAPIC partners, to increase the availability of combat casualty data coming from the JTAPIC Program Office to support vehicle design, development, and test and evaluation.

OT&E MISSION ACCOMPLISHMENTS, FISCAL YEAR 2010

I continually review and revise T&E policy as needed to promote consistency among the Services in the conduct and reporting of testing. This year I provided additional guidance on the content and timeliness of reporting of operational test and evaluation results, the timely provision of test data, and the standardization of Hard Body Armor and Combat Helmet testing. I also updated the guidelines for assessing information assurance and guidance for the operational test and evaluation of Information and Business Systems.

During this fiscal year, my office monitored 348 Major Defense Acquisition Programs (MDAPs) and special interest programs. We reviewed 53 TEMPs and Test and Evaluation Strategies and 70 Operational Test and Evaluation Plans for specific test events.

During FY10, DOT&E delivered seven Beyond Low-Rate Initial Production Reports (BLRIPs) (three of which were combined OT&E and Live Fire Reports), four special reports (three of which were combined OT&E and Live Fire and one of which was a review of the Army's Body Armor testing), and one Early Fielding Report to the Secretary of Defense and Congress (see Table 1). In addition to the Ballistic Missile Defense Systems (BMDS) section of this Annual Report, I provided a separate classified report on my assessment of BMDS to Congress, as well as a report on the Airborne Laser.

DOT&E also published eleven Operational Assessment reports and sixteen reports on Major Automated Information System (MAIS) programs (see Tables 2 and 3).

TABLE 1. DOT&E REPORTS TO CONGRESS DURING FISCAL YEAR 2010

PROGRAM	REPORT TYPE	DATE
BLRIP Reports		
Acoustic Rapid Commercial Off-the-Shelf (COTS) Insertion (A-RCI) AN/BQQ-10(V) Sonar System	OT&E BLRIP Report	October 2009
Virginia Class Submarine	Combined OT&E/LFT&E BLRIP Report	November 2009
Department of the Navy Large Aircraft Infrared Countermeasures (DoN LAIRCM)	OT&E BLRIP Report	December 2009
Vertical Launch Anti-Submarine Rocket (ASROC) with the Mk 54 Mod 0 Lightweight Hybrid Torpedo (VLA Mk 54)	OT&E BLRIP Report	January 2010
CV-22 Osprey	OT&E BLRIP Report	January 2010
USS *San Antonio* Class (LPD 17) Amphibious Transport Dock Ship	Combined OT&E/LFT&E BLRIP Report	June 2010
USMC H-1 Upgrades (AH-1Z)	Combined OT&E/LFT&E BLRIP Report	September 2010
Special Reports		
Assessment of the Mine Resistant Ambush Protected (MRAP) Family of Vehicles	Combined OT&E/LFT&E Special Report	March 2010
Operational and Live Fire Report of the M915A5 Truck Tractor, Line Haul	Combined OT&E/LFT&E Special Report	May 2010
Live Fire and Operational Test and Evaluation Report on the Mine Resistant Ambush Protected (MRAP) All-Terrain Vehicle (M-ATV)	Combined OT&E/LFT&E Special Report	June 2010
DOT&E Independent Assessment of the Army's Phase I and Phase II Follow-On Testing of Hard Body Armor	Special Report	July 2010
BMDS Reports		
Airborne Laser (ABL)	Missile Defense Report	January 2010
2009 Assessment of the Ballistic Missile Defense Systems	Annual Report	February 2010
Early Fielding Reports		
Littoral Combat Ship (LCS) 1	Early Fielding Report	July 2010

TABLE 2. DOT&E OPERATIONAL ASSESSMENT REPORTS DURING FISCAL YEAR 2010

Program	Date
Joint High Speed Vessel (JHSV)	November 2009
National Capital Region Integrated Air Defense System (NCR IADS)	December 2009
Early Infantry Brigade Combat Team (E-IBCT) Increment 1 Limited User Test (LUT)	January 2010
Extended Range Multi-Purpose (ERMP) Unmanned Aircraft System (UAS)	January 2010
Warfighter Information Network -Tactical (WIN-T) Increment 2 LUT	January 2010
Non-Line-of-Sight-Launch System (NLOS-LS) Flight LUT	March 2010
Mobile User Objective System (MUOS)	June 2010
Global Hawk Integrated System Evaluation (ISE)	June 2010
AH-64D Apache Block III (AB3)	June 2010
Navy Multiband Terminal (NMT)	July 2010
Extended Range Multi-Purpose (ERMP) Unmanned Aircraft System (UAS) Quick Reaction Capability (QRC) 2 LUT	August 2010

TABLE 3. DOT&E MAJOR AUTOMATED INFORMATION SYSTEM (MAIS) REPORTS FOR FISCAL YEAR 2010

Program	Date
Operational Test and Evaluation of the Global Combat Support System – Joint (GCSS-J) Version 7.1.0	November 2009
General Fund Enterprise Business System (GFEBS) Initial Operational Test and Evaluation (IOT&E) Results and Recommendations	December 2009
Global Combat Support System – Marine Corps (GCSS-MC)/Logistics Chain Management (LCM) Block 1, Release 1.1 System Assessment	January 2010
Battle Control System – Fixed Interim	February 2010
Family of Advanced Beyond-Line-of-Sight Terminal (FAB-T), Increment 1 Operational Assessment (OA-2) Report	February 2010
Rebuilding Analysis (RebA) Operational Assessment (OA) and Training Assessment	February 2010
Global Command and Control System – Maritime (GCCS-M) Version (v) 4.0.3 Test Results and Recommendations	March 2010
Operational Assessment of Public Key Infrastructure (PKI) Increment 2, Spiral 3	May 2010
Department of Defense Teleport Generation Two Phase Two Multi-Service Operational Test and Evaluation Results	June 2010
Expeditionary Combat Support System (ECSS) Release 1	June 2010
Expeditionary Combat Support System (ECSS) Release 1 (status update)	July 2010
Air Force Distributed Common Ground System (AF DCGS)	August 2010
Follow-on Operational Test and Evaluation II of Net-Centric Enterprise Services Increment 1	August 2010
Operational Assessment of Public Key Infrastructure (PKI) Increment 2, Spiral 4	August 2010
General Fund Enterprise Business system (GFEBS) Release 1.4.1 Limited User Test (LUT) Results and Recommendations	September 2010
Logistics Modernization Program (LMP)	September 2010

CONCLUSION

Since my report last year, I am gratified to report we have made progress implementing all my initiatives; more however, remains to be done. I will continue our alliance with the DDT&E and help that office achieve its mission defined in WSARA. I remain committed to assuring the Defense Department's operational and live fire tests are rigorous, objective, and clearly reported. It is with pleasure that I submit this report, as required by law, summarizing the operational and live fire test and evaluation activities of the Department of Defense during Fiscal Year 2010.

J. M. Gilmore

J. Michael Gilmore
Director

INTRODUCTION

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DOT&E Activity and Oversight

Activity Summary

DOT&E activity for FY10 involved oversight of 348 programs, including 46 major automated information systems. Oversight activity begins with the early acquisition milestones, continues through approval for full-rate production and, in some instances, during full production until deleted from the DOT&E oversight list.

Our review of test planning activities for FY10 included approval of 52 Test and Evaluation Master Plans (TEMPs)/Test and Evaluation Strategies, as well as 70 Operational Test Plans, and eight Live Fire Test and Evaluation (LFT&E) Strategies/Management Plans for inclusion in the TEMP. In FY10, DOT&E prepared seven Beyond Low-Rate Initial Production Reports, one Early Fielding Report, and four special reports for the Secretary of Defense and Congress, as well as the Ballistic Missile Defense Programs Annual Report and a report on the Airborne Laser.

DOT&E also prepared and submitted numerous reports to the Defense Acquisition Board (DAB) principals for consideration in DAB deliberations.

TEST AND EVALUATION MASTER PLANS / STRATEGIES APPROVED

Air and Space Operations Center Weapon System (AOC WS) ANIUSQ-163 (FALCONER) Increment 10.2

Air Force Distributed Common Ground System (AF DCGS) Block 10.2

Air Intercept Missile-9X Revision E

Airborne Signals Intelligence Payload (ASIP)

Apache Block III

B-2 Advanced Technology Bomber Radar Modernization Program Full-Rate Production Annex

C-130 Avionics Modernization Program (AMP) Change 1

Combat Control System, AN/BYG-l(V), 234-11 Revision 5

Combat Information Transport System (CITS) ACAT IAC Portfolio Capstone with Air Force Intra-Net (AFNET) Increment 1 Appendix

Common Submarine Radio Room (CSRR) Revision 4

E-2D Advanced Hawkeye (E-2D AHE) Change One, Number 1654, Revision B

EA-6B ICAP III Prowler Aircraft Upgrade Number 1549, Revision E

Early Infantry Brigade Combat Team (E-IBCT)

Early Infantry Brigade Combat Team (Increment 1 E-IBCT)

Excalibur Increment Ia-2

Expeditionary Combat Support System (ECSS)

Extended Range Multi-Purpose Unmanned Aircraft System (ER/MP UAS)

F/A-18+/CIDIEIF Software Qualification Number S1699, Revision B

F/A-18EIF APG-79 Active Electronically Scanned Array (AESA) Radar Upgrade (RUG) Phase III, Revision E, Revision G

F/A-18E/F Software Qualification, Revision G

F-35 Joint Strike Fighter Lightening II, Revision 3

General Fund Enterprise Business System (GFEBS)

Global Command and Control System-Maritime (GCCS-M) Increment 2 (4.1)

Global Positioning System (GPS) Enterprise

HC/MC-130 Recapitalization

Improved (Chemical Agent) Point Detection System-Lifecycle Replacement (IPDS-LR) Test and Evaluation Master Plan

Integrated Strategic Planning and Analysis Network (ISPAN) Increment 2

Joint Air-to-Surface Standoff Missile - Extended Range (JASSM-ER) (AGM-158B)

Joint Biological Point Detection System (JBPDS) Revision 16

Joint Cargo Aircraft

Joint Chemical Agent Detector (JCAD), Increment I, Version 3.1

Joint Counter Radio Controlled Improvised Explosive Device Electronic Warfare (JCREW) Systems Increment 1

Joint Mission Planning System-Expeditionary (JMPS-E) Mission Planning Environment (MPE) Increment I

Joint Mission Planning System-Maritime (JMPS-M) Number 1588 Revision C, Annex 'V' for the VH-3/VH-60 Mission Planning Environment (MPE) version 1.0

Joint Torpedo MK 48 Advanced Capability (ADCAP) Mod 7 Common Broadband Advanced Sonar System (CBASS) 0371-03, Revision 1

Marine Corps/Global Combat Support System Logistics Chain Management (GCSS-MC/LCM) Block 1

Mine Resistant Ambush Protected (MRAP) Low-Rate Initial Production (LRIP)

Miniature Air Launched Decoy-Jammer (MALD-J) ADM-160C Milestone B

Navy Enterprise Resource Planning (Navy ERP) Version 4

Navy Multi-band Terminal (NMT)

Non-Line-Of-Sight Launch Systems (NLOS-LS), Annex J

P-8A Poseidon

Palletized Load System (PLS) AI Tactical Truck

Small Diameter Bomb II (SDB-II) Milestone B (MS-B)

Small Tactical Unmanned Aircraft System/Tier II Unmanned Aircraft System (STUAS/Tier II)

Spider XM7 Command Network Munition Update for Low-Rate Initial Production (LRIP) Phase and Stand-off Capability Enhancement (SCE) Program

Stryker Nuclear, Biological, and Chemical Reconnaissance Vehicle (NBCRV), Revision 6

Surface Electronic Warfare Improvement Program (SEWIP) Block 2

Tactical Unmanned Aircraft System

Teleport, Generation 3, Phase 1

USMC H-I Upgrades Program (H-l) No. 1435 Revision D

Virginia (SSN 774) Class Submarine Test and Evaluation Master Plan 1425, Revision F

OPERATIONAL TEST PLANS APPROVED

Advanced Extremely High Frequency (AEHF) Operational Utility Evaluation (OUE) Revision I

Aegis Enterprise Program (DT/OT-CI)

Aegis Enterprise Program (OT-CI)

AGM-88E Advanced Anti-radiation Guided Missile (AARGM) Initial Operational Test and Evaluation (OT-C)

Air Force B-2 Radar Modernization Program Mode Set 2 FOT&E Plan

Air Force Distributed Common Ground System (AF DCGS) Block 10.2 Force Development Evaluation (FDE) Plan

Air Intercept Missile-9X Block II Sidewinder Operational Test Plan (OTP) Number 1412-QT-I1IC

Air Warfare/Ship Self-Defense (AW/SSD) Enterprise, CNO Project 1400, Follow-On Operational Test and Evaluation (OT-IIIE) of the Ship Self Defense System (SSDS) Mark 2 Mod lA and CNO Project 1471, Follow-On Operational Test and Evaluation (OT-D2) of the Evolved SeaSparrow Missile (ESSM) Program

AN/AAQ-24(V)25 Large Aircraft Infrared Countermeasures (DoN LAIRCM) OT-D2 Installed on United States Marine Corps (USMC) CH-53D Assault Support Helicopter

ANIBYG-l APB-07 Combat Control system, the ANIBQQ-I0 APB-07 A-RCI Sonar system and the TB-34 Towed Array Combined Test Plan

Apache Block III (AB3) Limited User Test (LUT)

B-1 Fighter Integrated Data Link (FIDL) Operational Assessment (OA) Plan

Combat Information Transport System (CITS) Air Force Intra-Net (AFNET) Increment 1 Operational Utility Evaluation (OUE) Plan

Common Aviation Command and Control System (CAC2S) OA Plan

Common Submarine Radio Room FOT&E (OT-DI)

Defense Enterprise Accounting and Management System (DEAMS) Early Operational Assessment (EOA) Plan

Department of Defense Public Key Infrastructure (PKI) Increment 2, Spiral 1 Secret Internet Protocol Router Network (SIPRNet) Token OA Plan

DoD Teleport System Generation Two, Phase Two (G2P2), MultiService OT&E Plan

E-2D Advanced Hawkeye (E-2D AHE) (OT-CI)

Expeditionary Combat Support System Release 1 EOA Plan

Expeditionary Fighting Vehicle (EFV) Hot Weather Developmental Test/Operational Test Plan

Expeditionary Fighting Vehicle Waterborne Directional Stability II Operational Test Plan

Extended Range MultiPurpose Unmanned Aircraft System LUT for the Quick Reaction Capability 2 Unit Capability

F/A-18 System Configuration Set (SCS) 23X OTP S1699-0T-D3, SCS H6E Software Qualification Testing (SQT) and Active Electronically Scanned Array Radar (AESA) FOT&E 2 OTP 1589-0T-IIIH

F-35 Joint Strike Fighter OA (OT-IIE)

General Fund Enterprise Business System Release 1.4.1 LUT

Global Combat Support System - Joint (GCSS-J) Version 7.1.0 OT&E Plan

Global Combat Support System - Army (GCSS-A) Release 1.1

Global Combat Support System - Marine Corps (GCSS-MC) / Logistics Chain Management, Block 1, Release 1.1 OTP

Global Command and Control System - Maritime (GCCS-M) v4.1 IOT&E Plan

Global Command and Control System - Maritime (GCCS-M) v4.1 OA Plan

Global Command and Control System - Maritime (GCCS-M) v4.l Unit Level OA Plan

Global Combat Support System – Joint (GCSS-J) Version 7.1.1

Global Positioning System (GPS) Enterprise IIF Modernization FDE

Improved (Chemical Agent) Point Detection System-Lifecycle Replacement (IPDS-LR) Program

Infantry Brigade Combat Team (IBCT) Increment I LUT

Joint Cargo Aircraft MultiService

Joint Chemical Agent Detector (JCAD) FOT&E

Joint Chemical Agent Detector (JCAD) Increment 1 Enhanced M4EI Developmental/Operational Test Plan

Joint Mission Planning (JMPS) F-16 MS.l +Mission Planning Environment (MPE) Supplement to the JMPS Field Development Evaluation Test Plan

Joint Mission Planning System FDE Test Plan Supplements for F-22 Version 11, F-16 Block 30 SCU 7, B-IB Release 4.0, and A-IO Suite 6

Joint Mission Planning System -Maritime Marine Helicopter Mission Planning Environment Program IOT&E (OT-IIE)

Joint Mission Planning System-Maritime (JMPS-M) Test Plan for CNO Project Number 1588 F/A-18 Mission Planning Environment (MPE) 2.3

Joint Mission Planning System-Maritime (JMPS-M) Test Plan for CNO Project Number 1588 IOT&E (OTIIN) VH-3/VH-60 Helicopter MPE

Joint Primary Aircraft Training System (JPATS) T-6 Avionics Upgrade Project (AUP) (OT-DI)

Large Aircraft Infrared Countermeasures (DoN LAIRCM) Installed on USMC CH-46E Assault Support Helicopter FOT&E (OT-DI)

LCS 2 Electronic Chart Display and Information System Navy (ECDIS-N) Configuration IOT&E (OT-A3)

Low Cost Conformal Array IOT&E (OT-C)

Mine Resistant Ambush Protected (MRAP) – All Terrain Vehicle (M-ATV), IOT&E

Miniature Air Launched Decoy – Jammer (MALD-J) ADM-160C OA

Mobile Landing Platform (MLP) EOA (OT-AI)

Multi-functional Information Distribution System – Joint Tactical Radio System (MIDS-JTRS) Program (OT-CI)

Navy Enterprise Resource Planning (Navy ERP) IOT&E (OT-C2B) Plan for Release 1.1

Navy Multiband Terminal (NMT) Program OA (OT-BI)

Net-Centric Enterprise Services (NCES) IOT&E Plan update for FOT&E 2

PATRIOT Post Deployment Build (PDB) 6.5 LUT

RQ-4 Global Hawk Block 20/30 Unmanned Aerial System IOT&E

Ship Self Defense System Mark 2 Mod 3 A FOT&E (OT-IIIE)

Space Based Space Surveillance (SBSS) Block 10 IOT&E Plan

Spider XM7 Command Network Munition Follow-on

STANDARD Missile-6 (SM-6) (OT-IIA)

Stryker-Mobile Gun System (MGS) Engineering Change Order (ECO) Validation Reliability

Surveillance Towed Array Sensor System (SURTASS) and Compact Low Frequency Active (CLFA) OA (OT-IIF)

Tactical Unmanned Aircraft System Laser Rangefinder/Designator LUT

Terminal High Altitude Area Defense (THAAD) LUT (OTA-TP)

USAF Warfare Center MQ-9 GBU-38 Joint Direct Attack Munition Combined Developmental Test Support/FDE Test Plan,

USMC H-I Upgrades Program AH-IZ OT-IIC3

Virginia Class Submarine FOT&E (OT-IIIA-5)

Virginia Class Submarine FOT&E Events OT-IIIA-I and OT-IIIA-2

XM501 Non Line-of-Sight Launch System Limited User Flight Test

LIVE FIRE TEST AND EVALUATION STRATEGIES / MANAGEMENT PLANS

Apache Block III LFT&E Strategy

Cartridge, 5.56mm, Ball, Lead Free Slug, M855 LFT&E Strategy

CH-53K LFT&E Strategy (Revision)

DDG1000 LFT&E Management Plan

Enhanced Combat Helmet LFT&E Strategy

Family of Medium Tactical Vehicles-Long Term Armor Strategy Rebuy LFT&E Strategy

Joint High Speed Vessel LFT&E Management Plan

Littoral Combat Ship LFT&E Management Plan

FY10 REPORTS TO CONGRESS		
PROGRAM	**REPORT TYPE**	**DATE**
BLRIP Reports		
Acoustic Rapid Commercial Off-the-Shelf (COTS) Insertion (A-RCI) AN/BQQ-10(V) Sonar System	OT&E BLRIP Report	October 2009
Virginia Class Submarine	Combined OT&E/LFT&E BLRIP Report	November 2009
Department of the Navy Large Aircraft Infrared Countermeasures (DoN LAIRCM)	OT&E BLRIP Report	December 2009
Vertical Launch Anti-Submarine Rocket (ASROC) with the Mk 54 Mod 0 Lightweight Hybrid Torpedo (VLA Mk 54)	OT&E BLRIP Report	January 2010
CV-22 Osprey	OT&E BLRIP Report	January 2010
USS *San Antonio* Class (LPD 17) Amphibious Transport Dock Ship	Combined OT&E/LFT&E BLRIP Report	June 2010
USMC H-1 Upgrades (AH-1Z)	Combined OT&E/LFT&E BLRIP Report	September 2010
Special Reports		
Assessment of the Mine Resistant Ambush Protected (MRAP) Family of Vehicles	Combined OT&E/LFT&E Special Report	March 2010
Operational and Live Fire Report of the M915A5 Truck Tractor, Line Haul	Combined OT&E/LFT&E Special Report	May 2010
Live Fire and Operational Test and Evaluation Report on the Mine Resistant Ambush Protected (MRAP) All-Terrain Vehicle (M-ATV)	Combined OT&E/LFT&E Special Report	June 2010
DOT&E Independent Assessment of the Army's Phase I and Phase II Follow-On Testing of Hard Body Armor	Special Report	July 2010
BMDS Reports		
Airborne Laser (ABL)	Missile Defense Report	January 2010
2009 Assessment of the Ballistic Missile Defense Systems (BMDS)	Annual Report	February 2010
Early Fielding Reports		
Littoral Combat Ship (LCS) 1	Early Fielding Report	July 2010

During FY10, DOT&E met with Service operational test agencies, program officials, private sector organizations, and academia; monitored test activities; and provided information to the DAB committees as well as the DAB principals, the Secretary and Deputy Secretary of Defense, the Under Secretary of Defense (Acquisition, Technology and Logistics), the Service Secretaries, and Congress. Active on site participation in, and observation of, tests and test related activities remain the most effective tools.

In addition to on-site participation and local travel within the National Capital Region, approximately 835 trips supported the DOT&E mission.

Security considerations preclude identifying classified programs in this report. The objective, however, is to ensure operational effectiveness and suitability do not suffer due to extraordinary security constraints imposed on those programs.

Program Oversight

DOT&E is responsible for approving the adequacy of plans for operational test and evaluation and for reporting the operational test results for all major defense acquisition programs to the Secretary of Defense, Under Secretary of Defense (Acquisition, Technology and Logistics), Service Secretaries, and Congress. For DOT&E oversight purposes, major defense acquisition programs were defined in the law to mean those programs meeting the criteria for reporting under section 2430, title 10, United States Code (Selected Acquisition Reports (SARs)). The law (sec.139(a)(2)(B)) also stipulates that DOT&E may designate any other programs for the purpose of oversight, review, and reporting. With the addition of such "non-major" programs, DOT&E was responsible for oversight of a total of 348 acquisition programs during FY10.

Non-major programs are selected for DOT&E oversight after careful consideration of the relative importance of the individual program. In determining non-SAR systems for oversight, consideration is given to one or more of the following essential elements:

- Congress or OSD agencies have expressed a high level of interest in the program.
- Congress has directed that DOT&E assess or report on the program as a condition for progress or production.
- The program requires joint or multi-Service testing (the law (sec. 139(b)(4)) requires DOT&E to coordinate "testing conducted jointly by more than one military department or defense agency").
- The program exceeds or has the potential to exceed the dollar threshold definition of a major program according to DoD 5000.1, but does not appear on the current SAR list (e.g., highly classified systems).
- The program has a close relationship to or is a key component of a major program.
- The program is an existing system undergoing major modification.
- The program was previously a SAR program and operational testing is not yet complete.

This office is also responsible for the oversight of LFT&E programs, in accordance with 10 USC 139. DoD regulation uses the term "covered system" to include all categories of systems or programs identified in 10 USC 2366 as requiring live fire test and evaluation. In addition, systems or programs that do not have acquisition points referenced in 10 USC 2366, but otherwise meet the statutory criteria, are considered “covered systems” for the purpose of DOT&E oversight.

A covered system, for the purpose of oversight for LFT&E, has been determined by DOT&E to meet one or more of the following criteria:

- A major system, within the meaning of that term in 10 USC 2302(5), that is:
  - User-occupied and designed to provide some degree of protection to the system or its occupants in combat
  - A conventional munitions program or missile program
- A conventional munitions program for which more than 1,000,000 rounds are planned to be acquired.
- A modification to a covered system that is likely to affect significantly the survivability or lethality of such a system.

DOT&E was responsible for the oversight of 132 LFT&E acquisition programs during FY10.

PROGRAMS UNDER DOT&E OVERSIGHT FISCAL YEAR 2010

(As taken from the September 2010 DOT&E Oversight List)

DoD PROGRAMS

Armed Forces Health Longitudinal Technology Application (AHLTA)

Ballistic Missile Defense System (BMDS)

Ballistic Missile Technical Collection (BMTC)

Chemical and Biological Distributed Early Warning System (CB DEWS)

Chemical Demilitarization Program – Assembled Chemical Weapons Alternatives (CHEM DEMIL-ACWA)

Chemical Demilitarization – Chemical Materials Agency (Army Executing Agent) (CHEM DEMIL-CMA)

Defense Enterprise Accounting and Management System – TRANSCOM (DEAMS-TRANSCOM)

Defense Security Assistance Management System (DSAMS) Block 3

Defense Travel System (DTS)

Electronic Health Records (EHRs)

EProcurement

Global Combat Support System – Joint (GCSS-J)

Global Command & Control System – Joint (GCCS-J)

Integrated Air and Missile Defense (IAMD) Roadmap programs

Joint Biological Point Detection System (JBPDS)

Joint Biological Stand-Off Detection System (JBSDS)

Joint Biological Tactical Detection System (JBTDS)

Joint Chemical Agent Detector (JCAD)

Joint Command and Control Capabilities (JC2C) – encompasses GCCS-Family of Systems, TBMCS-FL, DCAPES, USMC JTCW, USMC TCO

Joint Counter Radio IED Electronic Warfare (JCREW) Spiral 3.3

Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD)

Joint Tactical Radio System (JTRS) Small Airborne & Maritime/Fixed (AMF) Station

Joint Tactical Radio System (JTRS) Enterprise Manager (JENM)

Joint Tactical Radio System (JTRS) Enterprise Services (ENS)

Joint Tactical Radio System (JTRS) Ground Mobile Radio (GMR)

Joint Tactical Radio System (JTRS) Handheld, Manpack, and Small Form Fit Radios (HMS)

Joint Tactical Radio System Network Enterprise domain (JTRS NED)

Joint Warning and Reporting Network (JWARN)

Key Management Infrastructure (KMI)

Mine Resistant Ambush Protected Vehicles (MRAP) Family of Vehicles

Mounted Reconnaissance Sets – Kits and Outfits (MS-SKO)

Multi-Functional Information Distribution System (MIDS) – includes Low Volume Terminal and JTRS)

Multi-National Information Sharing (MNIS)

Public Key Infrastructure (PKI) Increment 1

Public Key Infrastructure (PKI) Increment 2

Shipboard Chemical, Biological, and Radiation Defense Systems – including the Improved (Chemical Agent) Point Detection System (IPDS)

Soldier Radio Waveform (SRW) Network Manager

Teleport Generations I/II and III

Theater Medical Information Program – Joint (TMIP-J) Block 2

Wideband Networking Waveform (WNW) Network Manager

ARMY PROGRAMS

9 mm Improved ("Green") Ammunition

Abrams Tank Modernization (M1E3)

Abrams Tank Upgrade (M1A1 SA/M1A2 SEP)

Advanced Threat Infrared Countermeasures/Common Missile Warning System (ATIRCM CMWS)

Advanced Precision Mortar Initiative (APMI)

AN/ALQ-211 Suite of Integrated Radio Frequency Countermeasures (SIRFC)

Apache Block III (AB3)

Armed Aerial Scout (previously named ARH Armed Recon Helicopter)

Armored Truck – Heavy Dump Truck (HDT)

ARMY PROGRAMS (continued)

Armored Truck – Heavy Equipment Transporter (HET)

Armored Truck – Heavy Expanded Mobility Tactical Truck (HEMTT)

Armored Truck – M915A5 Line Hauler

Armored Truck – M939 General Purpose Truck

Armored Truck – Palletized Loading System (PLS)

Army Integrated Air & Missile Defense (AIAMD)

Biometrics Enabling Capability (BEC)

Black Hawk Upgrade (UH-60M) – Utility Helicopter Upgrade Program

Bradley Fighting Vehicle System Upgrade

Bradley Tank Modernization (M2A3 V2)

CH-47F Cargo Helicopter

Common Infrared Countermeasures (CIRCM)

Common Missile Warning System (CMWS)

Distributed Common Ground System – Army (DCGS-A)

Early Infantry Brigade Combat Team (E-IBCT) Increment One

Early Infantry Brigade Combat Team (E-IBCT) Increment One Network Interface Kit

Early Infantry Brigade Combat Team (E-IBCT) Increment One Small Unmanned Ground Vehicle (SUGV)

Early Infantry Brigade Combat Team (E-IBCT) Increment One Tactical Unattended Ground Sensors (T-UGS)

Early Infantry Brigade Combat Team (E-IBCT) Increment One Unmanned Aircraft System (UAS) Class I Organic Air Vehicle Light

Early Infantry Brigade Combat Team (E-IBCT) Increment One - Urban Unattended Ground Sensors (U-UGS)

Early Infantry Brigade Combat Team (E-IBCT) Increment Two

Early Infantry Brigade Combat Team (E-IBCT) Multi-Mission Unmanned Ground Vehicle

Enhanced AN/TPQ-36 Radar System (EQ-36)

Enhanced Medium Altitude Recon Surveillance System (EMARSS)

Excalibur Family of Precision, 155 mm Projectiles

Extended Range Multi-Purpose (ERMP) Unmanned Aircraft System (UAS)

Family of Medium Tactical Vehicles (FMTV)

Force XXI Battle Command Brigade and Below (FBCB2) Program

Force XXI Battle Command Brigade and Below – Joint Capability Requirement (FBCB2-JCR)

General Fund Enterprise Business System (GFEBS)

Global Combat Support System – Army (GCSS-A)

Global Command and Control System – Army (GCCS-A)

Ground Combat Vehicle (GCV)

Guided Multiple Launch Rocket System – Unitary (GMLRS Unitary)

Guided Multiple Launch Rocket System (GMLRS) – Dual Purpose Improved Conventional Munitions (DPICM)

Guided Multiple Launch Rocket System Alternate Warhead (GMLRS AW)

HELLFIRE Romeo

High Mobility Artillery Rocket System (HIMARS)

High Mobility Multipurpose Wheeled Vehicle (HMMWV)

Hostile Fire Indicator

Identification Friend or Foe Mark XIIA Mode 5 (all development and integration programs)

Improved Carbine

Installation Information Infrastructure Modernization Program

Integrated Personnel and Pay System – Army (Army IPPS)

Intelligent Munitions System (IMS) "Scorpion"

Interceptor Body Armor

Javelin Antitank Missile System – Medium

Joint Air-to-Ground Missile (JAGM)

Joint Battle Command Platform (JBC-P)

Joint Cargo Aircraft (JCA)

Joint Cooperative Target Identification – Ground (JCTI-G)

Joint Future Theater Lift Concept (JFTLC)

Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System (JLENS)

Joint Lightweight Tactical Vehicle (JLTV)

Joint Personnel Identification (JPIv2)

Kiowa Warrior Replacement Program

Kiowa Warrior Upgrade

Land Warrior – Integrated Soldier Fighting System for Infantrymen

Light Utility Helicopter (LUH)

Logistics Modernization Program (LMP)

Long Endurance Multi-Intelligence Vehicle (LEMV)

LONGBOW APACHE – Airframe modifications on the APACHE Helicopter

M855 Lead Free Slug (LFS)

Nett Warrior

Paladin/FASSV Integrated Management (PIM)

Patriot Advanced Capability 3 (PAC-3) (Missile only)

Patriot/Medium Extended Air Defense System Combined Aggregate Program (PATRIOT/MEADS CAP)

Precision Guidance Kit XM1156 (PGK)

Shadow Unmanned Aircraft System

Small Unmanned Aircraft System (Raven UAS)

ARMY PROGRAMS (continued)

Spider XM7 Network Command Munition
Stryker – Armored Vehicle
Stryker M1126 Infantry Carrier Vehicle
Stryker M1127 Reconnaissance Vehicle
Stryker M1128 Mobile Gun System
Stryker M1129 Mortar Carrier
Stryker M1130 Commander's Vehicle
Stryker M1131 Fire Support Vehicle
Stryker M1132 Engineer Squad Vehicle
Stryker M1133 Medical Evacuation Vehicle
Stryker M1134 ATGM Vehicle
Stryker Modernization Program
Stryker Nuclear Biological Chemical Reconnaissance Vehicle (NBCRV)
Surface-Launched AMRAAM (SLAMRAAM)
Warfighter Information Network – Tactical (WIN-T) Increment 1
Warfighter Information Network – Tactical (WIN-T) Increment 2
Warfighter Information Network – Tactical (WIN-T) Increment 3
Warfighter Information Network – Tactical (WIN-T) Increment 4
X829E4 AKE

NAVY PROGRAMS

Acoustic Rapid COTS Insertion for SONAR
Active Electronically Scanned Array (AESA)
Advanced Airborne Sensor
Advanced Extremely High Frequency Navy Multiband Terminal Satellite Program (NMT)
AEGIS Modernization
AGM-88E Advanced Anti-Radiation Guided Missile (AARGM) Program
AH-1Z
AIM-9X – Air-to-Air Missile Upgrade
Air and Missile Defense Radar (AMDR)
Air Warfare/Ship Self Defense Enterprise
Airborne Laser Mine Detection System (ALMDS)
Airborne Mine Neutralization System (AMNS)
Airborne Resupply/Logistics for Seabasing (AR/LSB)
Amphibious Assault Vehicle Upgrade
AN/AAR-47 V2 Upgrade Missile/Laser Warning Receiver
AN/APR-39 Radar Warning Receiver
AN/AQS-20A Minehunting Sonar
An/BLQ-10 Submarine Electronics Support Measures
AN/BVS-1 Photonics Mast
AN/SLQ-25 NIXIE
AN/SQQ-89A(V) Integrated USW Combat Systems Suite
Anti-Torpedo Torpedo
Anti-Torpedo Torpedo Defensive System (Previously Surface Ship Torpedo Defense System) including all sensors and decision tools
Broad Area Maritime Surveillance Unmanned Aircraft System (BAMS UAS)
BYG-1 Fire Control (Weapon Control & TMA)
CG(X) - Next generation cruiser.
CH-53K – Heavy Lift Replacement Program
Close-In Weapon System (CIWS) including SEARAM
Cobra Judy Replacement – Ship-based radar system
Cobra Judy Replacement Mission Planning Tool
Common Aviation Command and Control System (CAC2S)
Consolidated Afloat Network Enterprise Services (CANES)
Cooperative Engagement Capability (CEC)
CVN 78 – *Gerald R. Ford* Class Nuclear Aircraft Carrier
DDG 1000 – *Zumwalt* Class Destroyer – includes all supporting PARMs
DDG 51 – *Arleigh Burke* Class Guided Missile Destroyer – includes all supporting PARMs
Department of Navy Large Aircraft Infrared Counter Measures (DoN LAIRCM)
Digital Modular Radio (DMR)
Distributed Common Ground System – Navy (DCGS-N)
Distributed Common Ground System – Marine Corps (DCGS-MC)
E-2D Advanced Hawkeye (AHE)
EA-18G – Airborne Electronic Attack variant of the F/A-18 aircraft
Enhanced Combat Helmet
Electronic Patrol - X (EP-X)
Evolved Sea Sparrow Missile (ESSM)
Evolved Sea Sparrow Missile Block 2
Expeditionary Fighting Vehicle (EFV)
F/A-18E/F SUPER HORNET Naval Strike Fighter
Future Pay and Personnel Management Solution (FPPS)
Global Combat Support System – Marine Corps (GCSS-MC)
Global Command and Control System – Maritime (GCCS-M)
Ground/Air Task Oriented Radar (G/ATOR)

NAVY PROGRAMS (continued)

H-1 UPGRADES (4BW/4BN) – USMC Mid-life Upgrade to AH-1W Attack Helicopter and UH-1N Utility Helicopter

Identification Friend or Foe Mark XIIA Mode 5 (all development and integration programs)

Integrated Defensive Electronic Countermeasures (IDECM) (All Blocks)

Joint and Allied Threat Awareness System (JATAS)

Joint Assault Bridge

Joint Expeditionary Fires (JEF)

Joint High Speed Vessel (JHSV)

Joint Multi-Mission Submersible (JMMS)

Joint Mission Planning System (JMPS) – Navy (E/F/A-18E/F/G and JMPS-E)

Joint Precision Approach and Landing System (JPALS)

Joint Stand-Off Weapon C-1 variant (JSOW C-1)

KC-130J Aircraft

KC-130J Harvest Hawk

LCC(R) – Command Ship Replacement

Littoral Combat Ship (LCS) – includes all Mission Packages and supporting PARMs, and 57mm, 30mm, and NLOS-LS lethality

LHA 6 – *America* Class Amphibious Assault Ship – includes all supporting PARMs

LHD 8 Amphibious Assault Ship

Light Armored Vehicle

Low Cost Conformal Array

LPD 17 – *San Antonio* Class Amphibious Transport Dock Ship – includes all supporting PARMs and 30mm lethality

Marine Personnel Carrier

Maritime Prepositioning Force (Future) Large, Medium-Speed, Roll-on/Roll-off Ships (MPF(F) LMSR)

Maritime Prepositioning Force (Future) Mobile Landing Platform (MPF(F) MLP)

Medium Tactical Vehicle Replacement Program (USMC) (MTVR)

MH-60R - Multi-Mission Helicopter Upgrade

MH-60S Multi-Mission Combat Support Helicopter

Mk 54 torpedo/Mk 54 VLA/Mk 54 Upgrades

Mk 48 CBASS Torpedo

Mk 48 Torpedo Mods

Mobile User Objective System (MUOS)

Naval Integrated Fire Control – Counter Air (NIFC-CA)

Navy Enterprise Resource Planning (ERP)

Navy Unmanned Combat Air System (UCAS)

Next Generation Enterprise Network (NGEN)

Next Generation Jammer

Ohio Replacement Program (Sea-based Strategic Deterrence) – including all supporting PARMs

Organic Airborne and Surface Influence Sweep (OASIS)

OSPREY MV-22 – Joint Advanced Vertical Lift Aircraft

P-8A Poseidon Program

Rapid Airborne Mine Clearance System (RAMICS)

Remote Minehunting System (RMS)

Rolling Airframe Missile (RAM) including RAM Block 1A Helicopter Aircraft Surface (HAS) and RAM Block 2 Programs

Ship Self-Defense System (SSDS)

SHIP TO SHORE CONNECTOR (SSC) (also called Joint Assured Maritime Access (JAMA))

Small Tactical Unmanned Aerial System (STUAS) – UAS Tier II

SSGN *Ohio* Class Conversion – includes all supporting PARMs

SSN 774 *Virginia* Class Submarine

Standard Missile 2 (SM-2) Block IIIB

Standard Missile 2 (SM-2) Block IIIC

Standard Missile-6 (SM-6)

Submarine External Communications System (SubECS)/Common Submarine Radio Room (CSRR)

Submarine Torpedo Defense System (Sub TDS) – including countermeasures and Next Generation Countermeasure System (NGCM)

Surface Electronic Warfare Improvement Program (SEWIP) Block 2

Surface Electronic Warfare Improvement Program (SEWIP) Block 3

Surface Electronic Warfare Improvement Program (SEWIP) Block 4

Surface Mine Countermeasures Unmanned Undersea Vehicle (SMCM UUV)

Surveillance Towed Array Sonar System/Low Frequency Active (SURTASS/LFA)

TACTICAL TOMAHAWK – Follow-on to TOMAHAWK Baseline missile program

T-AKE – *Lewis and Clark* Class of Auxiliary Dry Cargo Ships – includes all supporting PARMs

TB-33 Array Fiber Optic Thin Line System

TB-34 Next generation Fat Line Replacement Towed Array

TRIDENT II MISSILE – Sea-Launched Ballistic Missile

UH-1Y

Unmanned Surface Sweep System (US3)

Unmanned Undersea Vehicle program

Vertical Takeoff and Land Tactical Unmanned Air Vehicle (VTUAV) (Fire Scout)

VXX – Presidential Helicopter Fleet Replacement Program

AIR FORCE PROGRAMS

20mm PGU-28/B Replacement Combat Round

Advanced Pilot Trainer

Advanced Extremely High Frequency (AEHF) Satellite Program

Advanced Medium Range Air-to-Air Missile (AMRAAM)

Air and Space Operations Center – Weapons System (AOC-WS) initiative 10.2

Air and Space Operations Center – Weapons System (AOC-WS) initiatives including 10.0 and 10.1

Airborne Signals Intelligence Payload (ASIP)

Airborne Warning and Control System (AWACS) Block 40/45 Upgrade Program

Air Force Distributed Common Ground System (AF-DCGS)

Air Force Integrated Personnel and Pay System (AF-IPPS)

Air Force Network (AFNET) Increment 1

Air Force Network (AFNET) Increment 2

Air Force Network (AFNET) Increment 3

ALR-69A Radar Warning Receiver

Army Mission Planning System (AMPS)

B-2 Advanced Extremely High Frequency (EHF) SatCom and Computer Capability Increment I

B-2 Advanced Extremely High Frequency (EHF) SatCom and Computer Capability Increment II

B-2 RMP - B-2 Radar Modernization Program

Battle Control System – Fixed (BCS-F) 3.1

Battle Control System – Fixed (BCS-F) 3.2

Battlefield Airborne Communications Node (BACN) JUON

C-5 Aircraft Avionics Modernization Program (AMP)

C-5 Aircraft Reliability Enhancement and Re-engining Program (RERP)

C-17A - GLOBEMASTER III Advanced Cargo Aircraft Program

C-130 Aircraft Avionics Modernization Program (AMP)

C-130 Aircraft Avionics Modernization Program (AMP) Prime

C-130 Aircraft Avionics Modernization Program (AMP) Phase II

C-130J - HERCULES Cargo Aircraft Program

CITS AFNet Migration UON

Combat Search and Rescue Replacement (CSAR-X)

Command and Control Air Operations Software (C2AOS) (follow-on to Theater Battle Management Core System)

Command and Control Information Services (C2IS)

Common Vertical Lift Support Platform (CVLSP)

Cyber Control System (CCS) Increment 1

Cyber Control System (CCS) Increment 2

Defense Enterprise Accounting and Management System – Air Force (DEAMS – AF)

Defense Weather Satellite System (DWSS)

Deliberate and Crisis Action Planning and Execution Segments (DCAPES)

E-4B National Airborne Operations Center (NAOC) Aircraft Replacement Program

Enhanced Polar System (EPS)

Expeditionary Combat Support System (ECSS)

F-15E Radar Modernization Program

F-22 RAPTOR Advanced Tactical Fighter

F-35 Lightning II Joint Strike Fighter (JSF) Program

Family of Beyond Line-of-Sight Terminals (FAB-T)

Family of Beyond Line-of-Sight Terminals, Increment 2 (High Data Rate Airborne Terminal) (FAB-T HDRAT)

Financial Information Resource System

Full Scale Aerial Target

Global Broadcast Service (GBS)

Global Broadcast System (GBS) Defense Enterprise Computing Center (DECC)

GLOBAL HAWK (RQ-4A/B) – High Altitude Endurance Unmanned Aircraft System

Global Positioning Satellite Next Generation Control Segment (GPS OCX)

Global Positioning Satellite III (GPS-IIIA)

HC/MC – 130 Recapitalization

Identification Friend or Foe Mark XIIA Mode 5 (all development and integration programs)

Information Transport Service (ITS) Increment 2

Integrated Strategic Planning and Analysis Network (ISPAN) Increment 2

Joint Aerial Layer Network

Joint Air-to-Surface Standoff Missile (JASSM) and JASSM Extended Range (JASSM ER))

Joint Direct Attack Munition (JDAM)

Joint Primary Aircraft Training System (JPATS)

Joint Space Operations Center Mission System (JMS)

Joint Surveillance Target Attack Radar System (JSTARS) Re-engine Program

KC-X - Tanker Replacement Program

Large Aircraft Infrared Countermeasures Program (LAIRCM)

Light Armed Attack Aircraft

Light Mobility Aircraft

AIR FORCE PROGRAMS (continued)

Massive Ordnance Penetrator (MOP)

Military GPS User Equipment (GPS MGUE)

Miniature Air Launched Decoy (MALD), including MALD-Jammer (MALD-J)

Mission Planning Systems (MPS) Increments I-III including the Joint Mission Planning System (JMPS) - (RC-135)

Mission Planning System (MPS) Increment IV – (E-8/E-3, B-1, F-22, A-10)

Multi-Platform Radar Technology Insertion Program (MP RTIP)

MQ-9 REAPER Unmanned Aircraft System

MQ-X

National Airspace System (NAS)

NAVSTAR Global Positioning System (GPS) – includes Satellites, Control and User Equipment

NUDET Detection System (NDS)

OSPREY CV-22 – Joint Advanced Vertical Lift Aircraft

Presidential Aircraft Recapitalization (PAR) Program – Air Force One recapitalization program

Small Diameter Bomb (SDB) Increment I

Small Diameter Bomb (SDB) Increment II

Space-Based Infrared System Program, High Component (SBIRS HIGH)

Space-Based Space Surveillance (SBSS) Block 10

Space-Based Space Surveillance (SBSS) Block 10 Follow-on

Space Fence

Three-dimensional Expeditionary Long-Range Radar (3DELRR)

Vulnerability Life Cycle Management System (VLMS) 1.5

Vulnerability Life Cycle Management System (VLMS) 2.0

Wideband Global SATCOM (WGS) Program

DoD Programs

F-35 Joint Strike Fighter (JSF)

Executive Summary

- All three F-35 variants had entered flight test by June 2010. For the first time, all three integrated test forces at Fort Worth, Texas; Patuxent River Naval Air Station (NAS), Maryland; and Edwards AFB, California, conducted flight test operations with seven Systems Design and Development (SDD) test aircraft. The cumulative data for test sorties and points indicate progress slightly ahead of that planned. The test teams exceeded the goal of 394 total sorties for calendar year 2010 by early December 2010. However, progress in testing the Short Take-Off and Vertical Landing (STOVL) aircraft was less than planned.
- Immaturity of STOVL design and unexpected component deficiencies limited successful accomplishment of test points in areas critical to short take-off and vertical landing capability. Development of mission systems software continued to experience delays that affected flight test progress.
- Program leadership began re-planning SDD flight testing at the end of FY10, in conjunction with a restructuring of mission systems software development plans. These efforts followed the recommendations of the Program Executive Office's (PEO) Technical Baseline Review (TBR) of the program, which was a technical, "bottoms-up," independent review of the air vehicle platform, sustainment, mission systems software, and test. Finalization of the test schedule and integration into a master program schedule continued into early FY11.

- Service plans for initial training and operational capability, and acquisition plans for full-rate production need to be adjusted to a realistic timeline consistent with certification through testing of the incremental capability aircraft will actually provide, as well as later completion of SDD. Although the integrated test forces and development teams made significant progress, the results of flight testing and the TBR indicate more time and resources will be needed to complete SDD than incorporated in the June 2010 program baseline.

Actual versus Planned Test Flights and Points

		ALL VARIANTS ALL TESTING		STOVL ONLY FLIGHT SCIENCES		CTOL ONLY FLIGHT SCIENCES		CV ONLY FLIGHT SCIENCES		MISSION SYSTEMS	
		Flights	Points	Flights	Points	Flights	Points	Flights	Points	Flights	Points
FY10	ACTUAL	282	2,948	130	1,467	111	963	14	344	28	174
	PLANNED	256	2,496	173	1,678	43	485	9	77	32	256
Cumulative (as of 1 Dec 10)	ACTUAL	427	4,614	216	2,649	155	1,294	24	466	32	205
	PLANNED	390	4,404	254	3,010	69	825	21	201	46	368

System

- The F-35 Joint Strike Fighter (JSF) program is a joint, multi-national, single-seat, single-engine family of strike aircraft consisting of three variants:
  - F-35A Conventional Take-Off and Landing (CTOL)
  - F-35B Short Take-Off and Vertical Landing (STOVL)
  - F-35C Aircraft Carrier Variant (CV)
- It is designed to survive in an advanced threat (year 2012 and beyond) environment using numerous advanced capabilities. It is also designed to have improved lethality compared to legacy multi-role aircraft.
- Using an Active Electronically Scanned Array (AESA) radar and other sensors, the F-35 is intended to employ precision-guided bombs such as the Joint Direct Attack Munition and Joint Standoff Weapon, AIM-120C radar-guided air-to-air missiles, and AIM-9 infrared-guided air-to-air missiles.

- The program incrementally provides mission capability: Block 1 (initial), Block 2 (advanced), Block 3 (full).
- The F-35 is under development by a partnership of countries: the United States, Great Britain, Italy, the Netherlands, Turkey, Canada, Australia, Denmark, and Norway.

Mission

- A force equipped with F-35 units should permit the Combatant Commander to attack targets day or night, in all weather, in highly defended areas of joint operations.
- Targets include fixed and mobile land targets, enemy surface units at sea, and air threats, including advanced cruise missiles.

Major Contractor

Lockheed Martin, Aeronautics Division, Advanced Development Programs – Fort Worth, Texas

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Activity

Activity Affecting Test Strategy, Planning, and Resourcing

Joint Estimate Team II

- The second independent Joint Estimate Team (JET) review concluded last year that the SDD flight test plan lacked sufficient resources and incorporated unrealistic assumptions for flight test productivity relative to historical experience. At the time of the JET II review, the program had accomplished approximately 25 flight test hours on only two STOVL SDD test aircraft; no aircraft had ferried to the flight test centers.
- In early FY10, the program began the process of incorporating the review's key recommendations: adding test aircraft to the SDD test fleets from production lots, adding down-time for aircraft maintenance and modifications, reducing the assumed productivity of certain flight test aircraft, increasing and extending engineering and test operations staffs to support concurrent development and test, and adding an additional software integration and test lab. The program was also directed to implement recommendations of the first Independent Manufacturing Review Team, to include reducing production in the Future Years Defense Plan by 122 aircraft, thereby reducing concurrency of development and production.
- These reviews and actions, along with a review of cost and risk in development of the propulsion system, led to the acknowledgement of a breach of the Nunn-McCurdy "critical" cost thresholds for the JSF program.

Nunn-McCurdy Certification

- An Integrated Test Review occurred in April to support the Nunn-McCurdy certification. Representatives from the Edwards and Patuxent River flight test centers, JSF Operational Test Team, and the Services conducted the review and identified numerous issues affecting the executability of the flight test schedule.
- The Nunn-McCurdy program certification occurred in June. At the time of the certification of the new program budget baseline, the flight test program had accomplished approximately 190 flight test hours and ferried five total aircraft to the test centers, including two CTOL flight sciences aircraft, with an overall average number of 3.2 months on-site at the flight test centers. Low fly rates on STOVL flight sciences aircraft and unanticipated deficiencies in the design had begun to emerge in flight test. Analysis during the review indicated STOVL flight sciences was becoming the critical path to complete SDD flight test. The program acknowledged later ferry dates for remaining SDD test aircraft. The estimate of SDD flight test completion was extended to July 2015.

Technical Baseline Review (TBR)

- The new PEO commissioned a TBR of the program in June to determine the technical adequacy of program plans and resources. The TBR benefitted from more flight test results than previous reviews because the three Integrated Test Force sites had accumulated over 440 flight test hours and the overall average in months on-site for SDD aircraft at the flight test centers was 7.2 months. However, during the months since the last program review, more problems with STOVL design and mission systems software arose.
- The TBR recommended further changes to the parameters used to plan and model flight test schedules, as well as numerous changes in staffing and other resources needed to complete SDD and enter IOT&E. Specific changes to the schedule recommended by the TBR include lower flight rates for test aircraft that are tailored to each variant (lower than prior independent reviews), additional re-fly and regression sorties that are tailored to the type of testing, and more flight test sorties. The TBR also determined more time was needed for completion of all remaining software increments. The result is a completion of developmental flight test in late 2016, with STOVL flight sciences completing later than the other two variants.

F-35 Flight Test

STOVL Flight Sciences, Flight Test with BF-1, BF-2, and BF-3 Test Aircraft

- BF-3 ferried to Patuxent River NAS, Maryland, in February 2010; it is the last of three B-model flight sciences aircraft.
- Maintenance, test operations, and engineering staffs increased significantly (approximately 25 percent) in FY10 at Patuxent River, NAS. The program intends to reach full strength in 2011, pending hiring of qualified contractor personnel.

- The government-contractor test team attempted test points in up-and-away flight envelope expansion, STOVL-mode flight, handling qualities, propulsion testing, and readiness for the first ship integration test period (planned for late 2011).
- In FY10, STOVL Flight Sciences aircraft flew 130 of 173 planned sorties; the test team completed 1,467 of 1,678 planned test points. However, the test team accomplished only 10 of 42 planned vertical landings between March and November 2010; these are key to the shore-based build-up to testing on L-class amphibious ships at sea. In the first two months of FY11, STOVL flight sciences aircraft flew 54 sorties, 5 more than planned; the test team accomplished 356 of 506 planned test points. From mid-August until early November, the test team flew CTOL-mode configurations due to limitations of the vertical-lift capability of the STOVL system. STOVL-mode flight test operations began again in BF-1 in November 2010.
- In July, the program made changes to supply chain management to provide timely spares and implemented surge scheduling and 7-day/week maintenance operations. These actions contributed to an increase in flights per month of approximately 25 percent.
- Discoveries during STOVL Flight Sciences testing this fiscal year include transonic wing roll-off, greater than expected sideslip during medium angle-of-attack testing, higher and unanticipated structural loads on STOVL doors, and poor reliability and maintainability of key components.

CTOL Flight Sciences, Flight Test with AF-1 and AF-2 Test Aircraft

- AF-1 and AF-2 ferried to Edwards AFB, California, in May, as planned.
- Maintenance, test operations, and engineering staffs increased significantly (approximately 50 percent) in FY10. The program intends to reach full strength in 2011, pending hiring of qualified contractor personnel.
- In FY10, the test team made progress in envelope expansion, handling qualities, and propulsion test points. CTOL Flight Sciences aircraft flew 111 sorties, 68 more than planned. The test team completed 963 test points, exceeding the 485 planned flight test points for the fiscal year. In the first two months of FY11, CTOL flight sciences aircraft flew 44 sorties, 18 more than planned; the test team accomplished 331 of 340 planned test points.
- The program anticipates the remaining CTOL Flight Sciences aircraft, AF-4, will ferry to Edwards, AFB, California, by January 2011, approximately two months later than planned.
- Discoveries during CTOL flight sciences flight test in this fiscal year include transonic wing roll-off, greater than expected sideslip during medium angle-of-attack testing, and problems with reliability and maintainability of key components.

CV Flight Sciences, Flight Test with CF-1 Test Aircraft

- CF-1 flew for the first time in June 2010. The aircraft ferried to Patuxent River NAS, Maryland, in early November 2010, one month later than planned.
- While at Fort Worth, Texas, CF-1 flew airworthiness and initial-service-release propulsion system test flights, accomplishing 14 flight test sorties, five more than planned. As a result, CF-1 flew 344 test points, significantly more than the 77 planned for the fiscal year. In the first two months of FY11, aircraft CF-1 flew 10 of 12 planned sorties; the test team accomplished 4 of 14 planned test points.
- The Integrated Test Force at Patuxent River NAS, Maryland, built up maintenance and engineering support personnel in anticipation of the arrival of CF-1, which the program delivered to the test center in November 2010.
- The program anticipates the remaining CV flight sciences test aircraft, CF-2 and CF-5, will ferry to Patuxent River NAS, Maryland, in February 2011 and late 2013, respectively. Aircraft CF-2 would then arrive approximately two months later than planned.

Mission Systems, BF-4 and AF-3 Flight Tests and Software Development Progress

- Block 0.5 Infrastructure
  - The program released Block 0.5 software for flight test in March 2010, five months later than planned. The software had completed mission systems lab integration activity and integration flights on the Cooperative Avionics Test Bed (CATB). Block 0.5 is the infrastructure increment, which contains communications, navigation, and limited radar functionality.
  - Aircraft BF-4, loaded with Block 0.5, accomplished first flight in April 2010, five months later than planned, and then ferried to Patuxent River NAS, Maryland, in June, two months later than planned, and began Block 0.5 flight test.
  - Test teams attempted approximately 70 percent of the planned Block 0.5 flight test points on BF-4. Software problems occurring before and during flight test were not resolved in the Block 0.5 configuration. Program leadership deemed Block 0.5 unsuitable for initial training and adjusted the software development plan to implement fixes for the Block 0.5 problems in the initial release of Block 1. The integrated test force is re-flying selected Block 0.5 flight test points in the Block 1 configuration.
- Block 1, Initial Training Capability
  - The program delivered aircraft AF-3 in a Block 1 configuration to Edwards AFB, California, in December 2010, approximately five months later than planned.
  - The program intends the Block 1 design (which includes multi-sensor fusion capability) to support the initial

training syllabus for the initial cadres at the training center. The development team conducted integration activity with an initial version of Block 1, including fixes to Block 0.5 problems, in the mission systems labs and on the CATB.
  - The program planned to release the first Block 1 increment to flight test aircraft in August 2010, but F-35 flight testing did not begin until November 2010. By the end of November, the test team flew 4 of 14 planned sorties and accomplished 31 of 112 test points.
- Block 2 and Block 3 Software Development Progress
  - The Block 2 detailed flight test planning process began in September 2010.
  - In August, the program began re-planning the software development schedule for completing and certifying Block 1, Block 2, and Block 3 increments of SDD capability.
- Ferry of Remaining SDD Mission Systems Flight Test Aircraft
  - The program anticipates ferry of BF-5 in late March 2011 and CF-3 in May 2011; these deliveries to the test centers are approximately four and five months later than planned, respectively.

Modeling and Simulation

Verification Simulation (VSIM)

- The program commenced planning of validation efforts for F-35 modeling, development of the virtual battlespace environment, and integration of the two into one simulation intended for developmental test and evaluation.
- The program identified funding shortfalls for the Verification Simulation (VSIM) to meet OT&E needs, primarily in the battlespace environment, and provided data for an independent cost assessment leading to inclusion of VSIM costs in the program baseline. The Services have been directed to fully fund VSIM for OT&E.
- The PEO completed a VSIM Sufficiency Review to determine the means to provide the required OT&E VSIM capability.

Other Models and Corporate Labs

- The program continues to plan to accredit a total of 32 models and virtual laboratories for use as test venues (including VSIM) in developmental testing. The program planned to accredit 11 models by the end of FY10; however, the program office accredited only three venues by September 2010.
- Due to software development delays and shifts in capability to later software blocks, the program decided several models are not needed to support testing of Block 1 mission systems.

Static Structural and Durability Testing

- The test teams completed STOVL and CTOL static structural testing ahead of schedule, which is an important input to envelope expansion through flight test. The CV static test article completed initial drop tests for carrier suitability.
- CTOL and STOVL durability testing began in FY10. Results for a loading equivalent to one aircraft lifetime (8,000 hours) were expected in mid-FY11 for the STOVL aircraft and early FY12 for the CTOL aircraft. However, a major fatigue crack was found in the STOVL test article at approximately 1,500 flight hours. Failure of the bulkhead in flight would have safety of flight consequences. The program stopped fatigue testing on both the STOVL and CTOL test articles and began root cause analysis in November 2010. The STOVL bulkhead is constructed of aluminum alloy. The CTOL and CV bulkheads have a similar but not identical design and are made of titanium. The difference in bulkhead material is due to actions taken several years ago to reduce the weight of the STOVL aircraft.

Propulsion System Testing

- F135. The program delivered the first initial-service-release F135 engines to SDD CV and STOVL test aircraft. By the end of November 2010, CF-1 had flown 36 flight hours with this engine; however, BF-5 had not yet flown. The program began implementing plans to modify test aircraft to rectify the afterburner “screech” problem, a problem that prevents the engine from sustaining full thrust. These modifications are necessary for the test aircraft to complete envelope expansion at the planned tempo.
- F136. Engine testing accomplished approximately 430 of 739 planned ground test hours by the end of the fiscal year. The program is examining ways to accelerate testing in order to meet the planned start of flight test with the F136 in late 2011 for CTOL, and late 2012 for STOVL.

Operational Test and Evaluation

- In June, the JSF Operational Test Team (JOTT) began OT-2E, the fifth operational assessment of progress towards developing an operationally effective and suitable Block 3 mission capability in all three variants. The JOTT plans to complete this assessment in late 2011.
- At the request of the JSF Program Executive Officer (PEO), the JOTT is also developing plans to assess the initial training capability intended for use with the first fleet pilots and maintenance crews in 2011.
- The JOTT reviewed and re-validated the November 2008 requirements documentation for the VSIM for OT&E. DOT&E approved the re-validated requirements.
- The JOTT began the Readiness-to-Test evaluation process in FY10, which uses an assessment template to determine actions necessary for the weapons system to be ready to successfully enter and complete the planned OT&E periods. This process identifies potential gaps between verification of contract specification compliance and delivery of the mission capability necessary to meet the operational requirements.
- The JOTT significantly increased its work force and the Services identified pilots and maintenance crews for execution of early operational testing and assessments.

Air System-Ship Integration and Ship Suitability Testing

- Coordination continued between the JSF program office, Naval Sea Systems Command, and Naval Air Systems Command offices responsible for planning and implementing actions to integrate the JSF aircraft and support systems on naval ships. The teams focused efforts on readiness for initial ship trial periods that the program now plans in late 2011 (one year later than previously planned), as well as on planning the other actions needed to achieve initial operating capabilities of the B-model on L-class amphibious ships and the C-model on large-deck carriers.
- The coordination teams are working significant issues in these areas: identification of personnel hazard zones around B-model aircraft, interoperability of the Autonomic Logistics Information System with Service and joint systems, carrier jet blast deflector modifications needed for CV aircraft operations, aircraft-ship connectivity for alignment of inertial navigation systems, secure facilities for handling special access material, and spectrum limitations.
- The first ship trial period for the B-model STOVL aircraft has slipped from March 2011 to no earlier than late 2011 due to the slow flight test progress in accomplishing the shore-based build-up test points. The first C-model trial period on a large deck carrier is planned for early 2013.

Live Fire Test and Evaluation

- LFT&E conducted On-Board Inert Gas Generations System (OBIGGS) tests during FY09-FY10.
- The Weapons Survivability Lab at China Lake took delivery of the Full-Up System-Level (FUSL) F-35 aircraft. The aircraft is being prepared for ballistic testing. The test team will begin this testing in 1QFY11.

Assessment

Test Schedule Re-Planning and Implementation of Changes

- The year-long process of analyses during FY10 (JET II implementation, Nunn-McCurdy certification, and TBR) served to develop a more realistic estimate of SDD completion for Block 3 in all variants and identify steps to reduce risk in execution of the verification test and evaluation strategy. Although the sample size of experience with the CV is still small, the STOVL design emerged as the highest risk of all variants and the most difficult to progress through flight test. This is due in part to the difficulty in making progress in vertical lift operations compared to that planned. The analyses also revealed that the F-35 mission systems software development and test is tending towards familiar historical patterns of extended development, discovery in flight test, and deferrals to later increments. The modifications recommended by the TBR (lower fly rates, more regression and re-fly margin, more flights, and other resource additions) that result in completion of SDD flight test for Block 3 in all three variants later than previously estimated are realistic and credible. Completion of STOVL flight sciences in this timeframe is dependent on whether or not the necessary changes to STOVL design can be implemented and tested. It will also depend on whether these changes result in fewer aircraft operating limitations and greater aircraft availability for test. The program will potentially need as much as a year longer than the other two variants to complete this variant's flight sciences and ship integration testing. The expectations approaching 10 to 12 flight sciences sorties/month/aircraft in previous schedules are not achievable in the flight test program until changes are made to all variants that improve reliability and maintainability in flight test operations. Additionally, the process must begin to reduce the aircraft operating limitations, which inhibit flight test progress particularly in vertical lift STOVL testing.
- Mission Systems flight test still contains significant uncertainty, which will affect any estimate of a Block 3 completion date. This is primarily due to the delays incurred in development thus far and the fact that only the Block 0.5 flight test plan has actually been completed and approved. A test plan for Block 1 is currently in review by test center authorities, and the Block 2 test plan is in an initial draft state. Additionally, technical issues in the helmet mounted display and sensor fusion, along with uncertainties pertaining to new capabilities with which the program has limited experience on the F-35 aircraft (multi-function advanced data link, distributed aperture system, infrared/electro-optical fused sensor tracks) are risks that affect the ability to accurately predict the conclusion of mission systems flight test. Completion by early 2016 is possible provided further delays in delivery of Block 2 and Block 3 software are not incurred, and the program can overcome the helmet mounted display problem before Block 2 flight test must begin. Mission systems labs and CATB are important to software integration and test; use of these assets has enabled the resolution of many problems before flight test. However, F-35 flight test must include integration sorties to demonstrate software performance before performing flight test points for verification of capability. F-35 flight test for the purposes of software and sensor integration has not been, but needs to be, an explicit part of the flight test plan such that integration precedes verification events.
- The TBR also revealed a number of changes needed to directly support the Edwards and Patuxent River Integrated Test Force flight test centers to assure the highest possible rate of execution. Recommendations for additional maintenance and test operations work forces, improving spare parts supply chain management, increasing engineering support for test data analysis, standardizing network connectivity at all sites, and improving priority of the program on test ranges are credible, important efforts that need follow-up and require sustained emphasis for the duration of SDD flight test.

Verification Simulation for Operational Test and Evaluation

- Open-air testing is constrained by range limitations that are incapable of providing realistic testing of many key capabilities provided by Block 3 aircraft. Consequently, a

robust, operationally realistic VSIM is critical to performing IOT&E of JSF, as required by the Test and Evaluation Master Plan (TEMP).
- The program office and contractor team have begun work on the simulation for Block 2 capability needed for the OT-2F operational utility evaluation, and are beginning to focus on the process and data requirements to validate installed F-35 performance in the simulation. This critical work needs to be carefully resourced and coordinated, and should be subject to independent review.
- The JSF VSIM developed for IOT&E will have significant utility for development and testing of upgrades to aircraft capabilities beyond Block 3 occurring well after IOT&E is complete. The JSF Program Office Sufficiency Review determined a path for completing the simulation for Block 3 IOT&E within the baseline budget adjustment made in the Nunn-McCurdy certified program. Challenges remain in identifying and collecting the needed validation data for F-35 installed performance and completing the battlespace environment.

Training
- The Integrated Training Center made significant progress in preparation for receiving aircraft, support systems, and personnel. The development of the syllabi and training devices proceeded essentially on the pace planned in FY10. However, the adequacy of the training system for the Integrated Training Center requires reassessment. Users have expressed concerns about the adequacy of course content and its allocation between training venues, such as the self-paced computer-based lessons, electronically mediated instructor lectures, desktop Pilot Training Aid, training events conducted in the cockpit simulators, and on/in-aircraft training.
- The slower than planned pace of mission systems software development and significant aircraft operating limitations affect readiness to begin formal training, which is not likely to occur in mid-2011 as planned. The JOTT operational assessment of the intended training system and its planned products requested by the PEO will provide an independent identification of issues, and progress towards resolution. The effects of immature aircraft and support systems, along with user concerns about adequacy of training venues for intended uses, will be key aspects of this assessment.

Live Fire Test and Evaluation
- The OBIGGS system fails to inert the fuel tank ullage spaces throughout the combat flight envelopes evaluated.

Recommendations
- Status of Previous Recommendations. The program and Services are satisfactorily addressing four of eight previous recommendations. The remaining four recommendations concerning adequate flight test resourcing, coordinating expected level of low-rate initial production capability with users including the JOTT, accreditation of models used as test venues, and restoring the means to minimize fueldraulics leaks and coolant shutoff valves are outstanding.
- FY10 Recommendations. The program should:
  1. Assure the re-planned detailed mission systems development schedule and detailed flight test schedule are realistic.
  2. Annually evaluate flight test progress against planned performance, assess resources, and recommend adjustment of Service early fielding goals. Remain prepared to deal with continued discovery in flight test as more complex testing begins.
  3. Determine the impact of resolution of known critical technical issues, including Helmet Mounted Display, STOVL mechanization, handling characteristics, and afterburner “screech” on plans for flight test and fielding capability.
  4. Assure that there is explicit use of F-35 flight test for software integration before verification.
  5. Finalize plans to verify and validate the mission data load products through dedicated flight test.
  6. Complete VSIM development for OT&E in accordance with the operational testing requirements document and TEMP.
  7. Re-design the OBIGGS system to ensure that the fuel tank ullage volume oxygen concentrations are maintained below levels that sustain fire and/or explosion throughout the combat flight envelopes.

Global Combat Support System – Joint (GCSS-J)

Executive Summary

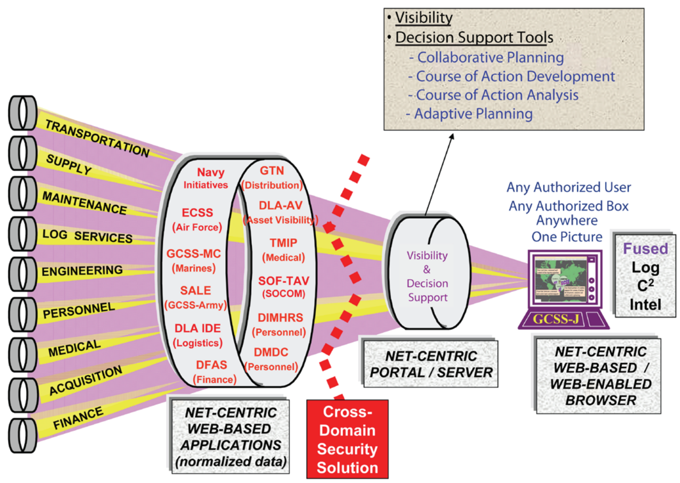
- The Joint Interoperability Test Command (JITC) conducted a risk assessment for each version of the software and recommended a level of test for DOT&E approval. DOT&E approved the plan for a full operational test for Global Combat Support System – Joint (GCSS-J) version 7.1.0. Because of lower risks for versions 7.1.1 and 7.1.2, DOT&E approved the plan for operational assessments based on JITC's observation of the developmental tests conducted by the program manager.
- The latest version, 7.1.2, is operationally effective and operationally suitable. The application is survivable against cyber attacks. The primary host server site, however, did not meet the required level of cyber attack detection measures.

System

- The GCSS-J is a web portal that enables users at combatant commands and joint task forces to access joint logistics applications.
- The system supports planning, execution, and control for engineering, health services, logistics services, supply, distribution, and maintenance operations. It is comprised of strategic servers (located in Montgomery, Alabama, and Pearl Harbor, Hawaii), a commercial off-the-shelf-based infrastructure, and Public Key Infrastructure.
- GCSS-J supports the situational awareness of the military operators by providing applications for the following: search, query, and reports capability; Watchboard (allowing rapid comparison of planned actions with actual events); electronic battlebook (organizing files and web pages into categories); knowledge management; business intelligence; mapping capability; joint engineer planning; and execution capability.
- GCSS-J Increment 7 follows an agile acquisition strategy that supports multiple releases of the updated software in coordination with the user, program manager, and testers. In 2010, the Defense Information Systems Agency (DISA) released three versions of GCSS-J: 7.1.0, 7.1.1, and 7.1.2.

Mission

- Joint commanders use GCSS-J to move and sustain joint forces throughout the entire spectrum of military operations.



C² - Command and Control
DFAS - Defense Finance and Accounting Service
DIMHRS - Defense Integrated Military Human Resources System
DLA-AV - Defense Logistics Agency - Asset Visibility
DLA-IDE - Defense Logistics Agency - Integrated Data Environment
DMDC - Defense Manpower Data Center
ECSS - Expeditionary Combat Support System
GCSS-Army - Global Combat Support System-Army
GCSS-MC - Global Combat Support System-Marine Corps
GCSS-Navy - Global Combat Support System-Navy
GTN - Global Transportation Network
IDE-AV - Integrated Data Environment - Asset Visibility
SALE - Single Army Logistics Enterprise
SIPRNET - Secret Internet Protocol Routed Network
SOCOM - Special Operations Command
SOF-TAV - Special Operations Forces - Total Asset Visibility
TMIP - Theater Medical Information Program

- Combatant Command and Joint Task Force commanders and logistics staffs use the GCSS-J to gain end-to-end visibility of combat support capability up through the strategic level, facilitating information flow across and between combat support and command and control functions.

Major Contractor

Northrop Grumman Mission Systems – Herndon, Virginia

Activity

- JITC conducted a risk assessment for each version of the software and recommended a level of test for DOT&E approval. DOT&E approved the plan for a full operational test for version 7.1.0. Because of lower risks for versions 7.1.1 and 7.1.2, DOT&E approved the plan for operational assessments based on JITC's observation of the developmental tests conducted by the program manager.
- JITC conducted an operational test of GCSS-J version 7.1.0 from October 20 through November 3, 2009, in accordance with the DOT&E-approved test plan.

- JITC assessed GCSS-J version 7.1.1 Secret Internet Protocol Router Network (SIPRNet) based on participation in the developmental test conducted from February 22 to April 22, 2010. JITC conducted a separate operational test at the primary hosting site in Montgomery, Alabama, March 8 - 19, 2010, to assess operational survivability against cyber attacks.
- JITC assessed GCSS-J version 7.1.2 using the results from the developmental tests conducted by the program manager in accordance with the risk assessment recommendations. The SIPRNet GCSS-J version 7.1.2 developmental test was from July 26 through August 3, 2010, and Unclassified but Sensitive Internet protocol Router Network (NIPRNet) version 7.1.2 developmental test was September 3 - 7, 2010.

Assessment

- GCSS-J version 7.1.0 was operationally effective. It incorporates an improved Query Tool. The Joint Logistics Management functional areas incorporated tools providing improved user visibility into the status of ammunition inventories and allowed easier interface with query tools and the Watchboard. Maintenance, Supply and Services, Movement, Personnel Management, and Health Services functional areas were operationally effective. However, the Joint Engineering Planning and Execution System had critical problems, making that function not operationally effective.
- GCSS-J version 7.1.0 was operationally suitable, with good training and good system reliability and availability. The performance of the help desk showed improvement. Evaluation of IA was limited. IA controls associated with protect, detect, react, and restore at the application level were satisfactory, but IA controls at the server level could not be assessed. DOT&E agreed to defer a vulnerability assessment of the DISA host server suite to the 7.1.1 operational test.
- GCSS-J version 7.1.1 corrected errors discovered in operational testing of GCSS-J version 7.1.0, and the system was assessed to be operationally effective and suitable. A separate vulnerability assessment of the DISA host server suite revealed that GCSS-J version 7.1.1 did not add significant vulnerability against cyber attacks, but that the primary host site in Montgomery, Alabama, could not detect the cyber attacks to the required level.
- Both the SIPRNet and NIPRNet version 7.1.2 are operationally effective and operationally suitable. Like version 7.1.1, version 7.1.2 does not cause an unacceptable increase in vulnerability of the DISA network. However, the primary host site must make additional improvements toward meeting the required level of cyber attack detection measures.

Recommendations

- Status of Previous Recommendations. DISA has taken appropriate action on the previous recommendations.
- FY10 Recommendation.
  1. DISA should improve the security posture of the server hosting sites and perform penetration tests on an annual basis.

Joint Chemical Agent Detector

Executive Summary
- In April 2009, the Joint Project Manager chose Smiths Detection's Lightweight Chemical Detector 3.3 to replace the M4 to improve chemical warfare agent detection sensitivity, reduce false alarm rate, increase battery life (to 25 hours from 12), and reduce acquisition and lifecycle costs.
- The program office conducted M4E1 developmental testing from May to October 2010.
- Integrated developmental and operational test and evaluation events included Chemical Warfare Agent Detection and Identification, Toxic Industrial Chemical Detection and Identification, Chemical Warfare Agent Detector Clear Down, and Chemical, Biological, and Radiological Contamination Survivability.
- The Army Test and Evaluation Command led a multi-service operational test at Dugway Proving Ground, Utah from July to August 2010.

System
- JCAD is a hand-held device that automatically detects, identifies, and alerts warfighters to the presence of nerve and blister vapors, as well as one blood chemical agent vapor and one toxic industrial chemical vapor.
- JCAD is a non-developmental item modified from a commercially available device. It operates as a stand-alone detector. It is carried by personnel and placed onto various platforms, including ground vehicles, at fixed-site installations, and at collective protection shelters. It supplements or replaces existing fielded chemical agent vapor detectors.
- The total Acquisition Objective for JCAD, M4 and M4E1, is 109,705 units. The JCAD will be issued to:
  - Army squads
  - Marine platoons
  - Air Force base reconnaissance, and ground-service personnel
  - Navy shore installations, and riverine or land-based units

Mission
- Units use JCAD to provide hazard level indication of chemical warfare agent and toxic industrial chemical vapors. This alerts personnel to take personal protection measures, including masking and unit force protection measures (contamination avoidance and increase in mission-level protective posture).
- JCAD is used for the following purposes:
  - Personal chemical vapor detector
  - Monitor in and around a vehicle or shelter's interior and exterior, or aircraft interior
  - Fixed installation monitor or array of monitors to provide remote alarming

Major Contractor
Smiths Detection – Edgewood, Maryland

Activity
- In April 2009, the Joint Project Manager chose Smiths Detection's Lightweight Chemical Detector 3.3 to replace the M4 to improve chemical warfare agent detection sensitivity, reduce false alarm rate, increase battery life (to 25 hours from 12), and reduce acquisition and lifecycle costs. The Joint Project Manager intends to procure 49,705 of the enhanced detector, designated the M4E1. The Joint Project Manager plans to begin production of the M4E1 in March 2011.
- DOT&E approved the JCAD Test and Evaluation Master Plan (TEMP) on July 22, 2010. It provides for side-by-side testing in both developmental and operational testing of the M4 and M4E1.

- The program office conducted M4E1 developmental testing from May to October 2010.
- The integrated test and evaluation program includes the following developmental/operational test events:
  - Chemical Warfare Agent Detection and Identification
  - Toxic Industrial Chemical Detection and Identification
  - Chemical Warfare Agent Detector Clear Down
  - Chemical, Biological, and Radiological Contamination Survivability.
- The Army Test and Evaluation Command led a multi-Service operational test at Dugway Proving Ground, Utah from July to August 2010.
- All testing was conducted in accordance with the DOT&E-approved TEMP.

Assessment

- DOT&E is currently evaluating the test data and plans to publish an evaluation report to support the February 2011 production decision.

Recommendations

- Status of Previous Recommendations. There was no FY09 report for this program. In accordance with DOT&E's FY08 recommendation, the Joint Program Manager plans to conduct surveillance and inspection of the fielded JCADs beginning in October 2011. Fielded systems found to be out of compliance with the initial set-up parameters will be returned to Smiths Detection for repair.
- FY10 Recommendations. None.

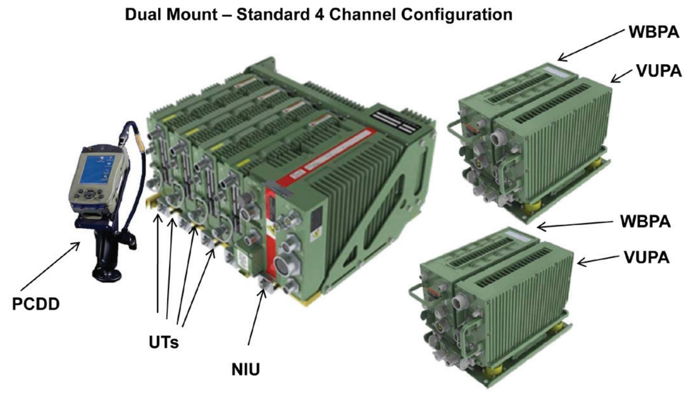
Joint Tactical Radio System (JTRS) Ground Mobile Radio (GMR)

Executive Summary

- The Joint Tactical Radio System (JTRS) Ground Mobile Radio (GMR) System Integration Test (SIT) was delayed from May 17 to June 29, 2010, due to problems with late hardware deliveries and immature software.
- The program completed the JTRS GMR SIT, which was modified into a customer test and a government-assessed developmental test, from June 29 to September 14, 2010. Due to JTRS GMR performance deficiencies revealed during the SIT, the Army delayed the planned December 2010 JTRS GMR Limited User Test (LUT) until June 2011 to allow time for reliability and performance improvements.
- The Early Infantry Brigade Combat Team (E-IBCT) Increment 1 LUT in September 2010 assessed the JTRS GMR as a component of the Network Integration Kit (NIK).
- The E-IBCT LUT 10 demonstrated the JTRS GMR's capability (as a component of the NIK) to transfer images from E-IBCT sensors to other NIKs within the brigade NIK/GMR network. The E-IBCT LUT 10 highlighted GMR deficiencies including poor support for secure voice networks, limited transmission range, difficulty connecting to sensor fields and concerns with reliability.

System

- JTRS is a family of software-programmable and hardware-configurable digital radios intended to provide increased interoperability, flexibility, and adaptability to support numerous tactical communications requirements.
- JTRS GMR components include portable control display devices, universal transceivers, network/information security interface units, and power amplifiers, which combine to create radio sets for installation in Army and Marine Corps ground vehicles.



NIU – Network Information/Security Unit
PCDD – Portable Control Display Device
UT – Universal Transceiver
VUPA – VHF (Very High Frequency)/UHF (Ultra High Frequency) Power Amplifier
WBPA – Wideband Power Amplifier

Mission

Commanders from the Army and the Marine Corps intend to use JTRS GMR to:

- Communicate and create networks to exchange voice, video, and data during all aspects of military operations.
- Interface with other JTRS product line radios and legacy radio systems in joint and coalition operations.

Major Contractor

The Boeing Company, Integrated Defense Systems – Huntington Beach, California

Activity

- The JTRS GMR has an approved Milestone B Test and Evaluation Master Plan with requirements based upon JTRS Operational Requirements Document 3.2.1. The Army is in the process of staffing an updated JTRS GMR Capabilities Production Document.
- The Army delayed the start of the GMR SIT developmental test from May 17 to June 29, 2010, due to problems with late hardware deliveries and immature software. The SIT used Engineering Development Model (EDM) GMRs hosting a selection of terrestrial and satellite JTRS waveforms, including the Wideband Networking Waveform (WNW) v4.0. The SIT was split into two parts:
  - SIT Part 1, June 29 - August 19, 2010, was a customer test using 35 GMR nodes to conduct continued test-fix-test activities of the WNW and to provide an instrumented network for the Director, Defense Research and Engineering to collect data to assess GMR's technology readiness levels.
  - SIT Part 2, September 1 - 14, 2010, was executed as a government developmental test of JTRS GMR and its

Increment 1 waveforms conducted by Army Test and Evaluation Command (ATEC).
- The JTRS GMR program participated in the Vice Chief of Staff of the Army (VCSA) Brigade Combat Team Integration Network exercise in July 2010. This event demonstrated exchange of information among the JTRS GMR, the Warfighter Information Network – Tactical, and the JTRS Handheld, Manpack, and Small Form Fit radios.
- ATEC assessed 15 JTRS GMRs, each serving as a component of a NIK, during the E-IBCT Increment 1 LUT 10 in September 2010. The JTRS GMR within the NIK employs the following waveforms:
  - Frequency hopping, secure Single Channel Ground and Airborne Radio System (SINCGARS)
  - Soldier Radio Waveform (SRW) v1.0c
  - WNW v4.0

Assessment
- The FY10 JTRS GMR schedule delays were due to late hardware deliveries and a technically immature operating environment and waveform software.
- In 2009, the JTRS GMR supported the 30-Node Wideband Networking Waveform (WNW) Field Test and the E-IBCT LUT 09 (as a component of the NIK) with pre-EDM GMRs and an earlier version of the WNW. These GMRs operating with the WNW had difficulty establishing a stable network, poor throughput, unsatisfactory message completion rates, and poor operational reliability.
- The September 2010 JTRS GMR SIT initial results indicate that the JTRS GMR and WNW performed better within portions of the network (subnets), but when tested across 29 GMR WNW nodes, the radio continued to demonstrate deficiencies noted in 2009, including:
  - Difficulty establishing the network
  - Low data throughput as data is transmitted throughout the network
  - Low message completion rates that decrease as communications traffic travels across the larger network
  - Low message completion rates that decrease as GMR nodes physically moved within the test range
- The September 2010 E-IBCT LUT 10 demonstrated the NIK (with JTRS GMR as a component) as capable of transmitting BSOs and images from E-IBCT sensors to others NIKs within the brigade NIK/GMR network. The JTRS GMR's performance (as a component of the NIK) highlighted the following deficiencies:
  - Undependable SINCGARS frequency-hopping secure waveform (used for voice command and control)
  - Limited transmission range of 7-10 kilometers which required the use of two NIK/GMR relay nodes
  - Difficulty connecting to E-IBCT sensors using the SRW
  - GMR and waveform difficulties which contributed to the poor reliability of the NIK
- Due to deficiencies in JTRS GMR performance revealed during the SIT, the Army delayed the planned December 2010 LUT (in support of the program's Milestone C) until June 2011 to allow time for reliability and performance improvements.
- The JTRS GMR program faces potential restructure under Nunn McCurdy that may impact the program's schedule and supporting test events.

Recommendations
- Status of Previous Recommendations. The program addressed two of the four FY09 recommendations. The previous recommendations regarding the correction of deficiencies noted in the 30-Node WNW Field Test and the E-IBCT LUT 09, as well as the synchronization of activities to create an integrated approach between JTRS GMR, JTRS Network Enterprise Domain, and the E-IBCT programs remain valid.
- FY10 Recommendation.
  1. The JTRS GMR program should execute an independent government developmental test to verify correction of all reliability and performance deficiencies revealed during previous testing.

Joint Tactical Radio System (JTRS) Handheld, Manpack, and Small Form Fit (HMS)

Executive Summary

- In April 2009, the Army completed the Rifleman Radio Limited User Test (LUT). DOT&E assessed the Rifleman Radio's LUT performance as supportive of mission preparation, movement, and reconnaissance, but the radio did not demonstrate usefulness during squad combat engagements and exhibited deficiencies in operational reliability, transmission range, battery life, and concept of operations.
- The Joint Tactical Radio System (JTRS) Handheld, Manpack, and Small Form Fit (HMS) Overarching Integrated Product Team (OIPT) postponed the program's Milestone C to allow the program time to resolve program shortfalls and prepare a strategy to address poor reliability and performance problems demonstrated during the Rifleman Radio LUT.
- The Army tasked the JTRS HMS program to participate in the Vice Chief of Staff of the Army (VCSA) July 2010 Brigade Combat Team Integrated Network exercise and delayed the JTRS HMS Rifleman Radio Verification of Correction of Deficiencies (VCD) test planned for May 2010 until January 2011. The 2009 Rifleman Radio LUT and 2011 VCD test will support a Milestone C decision.

System

- JTRS is a family of software-programmable and hardware-configurable digital radios intended to provide increased interoperability, flexibility, and adaptability to support numerous tactical communications requirements.
- The JTRS HMS program provides Handheld and two-channel Manpack Radios supporting Army, Marine Corps, Navy, and Air Force operations. The program develops Small Form Fit (SFF) radio configurations that include the stand-alone Army Rifleman Radio and embedded SFF variants that serve in Army host platforms such as the Early Infantry Brigade Combat Team (E-IBCT) Unattended Ground Sensors (UGS) and Unmanned Aircraft System (Class 1), and Nett Warrior.
- The program strategy has two phases of HMS production. Phase 1 is Rifleman Radios with National Security Agency (NSA) Type 2 encryption of unclassified information. Phase 2 is Manpack Radios with NSA Type 1 encryption of classified information.

Mission

Commanders from the Army, Marine Corps, Navy, and Air Force intend to:

- Use JTRS Handheld, Manpack, and Rifleman Radios to communicate and create networks to exchange voice, video, and data using legacy waveforms or the Soldier Radio Waveform during all aspects of military operations.
- Integrate JTRS SFF variants into host platforms to provide networked communications capabilities for users engaged in land combat operations to support voice, video, and data across the air, land, and sea battlespace.

Major Contractor

General Dynamics, C4 Systems – Scottsdale, Arizona

Activity

- In April 2009, the Army conducted the Rifleman Radio LUT at Fort Bliss, Texas, to support the program's Milestone C decision scheduled for November 2009. The LUT assessed the operational effectiveness, suitability, and survivability of the Rifleman Radio under numerous mission scenarios executed by an infantry platoon within the Army Evaluation Task Force.

- On October 20, 2009, the JTRS HMS OIPT postponed the program's Milestone C. The OIPT took this action to allow the program time to resolve unit cost issues and a commercial GPS waiver, and to prepare a strategy to correct reliability and performance deficiencies highlighted during the Rifleman Radio LUT.
- The JTRS HMS program scheduled a Rifleman Radio VCD test for May 2010 at the Maneuver Battle Lab, Fort Benning, Georgia. The Army postponed the VCD test to January 2011 when the program was tasked to support the VCSA Brigade Combat Team Integrated Network exercise in July 2010.
- The JTRS HMS program provided SFF A radios to the Brigade Combat Team Modernization program to support the 4QFY10 E-IBCT LUT 10. These radios functioned as components of the E-IBCT UGS.
- The Army Training and Doctrine Command refined two Rifleman Radio requirements as a result of the JTRS HMS OIPT.
  - The Rifleman Radio range requirement changed from a point-to-point range of 2 kilometers to uninterrupted communication for an infantry squad dispersed in a circle of 2 kilometers diameter for urban terrain and 1 kilometer for dense vegetation.
  - Battery life was reduced from 24 hours to eight hours due to technology limitations.
- The JTRS HMS program initiated a complete redesign of the Rifleman Radio hardware to address the deficiencies identified during the April 2009 LUT. The Production-Representative Radio (PRR) version of the Rifleman Radio incorporates design improvements in size, weight, and battery life, as well as increased radio frequency power out. PRR Rifleman Radios participated in the July 2010 VCSA Brigade Combat Team Integrated Network exercise. The JTRS HMS program intends to use PRR Rifleman Radios exclusively in the January 2011 VCD test that supports the Army's planned July 2011 Rifleman Radio Milestone C.
- The JTRS HMS program office has an aggressive schedule for conducting the Manpack Radio LUT in 3QFY11 and the Rifleman Radio IOT&E in 1QFY12.
- The Army is developing a JTRS HMS Manpack Radio Acquisition Strategy Report, Capabilities Production Document, and Test and Evaluation Master Plan (TEMP).

Assessment

- DOT&E assessed the performance of the Rifleman Radio as useful during mission preparation, movement, and reconnaissance activities. During combat engagements, the radio demonstrated poor performance and the squad had difficulty with employment of the radio.
- During the 2009 Rifleman Radio LUT:
  - Operational reliability was less than one-half of the radio's Milestone C requirement of 840 hours
  - Transmission range fell short of the radio's requirement of 2,000 meters, demonstrating connectivity to 1,000 meters
  - Batteries had a short lifespan and generated excessive heat
  - Concept of operations for employing the radio proved vague and at times hindered operations
- The JTRS HMS program did not assess the development of Position Location Information, Information Assurance, Electronic Warfare, and Nuclear, Biological, and Chemical operations during the Rifleman Radio LUT. These areas will be assessed in future developmental testing and the Rifleman Radio IOT&E.
- The JTRS HMS program continues preparation for its rescheduled January 2011 Rifleman Radio VCD test.
- The JTRS HMS Manpack does not have an approved Capabilities Production Document or TEMP.

Recommendations

- Status of Previous Recommendations. The JTRS HMS program is addressing all previous recommendations.
- FY10 Recommendations. The JTRS HMS program should:
  1. Develop a strategy to address poor reliability, poor performance, and the immature intra-platoon concept of operations demonstrated during the Rifleman Radio LUT. These improvements are critical for success during the scheduled 1QFY12 IOT&E.
  2. Complete necessary Manpack radio documentation to support future operational test.
  3. Assure that adequate developmental testing is performed prior to future operational tests.

Joint Warning and Reporting Network (JWARN)

Executive Summary

- Joint Warning and Reporting Network (JWARN) Joint Mission Application Software (JMAS) is operationally effective as an automated tool to increase situational awareness regarding potential chemical, biological, radiological, and nuclear (CBRN) attacks and support force protection decisions.
- JMAS is operationally suitable when hosted on Global Command and Control System (GCCS)-Army, GCCS-Joint, and Command and Control Personal Computer (C2PC)/Joint Tactical Common Workstation (JTCW) command and control systems.

System

- JMAS provides a single CBRN warning, reporting, and analysis tool for battalion/squadron-level units and above to support joint operations.
- The program office designed JMAS to improve the speed and accuracy of the NATO CBRN basic warning and reporting process through automation.

Mission

JMAS operators in command cells support CBRN battlefield management and operational planning by predicting chemical, biological, and nuclear hazard areas based on sensor and observer reports, identifying affected units and operating areas, and transmitting warning reports.

Major Contractor

Northrop Grumman Mission Systems – Winter Park, Florida

Activity

- The Service Operational Test Agencies (OTAs) conducted a post-operational test demonstration in October 2009 and a reliability assessment conference in 2010 to assess the effect of software changes on system reliability.
- DOT&E provided an Operational Evaluation of the JWARN JMAS to support the JMAS Full Deployment Decision on GCCS-Army, GCCS-Joint, and C2PC/JTCW command and control systems.

Assessment

- A unit equipped with JMAS is able to provide CBRN warning reports in time to institute force protection actions before encountering CBRN hazards for units operating 10 or more kilometers from area in which the CBRN hazard is initially identified.
- JMAS is not effective for warning at the company level due to its limited capability for warning units operating between 2.5 and 10 kilometers from the hazard release, depending upon meteorological conditions and distance.
- JWARN is interoperable with GCCS-Joint, GCCS-Army, and C2PC/JTCW command and control systems.
- Engineering changes resolved JMAS software reliability shortfalls identified during the FY08 Multi-Service OT&E.

Recommendations

- Status of Previous Recommendations: The program manager addressed all of the previous recommendations.
- FY10 Recommendations. None.

Mine Resistant Ambush Protected (MRAP) Family of Vehicles

FPI Cougar Category I

FPI Cougar Category II

Navistar Dash Category I

BAE RG-33L Category II

GDLS RG-31A2 Category I

BAE TVS Caiman Category I

NAVISTAR Ambulance Cat. I

BAE Ambulance Category II

Executive Summary

- DOT&E transmitted its Assessment of the Mine Resistant Ambush Protected (MRAP) Family of Vehicles to Congress and the Secretary of Defense in March 2010.
- In FY10, the MRAP program continued a capabilities insertion program in FY10 to acquire, test, and assess enhanced capabilities and solutions to be integrated across the MRAP Family of Vehicles. The capability insertions are undergoing developmental, live fire, and operational testing to assess their contribution to MRAP operational effectiveness.
- The Army Test and Evaluation Command (ATEC) completed the operational testing of the Force Protection Industries, Inc. (FPI) Cougar Independent Suspension System (ISS) and Navistar Dash MRAP variants in December 2009 at Yuma Proving Ground, Arizona.
- DOT&E assessed the FPI Cougar Category I (CAT I) and Category II (CAT II) as possessing the off-road mobility needed to transport units over Afghanistan terrain. The FPI Cougars are operationally suitable.
- The Navistar Dash, as tested, is not operationally effective for use in Operation Enduring Freedom. These vehicles could not negotiate cross-country terrain. The program plans to incorporate an ISS to improve off-road mobility. The vehicles were not operationally suitable due to poor reliability.

System

- MRAP vehicles are a family of vehicles designed to provide increased crew protection and vehicle survivability against current battlefield threats, such as IEDs, mines, and small arms. DoD initiated the MRAP program in response to an urgent operational need to meet multi-Service ground vehicle requirements. MRAP vehicles provide improved vehicle and crew survivability over the High Mobility Multi-purpose Wheeled Vehicle (HMMWV) and are employed by units in current combat operations in the execution of missions previously executed with the HMMWV.
- This report covers two categories of MRAP vehicles and the MRAP-Ambulance variant. The MRAP CAT I vehicle is designed to transport six persons and the MRAP CAT II vehicle is designed to transport 10 persons. The MRAP Ambulance variant vehicle is designed to transport up to three litter casualties and from three to six ambulatory casualties. MRAP vehicles incorporate current Service command and control systems and counter-IED systems. MRAP vehicles contain gun mounts with gunner protection kits capable of mounting a variety of weapons systems such as the M240B medium machine gun, the M2 .50 caliber heavy machine gun, and the Mk 19 grenade launcher. The program has developmental efforts underway to integrate improved protection against Rocket Propelled Grenades (RPGs) on existing MRAP vehicles.
- Five vendors have been awarded ongoing production contracts for MRAP CAT I and CAT II vehicles: FPI, General Dynamics Land Systems Canada (GDLS-C), NAVISTAR Defense, BAE-Tactical Vehicle Systems (BAE-TVS), and BAE Systems (BAE). Six CAT I and CAT II variants have been purchased:
  - FPI Cougar CAT I
  - FPI Cougar CAT II
  - NAVISTAR Defense MaxxPro CAT I vehicle and Ambulance variant

- BAE RG-33L CAT II and Ambulance variant
- GDLS-C RG-31A2 CAT I
- BAE TVS Caiman CAT I

- Units equipped with the MRAP CAT I vehicles will conduct small unit combat operations such as mounted patrols and reconnaissance. Many of these operations are conducted in urban areas. Units equipped with MRAP CAT II vehicles conduct ground logistics operations including convoy security, troop and cargo transportation, and medical evacuation. The MRAP Ambulance variant supports the conduct of medical treatment and evacuation.
- MRAP vehicles support multi-Service missions and are fielded to units based upon priorities established by the operational commander.

Major Contractors

- Force Protection Industries (FPI), Inc. – Ladson, South Carolina
- General Dynamics Land Systems Canada – Ontario, Canada
- NAVISTAR Defense – Warrenville, Illinois
- BAE-TVS – Rockville, Maryland
- BAE Systems – Santa Clara, California

Activity

- In FY10, the MRAP program continued a capabilities insertion program to acquire, test, and assess enhanced capabilities and solutions to be integrated across the MRAP Family of Vehicles. The major capability insertions are the following: ISS; Command, Control, and Communication Suite; Common Remote Weapon Station; and Gunner Protective Kit Overhead Protective Cover.
- The Joint Program Office is managing the capability insertion program through Engineering Change Proposals. The capability insertions are undergoing developmental, live fire, and operational testing to assess their contribution to MRAP operational effectiveness.
- ATEC completed the operational testing of the FPI Cougar ISS and Navistar Dash MRAP variants in December 2009 at Yuma Proving Ground, Arizona.
- In March 2011, the program will execute a Limited User Test (LUT) at Yuma Proving Ground, Arizona, to examine a unit's ability to execute missions with the MRAP Family of Vehicles modified with an ISS and the operational effectiveness of the FPI Cougar CAT II ambulance variant.
- Following publication of the DOT&E MRAP report in March 2010, the Secretary of Defense directed additional live fire testing on two of the MRAP variants. ATEC completed these tests in accordance with a DOT&E-approved test plan.
- ATEC completed Live Fire testing of the FPI Cougar A1 and A2 ISS upgrades in 3QFY10. DOT&E plans to issue a single vulnerability report on these vehicles in early FY11.

Assessment

- The FPI Cougar CAT I and CAT II demonstrated the off-road mobility needed to transport units over Afghanistan-like terrain during the MRAP All Terrain Vehicle IOT&E.
- The FPI Cougars with ISS enable units to be less predictable in their movement, continue operations under armor protection, and conduct a greater variety of mounted maneuver to approach and secure an objective than possible with current MRAPs.
- The FPI Cougars are operationally suitable.
- The Navistar Dash, as tested, is not operationally effective for use in Operation Enduring Freedom. These vehicles could not negotiate cross-country terrain. The program plans to incorporate an ISS to improve off-road mobility. The MRAP program intends to complete operational testing of an ISS-equipped Dash in FY11. The vehicles were not operationally suitable due to poor reliability. The Navistar Dash demonstrated 121 Mean Miles between Operational Mission Failure (MMBOMF) versus its operational requirement of 600 MMBOMF.

Recommendations

- Status of Previous Recommendations. The MRAP program continues to address all previous recommendations.
- FY10 Recommendation.
  1. The program should improve the Navistar Dash reliability and off-road mobility capability by integrating an ISS and completing operational testing of an ISS-equipped Dash.

Mine Resistant Ambush Protected (MRAP) All Terrain Vehicle (M-ATV)

Base MATV

Special Operations Forces MATV

Executive Summary

- The Army Test and Evaluation Command (ATEC) completed the IOT&E for the Mine Resistant Ambush Protected (MRAP) All Terrain Vehicle (M-ATV) at Yuma Proving Ground, Arizona, in December 2009.
- ATEC completed the majority of the Live Fire testing documented in the M-ATV Operational Test Agency Test Plan by March 2010.
- DOT&E provided the M-ATV Live Fire and Operational Test and Evaluation Report to Congress and the Secretary of Defense in June 2010. DOT&E assessed the M-ATV as operationally effective, operationally suitable, and survivable for armored tactical mobility and transport to units in support of Operation Enduring Freedom missions.
- The Special Operations Force (SOF) M-ATV variant IOT&E is planned for November 2010.

System

- The M-ATV is the smallest vehicle of the MRAP family of vehicles. The M-ATV is designed to have the current MRAP level of protection and mobility similar to the High Mobility Multi-purpose Wheeled Vehicle (HMMWV). The vehicle will support combat and stability operations in highly restricted rural, mountainous, and urban terrain with off-road movement conducted greater than 50 percent of the time.
- The M-ATV is designed to improve vehicle and crew survivability over the up-armored HMMWV. The M-ATV has the capability to add protection against attacks by Explosively Formed Penetrators (EFPs) and Rocket-Propelled Grenades (RPGs) to support mounted patrols, reconnaissance, security, and convoy protection.
- The M-ATV is designed to transport five persons and incorporates current Service command and control and counter-IED systems. The M-ATV includes gun mounts with gunner protection kits capable of mounting a variety of weapons systems such as the M240B medium machine gun, the M2 .50 caliber heavy machine gun, and the Mk 19 grenade launcher.
- Oshkosh Defense has been awarded a production delivery order for 10,000 M-ATV vehicles.
- The U.S. Special Operations Command (USSOCOM) required modifications to the base M-ATV vehicle to support SOF missions. These vehicles are referred to as the SOF M-ATV variants. The modifications included an additional fifth seat position, protection for the cargo area, rear area access, and some other improvements for human factors.

Mission

- Units equipped with the M-ATV vehicle conduct mounted patrols, convoy patrols, convoy protection, reconnaissance, and communications, as well as command and control missions to support combat and stability operations in highly restricted rural, mountainous, and urban terrain. The M-ATV is reconfigurable to meet mission requirements.
- M-ATV vehicles support multi-Service missions and are fielded to units based upon priorities established by the operational commander.

Major Contractor

Oshkosh Defense – Oshkosh, Wisconsin

Activity

- ATEC completed the IOT&E for the M-ATV at Yuma Proving Ground, Arizona, in December 2009.
- In March 2010, the Marine Corps Operational Test and Evaluation Activity completed M-ATV high-altitude testing at Camp Navajo, Arizona.
- The MRAP program has procured 421 SOF M-ATV variants for Special Operations Command.
- Live Fire testing of the SOF M-ATV variant commenced in 3QFY10.
- USSOCOM began the SOF M-ATV variant IOT&E in November 2010 at Yuma Proving Ground, Arizona.

Assessment

- The M-ATV is operationally effective, operationally suitable, and survivable for armored tactical mobility and transport to units in support of Operation Enduring Freedom missions.
- The M-ATV successfully demonstrated off-road mobility comparable to the up-armored HMMWV with Fragmentation Kit 5 in operational testing.
- The off-road mobility and maneuver capability of the M-ATV enables units to be less predictable in their movement, continue operations under armor protection, and conduct a greater variety of mounted maneuvers than possible with current MRAPs.
- The M-ATV has very limited room for the crew to egress the vehicle due to the location of mission command, control, and communication equipment on the center console.
- Based on results of the M-ATV high-altitude testing, vehicle mobility in soft soils can be a risk on unimproved trails and roads through mountainous terrain, especially when operating at the edge of the road, or should the trails give way. As a result, M-ATVs can roll over under these conditions.
- The SOF M-ATV variant Endurance Testing is ongoing at Yuma Proving Grounds, Arizona. The M-ATV has accumulated 586 operational miles of the planned 3,000 miles.
- Results from the SOF M-ATV variant automotive testing indicate the vehicle has comparable performance to the Baseline M-ATV.

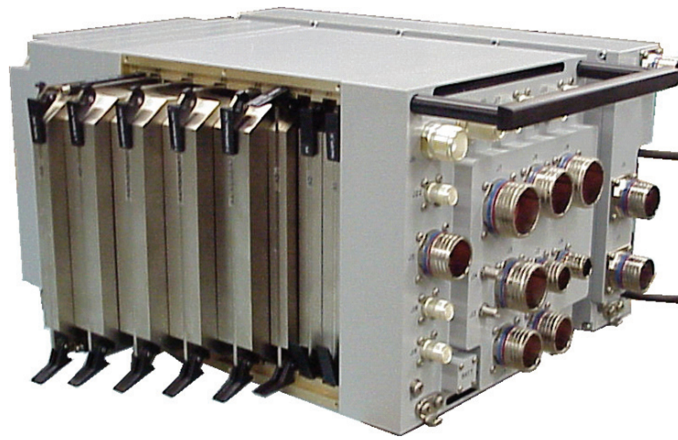
Recommendations

- Status of Previous Recommendations. The MRAP program continues to address all previous recommendations.
- FY10 Recommendations. None.

Multi-Functional Information Distribution System (MIDS)
(includes Low Volume Terminal (LVT) and Joint Tactical Radio System (JTRS))

Executive Summary

- The Multifunctional Information Distribution System – Joint Tactical Radio System (MIDS-JTRS) core terminal completed development and entered into IOT&E of the MIDS-JTRS integrated into the F/A-18E/F aircraft during July 2010. IOT&E is scheduled to complete in November 2010.
- Open issues at the transition from developmental test to independent operational test included Tactical Air Navigation (TACAN) range accuracy and excessive Built-In Test (BIT) False Alarms. Commander Operational Test Force (COTF) will examine these issues more closely, as well as the approved Critical Operational Issues, during the operational test.
- During the MIDS-JTRS IOT&E, the program successfully completed a multi-channel demonstration in which MIDS-JTRS simultaneously exercised Link 16, TACAN, and Single Channel Ground and Airborne Radio System (SINCGARS) functionalities.
- Not all MIDS-JTRS core terminal capabilities, such as Link 16 enhanced data throughput and instantiation of JTRS Software Communications Architecture waveforms, will be operationally tested due to limited current F/A-18E/F aircraft requirements and funding availability.



System

- Multifunctional Information Distribution System – Low Volume Terminal (MIDS-LVT) is a communications and navigation terminal in full-rate production. When integrated into a host platform, MIDS-LVT provides Link 16 digital data link, Link 16 digital voice communications, and TACAN capabilities. Since production started, the MIDS-LVT has evolved with hardware, firmware, and software updates to resolve performance and stability deficiencies and to provide new Link 16 capabilities.
- MIDS-JTRS is a pre-planned product improvement of the MIDS-LVT system. When integrated into a host platform, MIDS-JTRS provides MIDS-LVT capabilities, plus three additional programmable channels capable of hosting JTRS Software Communications Architecture-compliant waveforms in the 2 to 2,000 megahertz radio frequency bandwidth. In addition, MIDS-JTRS will provide the capability for enhanced throughput and Link 16 frequency re-mapping.
- The system under test includes the MIDS terminals and the host platform interfaces such as controls, displays, antennas, high power amplifiers, and any radio frequency notch filters.
- TACAN has an air-to-air mode and an air-to-ground mode and is a primary means of air navigation by military aircraft. Link 16 data link is a joint and allied secure anti-jam high speed data link that uses standard messages to exchange information among flight or battle-group host platforms or between combat platforms and command and control systems. Link 16 digital voice provides host platforms a secure anti-jam voice line-of-sight communications capability.

Mission

- U.S. Services and many allied nations will deploy MIDS-LVT and MIDS-JTRS-equipped aircraft, ships, and ground units in order to provide military commanders with the ability to communicate with their forces by voice, video, and data during all aspects of military operations. MIDS-JTRS networking capability and multiple waveforms (including new waveforms such as the Joint Airborne Networking – Tactical Edge (JAN-TE)) are intended to allow collaboration despite geographical and organizational boundaries.
- MIDS-JTRS-equipped units should be able to exchange information including air and surface tracks, identification, host platform fuel, weapons, mission status, engagement orders, and engagement results.

Major Contractors

- United States:
  - ViaSat – Carlsbad, California
  - Data Link Solutions – Wayne, New Jersey, and Cedar Rapids, Iowa
- Europe:
  - EuroMIDS – Paris, France

Activity

MIDS-LVT (B-1B Integration)

- Detachment 5, Air Force Operational Test and Evaluation Center (AFOTEC) conducted an Operational Assessment of the integration of the MIDS-LVT into the B-1B Bomber aircraft at Edwards AFB, California, from February to June 2010. The Common Link Information Processor (CLIP) facilitated the integration of MIDS-LVT into the B-1B aircraft. The Operational Assessment included three operational test flight sorties by the B-1B aircraft.

MIDS-JTRS

- The Naval Air Warfare Center completed the ground and flight Developmental Test and Evaluation of the MIDS-JTRS as integrated on the F/A-18E/F operating from the Naval Air Station (NAS) Patuxent River, Maryland, and NAS China Lake, California.
- The Naval Air Warfare Center, with participation by the Air Test and Evaluation Squadron Nine, conducted integrated aircraft carrier suitability flight testing of the F/A-18E/F with the integrated MIDS-JTRS core terminal.
- COTF started the F/A-18E/F MIDS-JTRS IOT&E in July 2010 at NAS China Lake, California, and participated in a large joint force training exercise conducted at Nellis AFB, Nevada to collect Link 16 interoperability test data.
- All testing was conducted in accordance with a DOT&E-approved Test and Evaluation Master Plan (TEMP) and operational test plans.

Assessment

MIDS-LVT (B-1B Integration)

- Results from the B-1B MIDS-LVT and CLIP integration Operational Assessment indicate that the transfer of MIDS-LVT Link 16 data via CLIP to the B-1B host computer was problematic. Specifically, inaccurate information transferred for some of the Link 16 message types, and CLIP could not completely and accurately process information from near simultaneous beyond-line-of-sight and line-of-sight transmissions of Link 16 messages. CLIP software was not yet mature, as indicated by the quantity of unresolved software discrepancies and a constant (not yet decreasing) rate of discovery of software discrepancies.

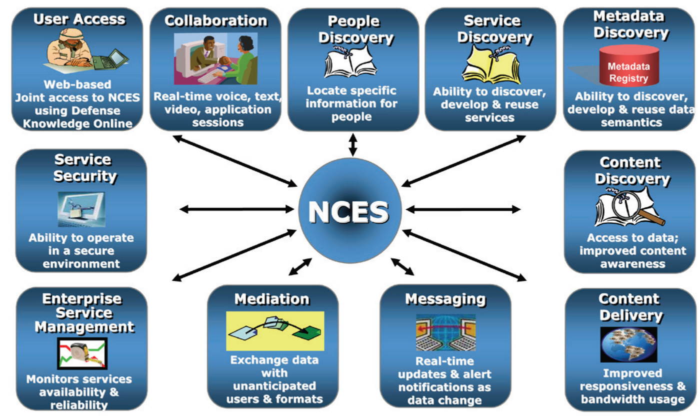
MIDS-JTRS

- The aircraft carrier suitability integrated test results indicate compatible operation of the F/A-18E/F MIDS-JTRS during approach, take-off, and landing on the aircraft carrier.
- The MIDS-JTRS IOT&E data collection and analysis effort is ongoing. There are emerging concerns related to MIDS-JTRS TACAN air-to-air range errors. There are emerging concerns regarding the ability to achieve the reliability requirement of 220 hours for the MIDS-JTRS terminal, as evidenced by ten MIDS-JTRS terminal (hardware) failures during IOT&E.
- Data show the BIT false alarm rate associated with the integration of the MIDS-JTRS into the F/A-18E/F is excessive, potentially affecting maintainability ratings for the system.
- The operational test squadron, Air Test and Evaluation Squadron Nine, based at NAS China Lake, California, identified aircraft integration discrepancies during the MIDS-JTRS installation and pre-operational flight checks conducted prior to the start of the IOT&E. Aircraft maintenance personnel resolved the issues by conducting significant levels of minor maintenance to correct aircraft electronic systems discrepancies or developing workarounds to permit IOT&E to begin as scheduled.

Recommendations

- The Air Force and Navy made satisfactory progress on the previous recommendations primarily related to the fielded MIDS-LVT.
- FY10 Recommendations.
  1. The Air Force B-1B and CLIP program offices should review the findings from the CLIP (B-1B/MIDS-LVT) integration Developmental Test and Operational Assessment and correct all major deficiencies prior to entry into the B-1B CLIP integration OT&E.
  2. The MIDS-JTRS and F/A-18 program offices should continue to characterize the TACAN discrepancies and develop a solution for test prior to fielding.
  3. The Navy should modify the MIDS-JTRS F/A-18 installation checklist for fielding to ensure appropriate maintenance personnel adequately prepare all antenna and cabling connections for installation of the terminal.
  4. The MIDS program office should focus industry efforts on achieving improved terminal manufacturing processes in order to elevate the overall reliability of the MIDS-JTRS system.
  5. The Navy, MIDS program office and industry should develop a solution to the excessive BIT false alarm rate for the MIDS-JTRS system as integrated into the F/A-18 E/F.

Network Centric Enterprise Services (NCES)



Executive Summary

- The Operational Test Team conducted a series of FOT&E II events on a subset of Increment 1 Net-Centric Enterprise Services (NCES) from November 2009 through July 2010. The FOT&E II was conducted in accordance with the DOT&E-approved test plan. However, testing of some services (Enterprise Service Management (ESM) and Machine-to-Machine Messaging) relied heavily on pilot programs and demonstrations providing less confidence in the results.
- The Milestone Decision Authority authorized full deployment for Service Discovery on February 12, 2010, and made a fielding decision for Enterprise File Delivery, Enterprise Search, ESM, Machine-to-Machine Messaging, and People Discovery on September 20, 2010.
- Penetration testing during the FOT&E revealed Information Assurance (IA) shortfalls at the Defense Enterprise Computing Centers (DECCs) housing NCES capabilities. The Defense Information Systems Agency (DISA) addressed these shortfalls and conducted a Verification of Corrections assessment from May to June 2010. Further incident response recommendations for the DECCs are being incorporated in plans, processes, and procedures to be released in late FY10.
- Machine-to-Machine Messaging is rated as operationally effective and operationally suitable with limitations. With the suspension of key pilot programs and demonstrations, no new programs have committed to use Machine-to-Machine Messaging. Users report a preference for another DISA service, the Joint User Messaging Service.
- DOT&E is unable to determine the operational effectiveness of Service Discovery and ESM based on FOT&Es I and II.
  - Service Discovery requires additional testing incorporating an expanded data base of registered services and a larger user base. The DoD Chief Information Officer (CIO) memorandum "Net-Centric Enterprise Services (NCES) Service Discovery Governance" (August 3, 2010) outlines a plan of action to improve the governance process and encourage the use of Service Discovery.
  - ESM testing also had a limited set of users who only used a portion of the capabilities provided. More guidance from DoD CIO and Under Secretary of Defense for Acquisition, Technology, and Logistics (USD (AT&L)) to the DoD Services, Agencies, and Commands is needed to help software service integrators select and configure appropriate ESM capabilities.

System

- NCES is a suite of individual capabilities that support automated information exchange across the DoD on both classified and unclassified networks. These capabilities include collaboration, discovery, and mediation and user access through the Defense Knowledge Online portal. Each service is unique and has its own IOT&E and acquisition fielding decision.
- NCES collaboration tools enable users to hold meetings and exchange information by text, audio, and video.
- The discovery capabilities (content, people, services, metadata, publish/subscribe) allow data producers to post information, alert others to the presence of new information, and evaluate the relevance of the data to their current roles and activities.
- NCES includes security and management capabilities that integrate with and rely upon:
  - ESM capabilities providing data on performance, operational status, and usage of web services that enhance network situational awareness to the Global Infrastructure Services Management Center
  - IA/computer network defense
- The software for all the NCES services is comprised of commercial off-the-shelf and government off-the-shelf products. The concept is to provide commercially available products managed under a contract that specifies maintenance, support, and performance levels for each Service, commonly known as Service-Level Agreements (SLAs).
- The warfighting, intelligence, and business communities (i.e., finance, medical, and logistics) will access NCES capabilities either directly or through a portal that controls access by the use of Public Key Infrastructure profiles.
- NCES services are available to all operational and tactical users who connect to a Defense Information System Network point-of-presence.
- NCES is a collection of services from which users can select those that best fit their needs. Users can be system or software developers, system or network administrators, communities of interest, programs of record, or personnel executing warfighting, business, and intelligence missions.

Mission

Joint Force Commanders will use selected NCES services to enable shared understanding, interface with other decision-makers, orient forces, assess the situation, and/or synchronize operations.

Major Contractor

Government Integrator – DISA

Activity

- The Joint Interoperability Test Command (JITC) led a multi-Service operational test team that conducted a series of FOT&E II events on a subset of NCES Increment 1 services from November 2009 through July 2010. The FOT&E II was conducted in accordance with the DOT&E-approved Test and Evaluation Master Plan and operational test plan. However, testing of some services (ESM and Machine-to-Machine Messaging) relied heavily on pilot programs and demonstrations providing less confidence in the results. Services tested include the following:
  - Enterprise File Delivery
  - Enterprise Search
  - ESM
  - Machine-to-Machine Messaging
  - People Discovery
  - Service Discovery
- The Milestone Decision Authority authorized full deployment for Service Discovery on February 12, 2010, and made a fielding decision for Enterprise File Delivery, Enterprise Search, ESM, Machine-to-Machine Messaging, and People Discovery on September 20, 2010.
- The test team conducted an IA assessment for a subset of the NCES services hosted at the DECCs. These assessments included IA documentation reviews, interviews with program office and hosting site personnel, penetration testing, and special events to assess restoration, failover, and incident response.
- The test team plans to conduct a continuous evaluation of the ESM service to assess how it performs as the number of users increase.

Assessment

- The FOT&E II events were adequate to assess the operational effectiveness and suitability of a subset of NCES. Immature procedures and processes and the absence of sufficient numbers of end users limited the ability of DOT&E to assess ESM and Service Discovery as operationally effective. During the FOT&E II events, testers encountered significant limitations. An extremely limited user base for many services precluded an assessment of scalability to the levels envisioned in the Capabilities Production Document for the DoD enterprise. In addition, inconsistent quality of data provided by the various Managed Service Providers precluded an assessment of suitability.
- The following is a synopsis of the results for each service evaluated during the FOT&E events:
  - The Enterprise File Delivery Service successfully synchronizes content to multiple consumers on the unclassified network and is operationally effective. It is considered operationally suitable with limitations. The SLA and documentation need improvement.
  - Enterprise Search is assessed as operationally effective with limitations. Improvements were made in timeliness, relevance of results, methods for exposing information, and the number of content sources since the IOT&E in 2008. However, users did not find that the NCES Enterprise Search provided advantages over existing search tools. Enterprise Search is also assessed as operationally suitable with limitations. User documentation and support to content owners need improvement.
  - DOT&E was unable to determine the operational effectiveness of ESM due to the low level of use (only one of three monitoring agents was used during the test) and because a majority of services being monitored were not being used in an operational context. Users report ESM provides a needed capability to optimize software performance and provide them situational awareness for distributed software services. More guidance from DoD CIO and USD (AT&L) is needed to enable software service integrators to select and configure appropriate ESM capabilities. Also, further testing should be conducted in which ESM provides situational awareness and management of operational services. ESM is considered to be operationally suitable due to its ease of use and good help desk support.
  - Machine-to-Machine Messaging is rated as operationally effective and operationally suitable with limitations. Users reported the service performs the required functions, but the users had problems troubleshooting faults, configuring security devices, and monitoring service health and status, and were not notified of upgrades or outages. With the suspension of key pilot programs and demonstrations, no new programs have committed to use Machine-to-Machine Messaging. Users report a preference for another DISA service, the Joint User Messaging Service. Since the DOT&E report, Machine-to-Machine Messaging has been integrated with a new Program of Record and the Program Office is currently working with several potential users.

- Upgrades to People Discovery demonstrated marked improvement and it is now considered operationally effective with limitations and operationally suitable. There is improved consistency of results and access to more authoritative personnel sources. The service meets availability and performance requirements and is easy to use. Users would like to see more contact information listed for each person, especially for People Discovery search results on the classified network. There is a need for the various authoritative personnel databases to maintain a consistent amount and type of personnel information/attributes on individuals to ensure accurate People Discovery search results (e.g. phone numbers, e-mail addresses, work organization).
- An upgrade to Service Discovery resolved findings from the FOT&E I, including user interface and documentation shortcomings. The DoD CIO signed a memorandum (NCES Service Discovery Governance) on August 3, 2010, with a Plan of Action to improve the governance processes and encourage the use of Service Discovery and the reuse of registered services. However, there is still a lack of sufficient governance processes for practical implementation of Service Discovery and Enterprise adoption to assess the mission benefits of service re-use.

• FOT&E II survivability assessments identified significant IA deficiencies at the sites hosting NCES capabilities. As a result of the FOT&E II assessment, DISA made adjustments to hosting sites and security practices. JITC conducted a Verification of Corrections assessment of these IA deficiencies from May to June 2010. Further incident response recommendations are being incorporated in plans, processes, and procedures to be released by DISA in late FY10.

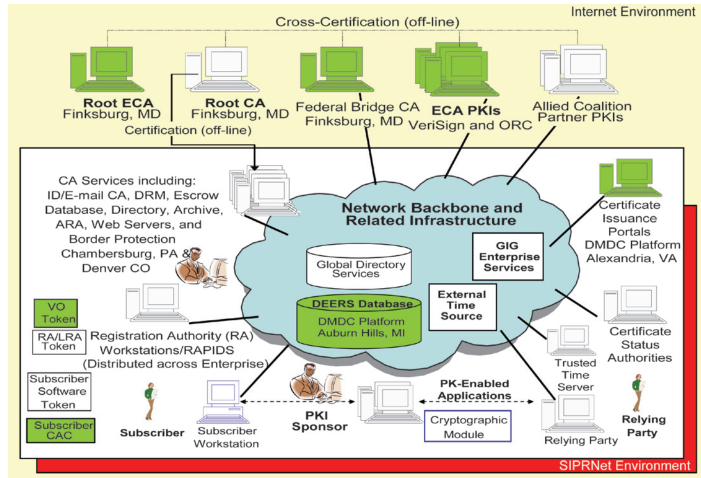
Recommendations

• Status of Previous Recommendations. The DoD CIO, DISA, and JITC satisfactorily addressed two of the three FY09 recommendations. The recommendation concerning periodic independent assessments to evaluate scalability of services to Enterprise levels remains.
• FY10 Recommendation.
    1. DISA and the NCES Program Management Office should conduct assessments evaluating adoption across the DoD and the utility of the Machine-to-Machine Messaging and People Discovery.

Public Key Infrastructure (PKI) Increments 1 and 2

Executive Summary

- DoD Public Key Infrastructure (PKI) Increments 1 and 2 provide authenticated identity management via a password-protected Common Access Card (CAC) and Secure Internet Protocol Routing Network (SIPRNet) token to enable DoD members, coalition partners, and others to access restricted websites, enroll in online services, and encrypt and digitally sign e-mail.
- JITC conducted separate FOT&Es for DoD PKI Increment 1, Spirals 3 and 4 in April 2010 and August 2010, respectively. The capabilities provided in the spirals were operationally effective, suitable, and survivable for deployment. However, Spiral 3 capabilities provided inaccurate reporting of certificate revocations that must be corrected.
- The Operational Assessment for Increment 2, Spiral 1 showed Registration Authorities (RAs) were able to efficiently issue SIPRNet tokens, and end users were able to use those tokens to facilitate missions through digital signing, encryption, and web-server authentication. However, reliability of the tokens was unacceptable when approximately ten percent of those distributed during the Operational Assessment were defective.



NOTE: Elements in Green are not on SIPRNet

ARA - Auto-key Recovery Agent
CA - Certification Authority
CAC - Commom Access Card
DEERS - Defense Enrollment Eligibility Reporting System
DMDC - Defense Manpower Data Center
DRM - Data Recovery Manager
ECA - Enterprise Certification Authority
GIG - Global Information Grid
ID - Identification
LRA - Local Registration Authority
ORC - Operational Research Consultants, Inc.
PK - Public Key
RA - Registration Authority
RAPIDS - Real-Time Automated Personnel Identification System
SIPRNet - SECRET Internet Protocol Router Network
VO - Verifying Official

System

- DoD PKI is a critical enabling technology for Information Assurance (IA). It supports the secure flow of information across the Global Information Grid (GIG) (Non-Secure Internet Protocol Routing Network (NIPRNet) and SIPRNet), as well as secure local storage of information.
- DoD PKI provides for the generation, production, distribution, control, revocation, recovery, and tracking of Public Key certificates and their corresponding private keys. DoD PKI works with commercial off-the-shelf (COTS) and government off-the-shelf (GOTS) applications to provide IA and e-business capabilities.
- Using authoritative data, DoD PKI creates a credential that combines identity information with cryptographic information that is non-forgeable and non-changeable. In this way, DoD PKI provides a representation of physical identity in an electronic form.
- DoD PKI Certification Authorities (CAs) for the NIPRNet and SIPRNet software certifications reside in the Defense Information Systems Agency (DISA) Defense Enterprise Computing Centers (DECC) in Chambersburg, Pennsylvania, and Oklahoma City, Oklahoma. PKI CAs for issuance of the SIPRNet hardware tokens reside in the DECC in Chambersburg, Pennsylvania.
  - DoD PKI is comprised of COTS hardware, COTS software, and other applications software developed by the National Security Agency (NSA).
  - Certificates are imprinted on the DoD CAC token for NIPRNet personnel identification using data taken from the Defense Enrollment Eligibility Reporting System (DEERS). The Secret DEERS provides the personnel data for certificates imprinted on a separate SIPRNet token.
- DISA and NSA are jointly developing DoD PKI in multiple increments. Increment 1 is broken into five spirals, four of which have been operationally tested and deployed on NIPRNet. Increment 2 is being developed and deployed in three spirals on the SIPRNet.

Mission

- DoD PKI enables net-centric operations by allowing military operators, communities of interest, and other authorized users to securely access, process, store, transport, and use information, applications, and networks regardless of technology, organization, or location.
- Commanders at all levels will use DoD PKI to provide authenticated identity management via password-protected CAC or SIPRNet token to enable DoD members, coalition partners, and others to access restricted websites, enroll in online services, and encrypt and digitally sign e-mail. Commanders will use specific PKI services to:
  - Enable and promote a common ubiquitous secure web services environment.
  - Enable the integrity of data/forms/orders moving within the GIG (both NIPRNet and SIPRNet), via use of digital signatures.

- Enable management of identities operating in groups or certain roles within GIG systems.
- Ensure the integrity and confidentiality of what is operating on a network by providing assured PKI-based credentials for any device on that network

Major Contractor

BAE Systems Incorporated – Arlington, Virginia

Activity

Increment 1 Spirals 3 and 4 (FOT&E)

- JITC conducted separate FOT&Es for DoD PKI Increment 1, Spirals 3 and 4 in April 2010 and August 2010, respectively. Integrated developmental and operational testing was accomplished according to DOT&E-approved test plans and procedures in the JITC PKI laboratory at Fort Huachuca, Arizona.
  - Spiral 3 testing evaluated software applications encompassing three new or improved capabilities: Local Registration Agent version 4 (LRA v4), Web Based Bulk Revocation (WBBR) server, and the Certificate History Repository Information Service (CHR-IS).
  - Spiral 4 testing evaluated system upgrades to the Robust Certificate Validation Service (RCVS), which includes migration to a new operating system and architecture enhancements.

Increment 2, Spiral 1 (Operational Assessment)

- For Increment 2, Spiral 1, JITC conducted an Operational Assessment in June and July 2010 in accordance with the DOT&E-approved test plan and procedures. Typical users from a variety of operational environments participated in the test event.
- The PKI Program Management Office (PMO) experimented with varying network conditions in February and September 2010 to better define problems with PKI use in tactical and austere environments.

Assessment

Increment 1, Spirals 3 and 4 (FOT&E)

- The testing conducted by JITC was adequate to assess the operational effectiveness and suitability of the DoD PKI Increment 1, Spirals 3 and 4 enhancements. The capabilities provided in the spirals were operationally effective, suitable, and survivable for deployment.
- Eleven deficiency reports (DRs) were opened during Spiral 3 testing, with no critical items identified. The two highest priority DRs involved certificate revocations. Inaccurate reporting of certificate revocations resulted in the RA concluding all certificates were revoked when that was not the case. These DRs must be resolved prior to deployment, or written guidelines must be given to users warning them of this potential reporting error.
- There are no outstanding issues with the Spiral 4 capabilities.

Increment 2, Spiral 1 (Operational Assessment)

- The testing conducted by JITC was adequate to assess the capabilities and limitations of DoD PKI Increment 2, Spiral 1.
- RAs were able to efficiently issue SIPRNet tokens and end users were able to use those tokens to facilitate missions through digital signing, encryption, and web-server authentication.
- Nearly ten percent of all tokens were found to be defective. Some tokens failed prior to or during the issuance process. A sizable fraction failed after issuance, having an adverse impact on the users. Problems with the software that formats tokens, inaccurate system documentation, and lack of a back-up system which prevents RAs from performing their duties when the system is down for maintenance also adversely affected operational suitability.
- Token problems must be resolved prior to starting the IOT&E.

Recommendations

- Status of Previous Recommendations. The PKI PMO satisfactorily addressed one of two recommendations from the FY08 annual report for Increment 1, Spirals 1 and 2. The recommendation concerning correction of a physical security vulnerability at Letterkenny Army Depot remains.
- FY10 Recommendations.

Increment 1, Spirals 3 and 4

1. The PKI PMO should provide data regarding the expected system load for Increment 1 at full deployment so an adequate capacity assessment can be done by DOT&E to support the full deployment decision following Increment 1, Spiral 5 testing in FY11.

Increment 2, Spiral 1

2. The PKI PMO should correct unresolved Increment 2, Spiral 1 SIPRNet token deficiencies identified during the Operational Assessment and confirm through testing that the fixes are operationally viable before purchasing more tokens in support of the Increment 2, Spiral 1 IOT&E.
3. The PMO should provide a written Continuity of Operations Plan for Increment 2 and ensure the alternate SIPRNet sight is operational; conduct IA testing during the IOT&E in accordance with DOT&E guidance to assess protect, detect, react, and restore capabilities; and develop a Life-Cycle Sustainment Plan.

Suite of Integrated Radio Frequency Countermeasures (SIRFC) AN/ALQ-211

Executive Summary

Army Special Operations Command

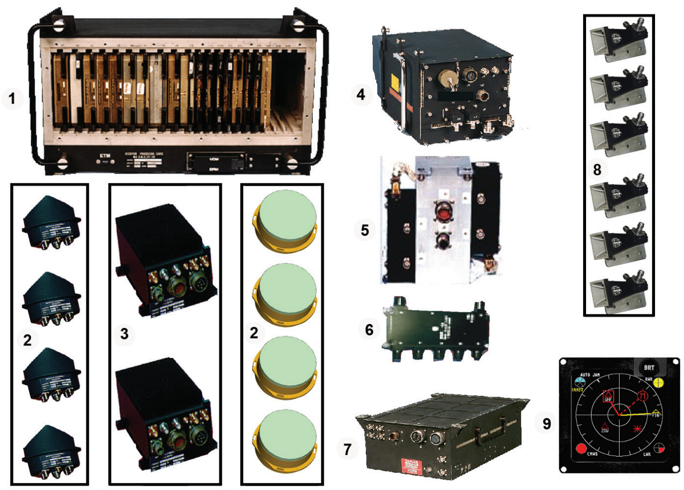
- After a lengthy engineering investigation, the Suite of Integrated Radio Frequency Countermeasures (SIRFC) Program Office directed a complete redesign of the radio frequency (RF) switch that was the primary source of poor system reliability. The Army was scheduled to receive the newly designed switch in late 2010 and should complete additional qualification testing in early 2011.
- Because of continued delays in resolving the RF switch reliability problem, DOT&E published the SIRFC IOT&E report to Congress in October 2010. In previous reporting, DOT&E stated that SIRFC was operationally effective based on preliminary analysis of operational test results. However, upon completion of a comprehensive analysis of all test data in context with SIRFC's ability to support operational mission accomplishment, DOT&E determined that the initial effectiveness assessment was incorrect. The final assessment (characterized below) and supporting analysis is included in the October 2010 IOT&E report.
- DOT&E assessed that SIRFC was not operationally effective and remains not operationally suitable. SIRFC does not provide sufficient survivability even with current aircrew tactics to allow penetration into the weapon engagement zone of many current radar-guided threat systems. Pending successful qualification and flight testing of the new RF switch, the SIRFC system should be operationally suitable.
- SIRFC provides more capability than the legacy RF countermeasures systems on the MH-47 and MH-60 aircraft; nonetheless, it is not effective against its intended threat environment.
- The SIRFC radar warning sub-system, which can operate separately from the RF countermeasures portion, provides aircrew with excellent situational awareness, rapidly detecting, identifying, and providing accurate relative bearing to threat radar systems.

Air Force Special Operations Command and Navy

- DOT&E released the CV-22 OT&E Report in January 2010, assessing SIRFC integration on that aircraft as not effective and not suitable.

System

- SIRFC is an advanced radio frequency self-protection system designed for installation on aircraft.
- Major SIRFC subsystems are:
  - Advanced threat Radar Warning Receivers (Numbers 1, 2, 3, 6, and 9 in picture)



1 - LRU (Line Replaceable Unit) Receive Processor
2 - Receive Antenna
3 - Amplifier
4 - LRU Advanced Countermeasure
5 - Radio Frequency Switch Assembly
6 - Electrical Assembly
7 - LRU High Power Receive Transmit
8 - Transmit Antenna
9 - Cockpit Display

  - Advanced threat radar jammer/Electronic Countermeasures (Numbers 4, 5, 7, and 8 in picture)
- SIRFC is integrated onto Army Special Operations Command (ASOC) MH-47 and MH-60 helicopters and Air Force Special Operations Command (AFSOC) CV-22 tilt rotor aircraft. The AFSOC CV-22 aircraft is supported by the Navy V-22 Joint Program Office (PMA-275).
- The SIRFC system integration is 90 percent common between the Service platforms, though the Army MH-47 and MH-60 aircraft have a higher power transmitter installed. Early integration challenges on the AFSOC CV-22 aircraft dictated the installation of a lower power transmitter. Future CV-22 block upgrades are scheduled to incorporate a higher power transmitter.

Mission

Special Operations Forces will use SIRFC to enhance the survivability of aircraft on missions that penetrate hostile areas. SIRFC-equipped units should be able to provide self-protection against threat radar-guided weapons systems by:

- Improving aircrew Situational Awareness and threat warning
- Employment of active electronic jamming countermeasures
- Expending countermeasures (i.e., chaff)

Major Contractor

ITT Electronics Systems – Clifton, New Jersey

Activity

Army Special Operations Command

- The SIRFC Program Office engineering investigation discovered deficiencies in the current RF switch design. As a result, the Technology Applications Program Office (TAPO) directed a complete switch redesign and is planning additional qualification testing to be completed in early FY11.
- As an interim solution, the SIRFC Program Office, in coordination with ASOC, reduced the power to the forward transmitter via a software change to minimize the chance of a switch failure. Testing of the reduced power was completed at Eglin AFB, Florida, in July 2009. Although limited in scope, the flight tests experienced no RF switch failures and indicated no change in system effectiveness against the very limited number of threats that SIRFC was effective against during IOT&E.
- DOT&E published the SIRFC IOT&E report to Congress in October 2010 based on the IOT&E and post-IOT&E testing.

Air Force Special Operations Command and Navy

- DOT&E released the CV-22 OT&E Report in January 2010 assessing the SIRFC integration as not effective and not suitable.

Assessment

- In previous reporting, DOT&E stated that SIRFC was operationally effective based on preliminary analysis of operational test results. However, upon completion of a comprehensive analysis of all test data in context with SIRFC's ability to support operational mission accomplishment, DOT&E determined that the initial effectiveness assessment was incorrect. The final assessment (characterized below) and supporting analysis is included in the October 2010 IOT&E report.
- Despite the common SIRFC hardware among all the platforms, some unique aircraft system integration challenges have resulted in a disparity in performance with each Service aircraft.
- Although the Services conducted SIRFC development and testing under two separate Test and Evaluation Master Plans, inter-program communication and coordination allowed the CV-22 program to benefit from the ASOC SIRFC program.

Army Special Operations Command

- SIRFC integration on ASOC helicopters is not operationally effective and remains not operationally suitable. The program's newly redesigned RF switch could resolve the suitability problems, pending successful qualification and flight testing.
- SIRFC provides more capability than existing RF countermeasures systems on the MH-47 and MH-60 aircraft, which include two legacy radar warning receivers (APR-39 and APR-44) and two legacy RF countermeasures systems (ALQ-136 and ALQ-162).
- Nonetheless, SIRFC does not provide sufficient survivability even with current aircrew tactics to allow penetration into the weapon engagement zone of many current radar-guided threat systems. It does, however, reduce the ability of some threat radars to track the aircraft and it reduces (but not eliminates) the ability of some radar-guided threat systems to shoot the aircraft. SIRFC has poor to marginal performance against a number of likely threats, and does not reduce the number of shots taken by an air defense system during an entire engagement sufficiently to provide the high survivability a slow-moving helicopter, operating covertly without support, requires.
- The SIRFC radar warning sub-system, which can operate separately from the RF countermeasures portion, provides excellent situational awareness, rapidly detecting, identifying, and providing accurate relative bearing to threat radar systems.

Air Force Special Operations Command and Navy

- As part of DOT&E's assessment of the CV-22 OT&E, SIRFC was assessed to be not operationally effective and not operationally suitable. Effectiveness performance was similar to that on the ASOC helicopters, but the suitability issues were unique to the CV-22 platform.

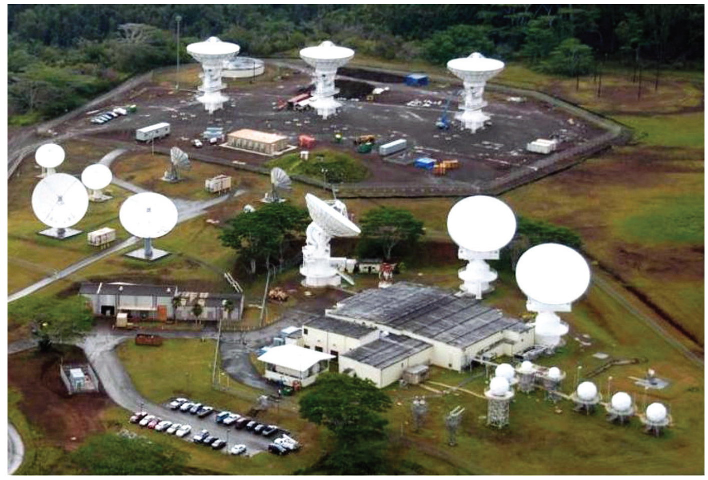
Recommendations

- Status of Previous Recommendations. The Services are satisfactorily addressing the two FY09 recommendations to conduct additional SIRFC flight testing on the RF switch redesign and to conduct CV-22 flight testing to verify correction of situational awareness problems in IOT&E; however, the recommendations have yet to be completed and therefore remain valid.
- FY10 Recommendations. None.

Teleport

Executive Summary

- A November 2009 Multi-Service Operational Test and Evaluation (MOT&E) demonstrated that the Teleport Generation 2, Phase 2 (G2P2) system is effective and suitable with some limitations. DoD Teleport G2P2 added military Ka-band terminals to access Wideband Global Satellites (WGS), the LinkStar Internet Protocol (IP) modem, and upgraded the software versions of the LinkWay and iDirect IP modems to use existing Teleport capabilities.
- Follow-on integrated testing in April 2010 demonstrated that the program manager corrected a power control problem with the iDirect IP Version-7 modem observed during the MOT&E.
- The Milestone Decision Authority granted the Defense Information Systems Agency (DISA) the authority to enter Teleport Generation 3, Phase 1 (G3P1) into the Production and Deployment Phase. Teleport G3P1 will integrate Advanced Extremely High Frequency (AEHF) Extended Data Rate (XDR) capability into the existing Teleport system Extremely High Frequency (EHF) architecture.



System

- DoD Teleport sites are globally distributed satellite communications (SATCOM) facilities. The system has six core Teleport facilities located in Virginia, Germany, Italy, Japan, Hawaii, and California. Teleport sites consist of four segments:
  - The radio frequency segment consists of SATCOM earth terminals that operate in X-, C-, Ku-, Ka-, Ultra High Frequency (UHF), and EHF bands. The terminals provide radio frequency links between the Teleport site and the deployed user SATCOM terminal via commercial or military satellites.
  - The Teleport base-band segment includes encryption, switching, multiplexing, and routing functions for connecting data streams or packetized data to the Defense Information Systems Network (DISN).
  - The network services segment provides connectivity to the DISN long-haul networks and data conversion functions necessary to meet the user's requirements.
  - The management control segment provides centralized monitoring and control of Teleport base-band hardware, SATCOM earth terminal hardware, transmission security, and test equipment.

Mission

- Combatant Commanders, Services, and deployed operational forces use Teleport systems in all phases of conflict to gain worldwide military and commercial SATCOM services.
- Teleport provides deployed forces access to standard fixed gateways from anywhere in the world for all six DISN services:
  - Secret Internet Protocol Router Network (SIPRNet)
  - Non-secure Internet Protocol Router Network (NIPRNet)
  - Defense Red Switch Network (DRSN)
  - Defense Switched Network (DSN)
  - Video Teleconferences (VTC)
  - Joint Worldwide Intelligence Communications System (JWICS)

Major Contractor

Government Integrator – DISA

Activity

- The Joint Interoperability Test Command (JITC) conducted the G2P2 MOT&E November 2009 at the Hawaii DoD Teleport site and the Pacific Theater Network Operations Center (TNC) at Wheeler Army Air Field, Hawaii. Eleven operational units along with a special LinkStar unit operated from deployed locations in California, Oklahoma, Arizona, Idaho, Hawaii, and Korea.
- The MOT&E focused on Teleport's capability to provide deployed users Ka-band access, DISN services using three different current force IP modem variants, and the system control and management capability.
- JITC and the program office conducted a follow-on test at the Wahiawa Teleport in April 2010 to verify correction of a

power control problem associated with the iDirect Version-7 IP modems.
- Teleport G3P1, which consists of adding Navy Multi-band Terminals (NMT) to communicate over AEHF satellites, has achieved Milestone C.

Assessment
- The MOT&E was adequate to evaluate the operational effectiveness and suitability of the Teleport G2P2 system. The Teleport G2P2 system is effective and suitable with limitations. The newly installed Ka-band access provides connectivity over the WGS system. The newly installed LinkStar IP modem and upgraded Linkway and iDirect Version-7 IP modems provide connectivity over commercial Ku-band and military X- and Ka-band satellites.
- The two major deficiencies in effectiveness observed during MOT&E were an iDirect Version-7 IP modem power control problem that prevented consistent IP access over WGS and the inability of users to complete DSN secure calls on a consistent basis.
- The major deficiencies in suitability were lack of documentation and training preparing Teleport operators to troubleshoot system-level problems, and lack of detailed Concepts of Operations that adequately describe the roles and responsibilities and operational configurations of IP-based SATCOM networks.
- Follow-on testing in April 2010 confirmed that the program manager corrected the power control problem observed during MOT&E with the iDirect Version-7 IP access over WGS.

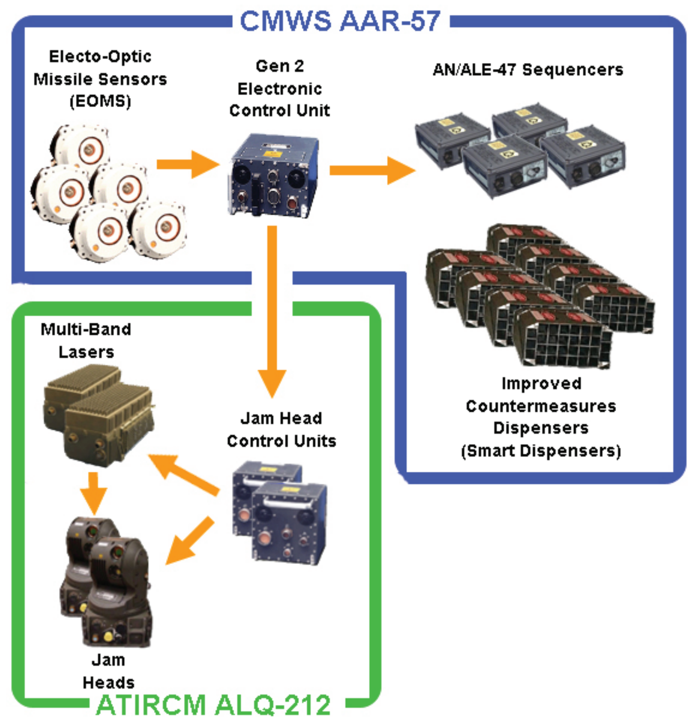
Recommendations
- Status of Previous Recommendations. DISA has satisfactorily addressed all previous recommendations.
- FY10 Recommendations. DISA should:
  1. Develop a technical or procedural solution for DSN secure calls approved by the user community and JITC should validate the corrective action.
  2. Improve system documentation and maintenance training, particularly with respect to system-level troubleshooting procedures.
  3. Develop documentation that adequately describes the roles and responsibilities and operational configurations of IP-based SATCOM networks.

Army Programs

Army Programs

Advanced Threat Infrared Countermeasures (ATIRCM) Quick Reaction Capability (QRC) / Common Missile Warning System (CMWS)

Executive Summary
- The Army declared a critical Nunn-McCurdy breach for the combined Advanced Threat Infrared Countermeasures (ATIRCM) and Common Missile Warning System (CMWS) programs on March 25, 2010. The Milestone Decision Authority rescinded the programs' Milestone C approval in June 2010. The Milestone Decision Authority reinstated Milestone C for the CMWS subprogram, but the ATIRCM subprogram did not receive a new milestone approval. However, the ATIRCM Quick Reaction Capability (QRC) program proceeded as planned.
- The Army continues to equip its helicopters and fixed-wing aircraft with CMWS. The OH-58D Kiowa Warrior helicopter is the next major platform to begin receiving CMWS. No dedicated OT&E of CMWS has taken place since the IOT&E in November 2005.
- CMWS has some system effectiveness limitations due to the lack of more advanced threat detection algorithms. The generation (GEN) 3 Electronic Control Unit (ECU) hardware upgrade is designed to provide improved computing and processing accommodating advanced algorithms that may improve system effectiveness.
- The Army continues to equip the CH-47D Chinook helicopter with the ATIRCM QRC system. The Army deployed these Chinooks in support of Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF). The Army completed the first unit equipped with ATIRCM QRC in November 2009.
- The results from ATIRCM QRC testing show satisfactory system performance against the threats that were tested. The Army tested ATIRCM laser jam codes at the Guided Weapons Evaluation Facility (GWEF) at Eglin AFB, Florida, during 2010. DOT&E analysis of ATIRCM QRC test results led to the discovery of a major inconsistency in jam code testing between the way the GWEF at Eglin AFB, Florida, incorporated the ATIRCM laser into their facility and how it actually operated on the aircraft. The Army has eliminated this inconsistency.



System
- CMWS and ATIRCM QRC are the Army's aircraft missile countermeasure systems designed to detect incoming infrared-guided missiles, to warn pilots of the threat, and to command automatic employment of laser and/or flare infrared countermeasures.
- The CMWS consists of electro-optical missile sensors that detect an oncoming missile threat, and an ECU that informs the crew of the threat and activates countermeasures.
- CMWS, coupled with flare dispensers, is currently fielded on 1,097 Army CH-47, UH-60, AH-64, C-12 series, C-23, and UC-35 aircraft. The Army Procurement Objective is currently 2,002 B-kit systems. (B-kits are the components of the CMWS and ATIRCM QRC system. A-kits are the airframe modifications such as wiring and structural modifications that support the B-kit installations).
- ATIRCM QRC adds an infrared laser jammer to the CMWS to provide improved infrared defensive countermeasures. The Army objective is to field ATIRCM QRC on 83 CH-47D/F Chinooks. The Army has currently fielded 54 ATIRCM QRC-equipped Chinooks. The ATIRCM program will be terminated at the end of the QRC effort.

Mission
- Combatant Commanders currently use the fielded version of CMWS and flares to warn pilots and provide infrared countermeasures within the design parameters of the system. The system is used to protect Army helicopters and fixed-wing aircraft and crews during vulnerable low-altitude operations such as normal take-off and landing, assault, attack, re-supply, rescue, and forward arming and refueling missions from

shoulder-fired, vehicle-launched, and other infrared-guided missile threats.
- Combatant Commanders use the integrated ATIRCM QRC and CMWS suite to provide improved notification against infrared-guided missiles for CH-47D/F Chinook helicopters.

Major Contractors

BAE Systems, Electronics and Integrated Solutions, and Electronic Warfare Division – Nashua, New Hampshire

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Activity

- The Army declared a critical Nunn-McCurdy breach for the combined ATIRCM and CMWS programs on March 25, 2010. The Milestone Decision Authority rescinded the programs' Milestone C approval in June 2010. The Milestone Decision Authority reinstated Milestone C for the CMWS subprogram but the ATIRCM subprogram did not receive a new milestone approval. However, OSD allowed the ATIRCM QRC program to proceed as planned.

CMWS

- The Army has continued to field the production CMWS designed to support immediate needs, while continuing development of an advanced full-threat-capable CMWS. The Army plans to begin developmental testing of the advanced full-threat-capable CMWS algorithms in support of worldwide operations in FY11.
- The Army accomplished qualification testing of the existing GEN 2 ECU and other system components throughout FY10.
- The Army is developing an upgraded GEN 3 ECU to enable the full-threat-capable CMWS. The Army accomplished qualification, reliability, and developmental flight testing throughout FY10.
- The Army accomplished qualification, installation, and performance flight testing of the CMWS and flares system on the OH-58D Kiowa Warrior. Fielding of the CMWS and flares system for the OH-58D will begin in FY11.
- The Army is updating the November 2005 Test and Evaluation Master Plan (TEMP) with current test plans and resources to support fielding of the GEN 3 ECU and full-threat-capable CMWS. The Army has planned for Integrated Developmental and Operational Testing in 3QFY11.

ATIRCM QRC

- The Army began installing production A-kits and B-kits on the CH-47D Chinooks for the ATIRCM QRC and CMWS in May 2009, and completed the First Unit Equipped in November 2009. The Army has fielded 54 ATIRCM QRC-equipped Chinooks in support of operations for OIF and OEF since July 2010.
- The Army accomplished ATIRCM QRC installation and flight testing for the CH-47F aircraft in June 2010 at Fort Rucker, Alabama.
- The Army tested ATIRCM QRC laser jam codes at the GWEF at Eglin AFB, Florida, during 2010. DOT&E analysis of ATIRCM QRC test results led to the discovery of a major inconsistency in jam code testing between the way the GWEF at Eglin AFB, Florida, incorporated the ATIRCM QRC laser into their facility and how it actually operated on the aircraft. The Army has eliminated this inconsistency.
- The Army has conducted all testing in accordance with the DOT&E-approved TEMP.

Assessment

CMWS

- CMWS has some system effectiveness limitations due to the lack of advanced threat detection algorithms. The GEN 3 ECU hardware upgrade is designed to provide improved computing and processing to accommodate advanced algorithms that may improve system effectiveness.
- The reliability data the Army has collected from deployed operations show that the system exceeds its reliability requirements of 423 hours by achieving 1,155 hours. However, the overall reliability has decreased in FY10 compared to FY09.

ATIRCM QRC

- The results from ATIRCM QRC testing show satisfactory system performance against OIF and OEF threats.
- The reliability data collected by the Army from deployed operations show the combined CMWS and ATIRCM QRC system exceeding its reliability requirement of 150 hours by achieving 293 hours, demonstrating system reliability improvements.

Recommendations

- Status of Previous Recommendations. The Army has satisfactorily addressed two of the three FY09 recommendations. The Army has not accomplished accreditation of their digital system model for CMWS, which DOT&E recommended in FY09.
- FY10 Recommendations. None.

Apache Block III (AH-64D)

Executive Summary

- In November 2009, the Army conducted the Apache Block III (AB3) Limited User Test (LUT) in support of a September 2010 Milestone C Low-Rate Initial Production (LRIP) decision.
- During the LUT, an Air Weapons Team consisting of two AB3 aircraft and the surrogate Unmanned Aircraft System (UAS) successfully completed nine of 12 missions in a realistic operational environment. The addition of the surrogate UAS provided the AB3 crew with increased situational awareness from remote and secure locations.
- The Army conducted developmental testing of subsystems including the improved drive system; composite main rotor blades; integrated aircraft survivability equipment; Fire Control Radar (FCR); and 701-D engine with enhanced electronic controls and weapons accuracy, performance, and integration.
- The Apache Program Office continues to implement its reliability growth program by investigating potential improvements to reliability of AB3 and legacy components.
- DOT&E approved an Alternative LFT&E strategy in February 2010.

System

- The AB3 is a modernized version of the AH-64D Attack Helicopter. The Army intends to organize the AB3 into 24 aircraft Attack/Reconnaissance Battalions assigned to the Combat Aviation Brigades.
- The Army's acquisition objective is for 690 AB3 aircraft: 634 remanufactured and 56 new builds.
- The AB3 aircraft include the following:
  - Level 2 through 4 UAS control - Level 2 receives UAS video feed; Level 3 controls the UAS sensors; and Level 4 controls the UAS sensors and flight.
  - Improved Radar Electronic Unit to provide Radio Frequency Interferometer passive ranging, extended Fire Control Radar range, and maritime targeting
  - Improved performance with 701D engines, composite main rotor blades, weight reduction through processor and avionic upgrades, and an improved drive system
  - Enhanced survivability with integrated aircraft survivability equipment and additional crew and avionic armoring
  - Enhanced communication capability with an integrated communication suite to meet global air traffic management requirements, which includes satellite communication and Link 16 (data link)
  - Improved reliability and maintainability using embedded system-level diagnostics, improved electronic technical manuals, and reduced obsolescence

Mission

The Attack/Reconnaissance Battalions assigned to the Combat Aviation Brigade will employ the AB3 to conduct the following missions:

- Attack
- Movement to contact
- Reconnaissance
- Security

Major Contractors

- Aircraft: The Boeing Company Integrated Defense Systems – Mesa, Arizona
- Sensors and UAS datalink: Longbow Limited – Orlando, Florida and Baltimore, Maryland

Activity

- The Army conducted the AB3 LUT in November 2009 at the Yuma Proving Ground, Arizona, to support a September 2010 Milestone C LRIP decision. The testing was conducted in accordance with a DOT&E-approved Test and Evaluation Master Plan/test plan. During the LUT an Air Weapons Team consisting of two AB3 aircraft and the surrogate UAS successfully completed nine of 12 missions in a realistic operational environment.
- The Army conducted developmental and operational flight-testing of the AB3 Aircraft Survivability Equipment (ASE) suite in August 2009 in side-by-side testing of the AB3 ASE suite with the legacy Apache Block II ASE suite.

- As of September 30, 2010, the AB3 program completed 1,247 developmental ground and flight hours on five prototype aircraft. Testing included: laboratory and ground qualification for the improved drive system and the redesigned 30 mm gun system controller, tethered hover flight, aerial rocket firing, avionics integration, FCR performance and navigation accuracy, the Integrated Helmet and Display Sight System, and UAS interoperability.
- Following completion of the LUT, prototype aircraft were reconfigured with the AB3 drive train, 701-D engine, and new composite main rotor blades.
- The LFT&E strategy, approved February 2010, includes non-destructive, controlled damage, and selected ballistic (static and dynamic) live fire testing at the component, subsystem, and system level. The start of LFT&E has been moved to 2QFY11 to accommodate continued improved drive system testing on the Ground Test Vehicle that will be used for system level LFT&E.

Assessment

- The Army demonstrated in a realistic operational environment that teaming AB3 with a surrogate UAS provides the AB3 crew with increased situational awareness from remote and secure locations.
- The AB3 attained a Hover Out-of-Ground Effect capability that was approximately 99 percent of the required hover performance requirement. The 1 percent shortfall would have little operational impact.
- Initial FCR testing indicated performance comparable to that of the legacy FCR in most operating modes. However, the FCR generated excessive false targets in some operating modes.
- During the LUT, the Integrated Helmet and Display Sight System helmets did not fit well and limited the pilots' visibility of the Helmet Display Unit (HDU) imagery.
- The AB3 Milestone C requirement is 2.3 hours between essential maintenance actions. Current point estimates for reliability are 3.14 hours based on developmental flight testing and 2.6 hours based on the LUT. This indicates the AB3 program is on the projected growth curve for achieving reliability requirements.
- The integrated AB3 ASE suite improves pilot understanding of threat locations and provides new capability to locate and target threat systems.
- Mission planning tools do not allow creation of a flight plan for the UAS or multiple frequency settings for the ARC-231 radios.

Recommendations

- Status of Previous Recommendations. Per the two FY09 recommendations, the Army continues to look for and implement reliability improvements on baseline and AB3 components as well as look for opportunities for test articles to support earlier Live Fire test events.
- FY10 Recommendations. The program should:
  1. Implement planned AB3 weight reduction initiatives, such as the Lightweight Hellfire Launcher.
  2. Continue FCR performance testing with hardware and software fixes in place to confirm that performance deficiencies have been resolved.
  3. Continue to refine the procedures for initiation of the Tactical Common Data Link between AB3 and UAS systems.
  4. Continue integration with mission planning software to facilitate full AB3 functionality and adequate operational mission planning.
  5. Test the AB3 with the MQ-1C Gray Eagle UAS using Soldiers at the earliest opportunity.

Armored Tactical Vehicles – Army

Executive Summary

- The Joint Light Tactical Vehicle (JLTV) program continues in the Technology Development phase. In June 2010, the program began test activities in the U.S. and Australia, continued to confirm maturity of vehicle technology, and refined operational requirements prior to entry into the Engineering and Manufacturing Development phase.
- The Family of Medium Tactical Vehicles (FMTV) Re-buy Product Verification Test (PVT) is ongoing.
- The FMTV System-Level Live Fire Test (LFT) began in November 2010 and the Integrated Developmental Test/ Operational Test is planned for March 2011.
- DOT&E delivered the M915A5 Line Haul Tractor Operational and Live Fire Report to Congress in May 2010. The M915A5 Line Haul Tractor is operationally effective, operationally suitable, and survivable.

System

JLTV

The JLTV will consist of Mission Role Variants (MRVs) and right hand drive vehicles for Australia:

- JLTV General Purpose Vehicle
  - General Purpose Vehicle
  - Heavy Guns Carrier Vehicle
  - Close Combat Weapons Vehicle
  - Reconnaissance Vehicles
- JLTV Combat Tactical Vehicle
  - Command and Control on the Move (C2OTM) Vehicle
- JLTV Utility Vehicle
  - Utility Prime Mover/Shelter Carrier
- Right Hand Drive (RHD) JLTV General Purpose Vehicle, C2OTM Vehicle, and Utility Vehicle

FMTV

The FMTV Re-buy is the fourth stage of FMTV evolution. These vehicles consist of light and medium variants intended to operate on- and off-road.

- Light Medium Tactical Vehicle (LMTV)
  - Transports a minimum of 5,000-pound payload and a 12,000-pound towed load
- Medium Tactical Vehicle (MTV)
  - Transports 10,000-pound payload and a 21,000-pound towed load

M915A5 Line Haul Tractor

The M915A5 is a 6 by 4 truck tractor system that is compatible with the M872 trailer and other legacy tankers and trailers.

Mission

JLTV

- The Services will employ JLTV as a light tactical wheeled vehicle for battlefield situational awareness, force application, and focused logistics.

JLTV
General Purpose

JLTV
Combat Tactical Vehicle

JLTV
Utility Vehicle

FMTV

M915A5

FMTV

- The Army employs the FMTV as multi-purpose transportation and unit mobility vehicles in maneuver, maneuver support, and sustainment units.

M915A5 Line Haul Tractor

- The M915A5 is a line haul tractor truck used in transportation units to transport bulk and containerized supplies from point of origin to as far forward as brigade areas within a theater of operation.

Major Contractors

JLTV

- BAE Ground Systems – Santa Clara, California
- Lockheed Martin Systems – Owego, New York
- General Dynamics Land Systems – Sterling Heights, Michigan

FMTV

- Oshkosh Corporation – Oshkosh, Wisconsin

M915A5

- Daimler Truck North America – Charlotte, North Carolina

Activity

JLTV

- The program awarded three competitive technology development contracts in October 2008. In May 2010, each contractor delivered prototype vehicles, ballistic hulls, and ballistic armor for test.
- The Army and Marine Corps began Technology Development phase test activities in June 2010. In order to assess technical maturity, system integration, and achievability of requirements, testing will examine the system performance, reliability, and vulnerability of each contractor's vehicles. The program plans to complete Technology Development phase testing by March 2011.
- JLTV Vendors prototype vehicles are undergoing 20,000 miles endurance testing at Montegetta Proving Ground, Australia, and Aberdeen Test Center, Maryland, to assess reliability and maintainability of these variants.
- Soldiers and Marines will conduct a User Evaluation planned for January 2011 to assess the capability of employing the JLTV to conduct crew and individual mission tasks. Testers at Aberdeen Proving Ground, Maryland, began ballistic testing in FY10 to assess the capability of the JLTV to meet Force Protection requirements.
- The JLTV Milestone B decision is planned for 4QFY11.

FMTV

- The Army awarded a competitive re-procurement contract to Oshkosh Defense for 23,341 vehicles over a five year contract (FY09-13).
- The program began the FMTV Re-buy PVT at Aberdeen Proving Ground, Maryland, and Yuma Test Center, Arizona, in July 2010. Performance testing consisted of six trucks and trailers and was designed to assure the FMTV produced by Oshkosh meets the requirements of the system. In July 2010, the 20,000-mile endurance testing commenced on 12 vehicles to assess the reliability and maintainability of the FMTV.
- The FMTV developmental/operational test is scheduled to begin in early 2011. The purpose of the test is to confirm that FMTV-trained Soldiers can employ the new LMTV and MTV variants to support multi-purpose transportation missions.
- The FMTV ballistic exploitation began in July 2010 and System-Level Live Fire began in November 2010. The purpose of the test is to confirm that the armor improvements provide increased protection.

M915A5 Line Haul Tractor

- The Army completed the FOT&E of the M915A5 in September 2009 and the live fire testing in December 2009. Testing was conducted in accordance with the DOT&E-approved Test and Evaluation Master Plan (TEMP) and test plan.

Assessment

JLTV

- Testing conducted during the Technology Development phase is allowing the program to assess the maturity of the vendors' technology, refine requirements, and further develop its acquisition strategy and TEMP.
- During on-going Reliability, Availability, and Maintainability (RAM) testing, vendor prototype vehicles experienced failures related to ride height adjustment, brakes, vehicle power loss, and fluid leaks.
- The JLTV vendor RHD variant vehicles are experiencing similar failure modes as the JLTV Left Hand Drive vehicles.
- DOT&E will provide an Operational Assessment of the JLTV to support a Milestone B decision in 4QFY11.

FMTV

- On-going analysis and assessment of PVT data indicate that the FMTV Re-buy vehicles are meeting most performance requirements.
- Endurance Testing is ongoing. The LMTVs have accumulated 35,607 miles and the MTVs have accumulated 35,811 miles out of 40,000.
- Initial ballistic LFT indicates that improved armor used in the Re-buy vehicles increases Soldier protection compared to earlier versions of the FMTV.

M915A5 Line Haul Tractor

- The M915A5 Line Haul Tractor is operationally effective, operationally suitable, and survivable. Transportation units equipped with the M915A5 have the ability to move and transport required loads of cargo and relocate unit equipment.
- Based upon live fire testing, the M915A5 provides armor protection to the crews against the required threats while maintaining mission capability.

Recommendations

- Status of Previous Recommendations. The Army addressed all previous recommendations.
- FY10 Recommendations.

JLTV

1. The program should capitalize on the lessons learned from the JLTV Technology Development phase testing to update the Engineering Manufacturing and Development RAM Growth Plan.
2. The JLTV program must submit a TEMP to support the Milestone B Decision in 4QFY11.

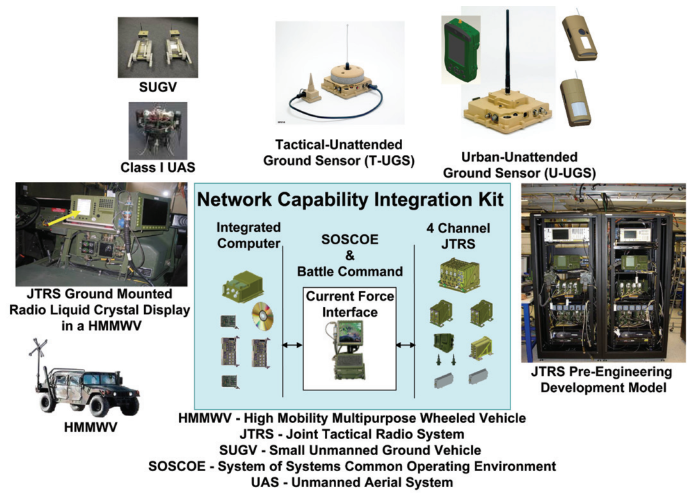
FMTV

3. The program should continue with the existing planned PVT Integrated Test Event to confirm the operational effectiveness and suitability of the FMTV.

Early Infantry Brigade Combat Team (E-IBCT)

Executive Summary

- The Under Secretary of Defense for Acquisition, Technology, and Logistics (USD (AT&L)) approved a Milestone C decision for Early Infantry Brigade Combat Team (E-IBCT) Increment 1 on December 24, 2009. The decision included approval for Low-Rate Initial Production (LRIP) of equipment for one E-IBCT.
- The USD (AT&L) cancelled the Non-Line-of-Sight Launch System (NLOS-LS) program in May 2010 based upon a recommendation from the Army that NLOS-LS was not cost-effective.
- The Army Test and Evaluation Command (ATEC) conducted a Limited User Test (LUT 10) at White Sands Missile Range, New Mexico, in September 2010. LUT 10 was the second operational test of the E-IBCT systems and was intended to assess progress in E-IBCT operational effectiveness and suitability in a realistic operational environment.
- Based upon analyses of the results from LUT 10 and developmental testing, DOT&E's current assessment of the E-IBCT systems is that, with the exception of the SUGV, none of the systems have demonstrated an adequate level of performance to be fielded to units and deployed in combat. The SUGV has demonstrated a sufficient level of tactical utility and operational reliability to merit fielding.



System

- E-IBCT Increment 1 now includes the following capabilities.
  - Network Integration Kit (NIK) mounted on a tactical wheeled vehicle such as High Mobility Multi-purpose Wheeled Vehicle or Mine Resistant Ambush Protected vehicle, consisting of:
    - Integrated Computer System with battle command software
    - Joint Tactical Radio System – Ground Mobile Radios
  - Unattended Ground Sensors (UGS)
    - Tactical UGS (T-UGS), including a Gateway; Intelligence, Surveillance, and Reconnaissance nodes (which include acoustic and seismic sensors); Radiological and Nuclear sensors; Passive Infrared sensors; and Electro-Optical/Infrared imagers.
    - Urban UGS (U-UGS), which are small, leave-behind imaging and intrusion detection sensors emplaced in structures such as buildings, caves, and tunnels
  - Class 1 Unmanned Aerial System (UAS), Block 0
  - Small Unmanned Ground Vehicle (SUGV), Block 1
- The Army plans to field the first E-IBCT Increment 1 in FY11 with a total procurement objective of nine Increment 1 E-IBCTs.
- Detailed reports on the NIK, UGS, Class 1 UAS Block 0, and SUGV are provided following this overview.

Mission

E-IBCTs will perform all tactical operations – offensive, defensive, stability, and support – currently conducted by infantry forces. The Army intends the E-IBCT systems to enhance brigade intelligence, surveillance, and reconnaissance, as well as command and control capabilities.

Major Contractors

- Prime: The Boeing Company, Integrated Defense Systems – St. Louis, Missouri
- Class 1 UAS: Honeywell, Aerospace Division – Albuquerque, New Mexico
- UGS: Textron Defense Systems – Wilmington, Massachusetts
- SUGV: iRobot – Burlington, Massachusetts

Activity

- The USD (AT&L) approved a Milestone C decision for E-IBCT Increment 1 on December 24, 2009. The decision included approval for LRIP of equipment for one E-IBCT. This decision did not include the NLOS-LS, which was still undergoing testing at that time. This Milestone C decision also contained a provision to conduct a comparative test, as part

of the E-IBCT IOT&E in FY11, of an E-IBCT-equipped unit with an infantry brigade combat team equipped as currently deployed for operations.
- The USD (AT&L) subsequently cancelled the NLOS-LS program in May 2010 based upon a recommendation from the Army that NLOS-LS was not cost-effective.
- Since the Milestone C decision, the E-IBCT program has pursued an intensive effort to fix reliability deficiencies identified in operational and developmental testing in 2009 for all E-IBCT systems.
- The Army conducted Technical Test 1 (TT-1), a developmental test, in July 2010 at White Sands Missile Range, New Mexico, to assess improvements in reliability.
- ATEC executed a Limited User Test (LUT 10) at White Sands Missile Range, New Mexico, in September 2010 in accordance with a DOT&E-approved test plan.
- LUT 10 was the second operational test of the E-IBCT systems and was intended to assess progress in E-IBCT operational effectiveness and suitability in a realistic operational environment. During LUT 10, an infantry battalion consisting of two infantry companies equipped with E-IBCT systems executed a series of offensive, defensive, and stability missions during three 96-hour scenarios. The results of LUT 10 will be used to inform a DAB decision to purchase an additional two E-IBCTs as part of LRIP.

Assessment
- Reliability test results from TT-1 indicate that all E-IBCT systems are showing notable improvement in reliability.
  - During TT-1, four of the five systems – Class 1 UAS, SUGV, T-UGS, and U-UGS – exceeded system requirements for Mean Time Between System Abort (MTBSA).
  - Two of the five systems – T-UGS and SUGV – are meeting reliability requirements for Mean Time Between Effective Function Failures (MTBEFF). EFFs are less severe failures than system aborts, representing a degradation in system performance as opposed to rendering the system unusable. The MTBEFF results reflect the program's priority on fixing the system aborts, which are the most serious failure modes.
  - The NIK, while demonstrating improved reliability (79 hours MTBSA, 31 hours MTBEFF) over last year's performance (33 hours MTBSA, 19 hours MTBEFF), fell short of meeting its MTBSA requirements (112 hours MTBSA, 37 hours MTBEFF).
- Based upon analyses of the results from LUT 10 and developmental testing, DOT&E's current assessment of the E-IBCT systems is that, with the exception of the SUGV, none of the systems have demonstrated an adequate level of performance to be fielded to units and deployed in combat. The SUGV has demonstrated a sufficient level of tactical utility and operational reliability to merit fielding. Individual system assessments are detailed below. More detailed system assessments are contained in the individual system reports following this overview.
  - There was no demonstrated tactical utility for the NIK's primary function of networking sensor output (consisting of still images from the E-IBCT systems) with higher tactical echelons, e.g. battalion or brigade headquarters. Sensor information from the E-IBCT systems is of limited tactical utility above company level and the test unit predominately employed local system controllers at the platoon and company level, operating the systems unconnected to the NIK. The only exception was the T-UGS, which requires the NIK for local control. The test unit found connecting systems to the NIK via a gateway to be difficult and time-consuming.
  - NIK start-up and re-boot times are excessive, and the complexity of NIK operating and trouble-shooting procedures limited its usefulness in supporting tactical operations.
  - The SUGV was the most tactically useful of the E-IBCT systems. The test unit successfully employed the SUGV in support of a range of tactical missions.
  - The Class 1 UAS demonstrated some limited tactical utility, particularly in a static defense. However, the Class 1 UAS is still not reliable.
  - T-UGS and U-UGS demonstrated little tactical utility, providing little useful tactical intelligence.
  - Overall, the E-IBCT program has significantly improved E-IBCT systems' reliability over the past year. Based upon the LUT 10 results, the T-UGS, U-UGS, and SUGV are currently meeting reliability requirements. The NIK, while showing some improvement (79 hours MTBSA), still falls short of the reliability requirement (112 hours MTBSA). The Class 1 UAS has demonstrated little reliability improvement (3.11 hours MTBSA, 2.57 hours MTBEFF) when measured against last year's LUT 09 performance (1.5 hours MTBSA, 1.47 hours MTBEFF) and still falls short of its reliability requirements (23 hours MTBSA, 11 hours MTBEFF).
- The effectiveness of the E-IBCT systems is dependent upon the availability of production-representative Joint Tactical Radio System (JTRS) radios, corresponding waveforms, and network management tools to be provided by the JTRS program. This is a risk area for the E-IBCT program, as the JTRS development and test and evaluation schedule currently lags the E-IBCT program schedule by several months.

Recommendations
- Status of Previous Recommendations. The E-IBCT program and Army have taken positive steps to address the four FY09 recommendations. These recommendations included improving E-IBCT systems' reliability, improving SUGV line-of-sight communications ranges, obtaining an Interim Authority to Operate (IATO) for all E-IBCT radios prior to IOT&E, and assuring that an adequate high fidelity Real Time Casualty Assessment system is available to support E-IBCT operational testing. These recommendations remain valid

and are focused on conducting a successful E-IBCT IOT&E in FY11.

- FY10 Recommendations.
  1. The Army should not execute the E-IBCT IOT&E until all E-IBCT network components, including the JTRS radios and waveforms and the NIK's Cross Domain Guard have received an IATO from the appropriate authority. The IATO will certify that these components are ready for operation in combat.
  2. Recommendations specific to the NIK, UGS, Class 1 UAS, and SUGV are contained in detailed reports following this overview.

Early Infantry Brigade Combat Team (E-IBCT) Network Interface Kit (NIK)

Executive Summary

- The Army conducted an Early Infantry Brigade Combat Team (E-IBCT) Limited User Test 09 (LUT 09) in 4QFY09 and an E-IBCT Increment 1 LUT 10 in 4QFY10. The Network Interface Kit (NIK) served as the communications means for E-IBCT sensor systems during both events.
- The E-IBCT LUT 09 demonstrated the NIK's ability to send Battle Space Object (BSO) reports to Army battle command systems and to exchange voice and data with the current force network. However, it also revealed NIK deficiencies in operational reliability, message completion rates, transmission range, start-up time, and complexity of operations.
- The December 24, 2009 E-IBCT Acquisition Decision Memorandum (ADM) authorized Low-Rate Initial Production (LRIP) of 81 NIKs for the first brigade. The ADM delayed purchases to equip the remaining two brigades until a scheduled December 2010 Defense Acquisition Board (DAB) In Progress Review (IPR).
- The E-IBCT Increment 1 LUT 10 demonstrated the NIK's capability to send BSO reports to Army battle command systems and to exchange voice and data with the current force network. While the NIK showed performance and reliability improvements over LUT 09, the NIK demonstrated deficiencies in dependability of voice command and control radio, start-up time, operational reliability, complexity of operations, and survivability, as well as demonstrating too much reliance on Field Service Representatives to maintain the system. The NIK did not demonstrate military utility, as its performance did not enhance mission accomplishment and only 5 sensor images out of approximately 4,000 collected were forwarded from the receiving NIK to higher headquarters. The LUT 10 results will support an LRIP decision for Brigades 2 and 3 at the December 2010 DAB IPR.

System

- The E-IBCT NIK consists of vehicle-mounted radios and computers that provide the communications interface between the current force command and control (C2) network and the E-IBCT sensors:
  - Tactical Unattended Ground Sensors (T-UGS)
  - Urban Unattended Ground Sensors (U-UGS)
  - Unmanned Aircraft System (UAS) Class 1 Block 0
  - Small Unmanned Ground Vehicle (SUGV)
- The E-IBCT NIK provides the means for transmission of voice, data, and sensor images from E-IBCT sensor fields to other NIKs within the E-IBCT.
- The E-IBCT NIK supports the update of the Force XXI Battle Command Brigade and Below/Blue Force Tracking (FBCB2/BFT) with E-IBCT sensor data.



1 - NIK components, Ground Mobile Radio (GMR) and Integrated Computer System (ICS), rack mounted in the rear of a Mine Resistant Ambush Protected (MRAP) vehicle
2 - NIK components, GMR and Force XXI Battle Command Brigade and Below (FBCB2), within a MRAP vehicle
3 - MRAP vehicle equipped with NIK

- The E-IBCT NIK hardware components consist of:
  - Joint Tactical Radio System (JTRS) Ground Mobile Radio (GMR)
  - Integrated Computer System with internal Cross Domain Guard
  - Force XXI Battle Command Brigade and Below/Blue Force Tracking (FBCB2/BFT)
- The JTRS GMR, as a component of the NIK, hosts the following radio waveforms:
  - Wideband Networking Waveform (WNW) v4.0
  - Soldier Radio Waveform (SRW) v1.0c
  - Single Channel Ground and Airborne Radio System (SINCGARS)

Mission

The Army intends the NIK to provide E-IBCT leaders with the means to:

- Rapidly disseminate critical operational/tactical information.
- Exercise remote control of UGS fields.
- Receive and update the Common Operating Picture (COP).
- Interface with the existing command and control communications networks within the E-IBCT.

Major Contractor

The Boeing Company, Integrated Defense Systems – Huntington Beach, California

Activity

- In 4QFY09, the Army conducted the E-IBCT LUT 09. The NIK served as the interface for brigade sensors to transmit data and images to command posts and other NIKs within the Brigade. During LUT 09, the NIK used pre-Engineering Development Model JTRS GMR loaded with early versions of waveforms to receive and transmit images originating from the brigade sensors. The NIK used modified versions of existing FBCB2/BFT to update the unit's situational awareness with sensor reports.
- The December 24, 2009 E-IBCT ADM authorized procurement of Brigade 1 LRIP (81 NIKs) and delayed purchases to equip two additional brigades until a scheduled December 2010 DAB IPR, following the E-IBCT LUT 10.
- In 4QFY10, the Army conducted the E-IBCT LUT 10. The NIK provided communications means for brigade sensor systems similar to the LUT 09, but covered a larger area of operations. During the LUT 10, the NIK used an Engineering Development Model JTRS GMR with more mature versions of waveforms to handle terrestrial transmission of images originating from the brigade sensors. The NIK used newer versions of FBCB2 Joint Capability Requirement (JCR)/BFT to update unit situational awareness using sensor reports.
- The Army conducted LUT 09 and LUT 10 in accordance with DOT&E-approved test plans.
- The NIK is dependent upon the JTRS GMR (as a NIK component) to support SRW connections to sensor fields and WNW connections to other NIKs within the brigade. The JTRS GMR program lags the development of the E-IBCT systems by approximately one year.

Assessment

- The E-IBCT LUT 09 demonstrated the NIK's capability to send BSO reports to Army battle command systems and to exchange voice and data with the current force network. The test revealed NIK deficiencies in operational reliability, message completion rates, transmission range, start-up time, and complexity of operations.
- The E-IBCT Increment 1 LUT 10 demonstrated the NIK's capability to send BSO reports to Army battle command systems and to exchange voice and data with the current force network. While the NIK showed performance and reliability improvements over E-IBCT LUT 09, the NIK demonstrated the following deficiencies:
  - The GMR SINCGARS secure waveform proved undependable in supporting unit voice command and control of operations. Unit leaders resorted to using legacy SINCGARS radios to accomplish their missions.
  - NIK start-up times ranged from 25 minutes to 10 hours to achieve full mission capability.
  - The NIK did not meet its reliability requirements when assessed from an operational standpoint. The NIK demonstrated 79 hours (with a requirement of 112) for Mean Time Between System Abort (MTBSA) and 31 hours (with a requirement of 37) for Mean Time Between Essential Function Failure (MTBEFF).
  - The NIK is complex to operate and relies too much on Field Service Representatives to maintain the system.
  - The NIK has survivability concerns in the area of Computer Network Operations.
  - The NIK did not demonstrate military utility, as its performance did not enhance mission accomplishment and only 5 sensor images out of approximately 4,000 collected during LUT 10 were forwarded from the receiving NIK to higher headquarters.
- The E-IBCT Increment 1 LUT 10 results will support an LRIP decision for Brigades 2 and 3 at the December 2010 E-IBCT DAB IPR.

Recommendations

- Status of Previous Recommendations. This is the first annual report for this program.
- FY10 Recommendations. The Army should:
  1. Continue its NIK reliability growth program and efforts to correct NIK deficiencies observed during operational testing.
  2. Synchronize JTRS GMR development with the E-IBCT program and conduct independent developmental testing to assure JTRS GMR deficiencies are corrected.

Early Infantry Brigade Combat Team (E-IBCT) Small Unmanned Ground Vehicles (SUGV)

Executive Summary

- Based on lessons learned from the Limited User Test (LUT) 09, the contractor made several improvements to the SUGV.
- In 2010, the Army conducted developmental testing and a LUT of the Small Unmanned Ground Vehicles (SUGV) at White Sands Missile Range, New Mexico.
- The test unit successfully employed the SUGV in support of a range of tactical missions.

System

- The Army intends the Early Infantry Brigade Combat Team (E-IBCT) SUGV Block 1 to provide an organic reconnaissance capability in urban terrain and subterranean battle space.
- The SUGV Block 1 consists of a SUGV Block 1 vehicle, an Operator Control Unit (OCU) with a hardened handheld controller and Ruggedized Personal Digital Assistant (RPDA), a goggle- or glasses-mounted display, a Local Display and Control unit (LDAC), and an integrated vest housing the processor, battery, and radio.
- The SUGV Block 1 will be employed by the IBCT at the platoon level. In urban operations, the operator will transport the SUGV Block 1 by organic wheeled, tracked, trailer, air assault, or airborne means, or dismounted with a Modular Lightweight Load-carrying Equipment (MOLLE) pack. After mission accomplishment, the operator will recover the SUGV Block 1.

LDAC - Local Display and Control
RPDA- Ruggedized Personal Digital Assistant
SUGV - Small Unmanned Ground Vehicles
U-UGS - Urban-Unattended Ground Sensors

Mission

Dismounted Soldiers are meant to use the SUGV to gain situational awareness/situational understanding without being exposed directly to the threat or hazard.

Major Contractor

iRobot – Burlington, Massachusetts

Activity

- Based upon LUT 09 performance, the Army upgraded the SUGV prior to E-IBCT LUT 10. Design improvements include:
  - Software upgrades to the controller and robot
  - Greater rigidity in the flippers
  - Improved circuit board design
  - New laser range finder
  - A new camera
- The Under Secretary of Defense for Acquisition Technology and Logistics (USD (AT&L)) approved a Milestone C decision for E-IBCT Increment 1, including SUGV, on December 24, 2009. As part of this decision, a low-rate initial production (LRIP) for one E-IBCT was approved.
- The Army conducted the contractor/government developmental test (TT-1) in July 2010 at White Sands Missile Range, New Mexico, to assess improvements in SUGV performance and reliability.
- The Army conducted LUT 10 in accordance with a DOT&E-approved Test and Evaluation Master Plan at White Sands Missile Range, New Mexico, in September 2010.
- LUT 10 was the second operational test of the SUGV and was intended to assess progress in SUGV operational effectiveness and suitability. During LUT 10, an infantry battalion consisting of two infantry companies equipped with the SUGV executed a series of offensive, defensive, and stability missions during three 96-hour scenarios.
- The results of LUT 10 will be used to inform a Defense Acquisition Board (DAB) decision whether to purchase additional SUGVs in LRIP or not.

Assessment

- Reliability test results from contractor/government developmental test (TT-1) indicate that the SUGV showed notable improvements in reliability. During TT-1, the SUGV exceeded system requirements for Mean Time Between System Aborts (MTBSA), with a point estimate of 339 hours compared to a requirement of 42 hours.
- The SUGV also met reliability requirements regarding Mean Time Between Effective Function Failures (MTBEFF), with a point estimate of 117 hours compared to a requirement of 21 hours. EFFs are less severe failures than system aborts, representing a degradation in system performance as opposed to rendering the system unusable.
- Developmental testing reliability results tend to be better than operational testing results. Generally, operational testing is conducted in a more complex and demanding environment than that found in developmental testing.
- The test unit successfully employed the SUGV in support of a range of tactical missions.
- In LUT 10, the SUGV exceeded its reliability requirements, with a MTBSA of 178 hours against a requirement of 42 hours, and a MTBEFF of 178 hours against a requirement of 21 hours.
- The test unit did not send tactical images over the network. Setting up the gateway and Network Integration Kit (NIK) was time-consuming and impractical in most operations. During LUT 10, the test unit set up the gateway during 4 of 35 taskings, and sent only one image to a NIK throughout the test.

Recommendations

- Status of Previous Recommendations. The FY09 recommendation for the E-IBCT program to improve the line-of-sight communications range between the SUGV operator and the robotic vehicle remains valid. The SUGV communications range requirement of 1,000 meters, if met, would be satisfactory for effective SUGV employment.
- FY10 Recommendation.
  1. The Army should continue to improve the SUGV based on lessons learned in LUT 10. Improvements should include a tether to extend SUGV range and to retrieve SUGV in confined spaces.

Early Infantry Brigade Combat Team (E-IBCT) Class 1 Block 0 Unmanned Aircraft System (UAS)

Executive Summary

- The Under Secretary of Defense for Acquisition, Technology, and Logistics (USD (AT&L)) granted Milestone C approval for Early Infantry Brigade Combat Team (E-IBCT) Increment 1 on December 24, 2009. The decision included approval for Low-Rate Initial Production (LRIP) of equipment for one E-IBCT.
- The Class 1 Block 0 Unmanned Aircraft System (UAS) is one of the planned E-IBCT Increment 1 capabilities.
- The Army has undertaken an extensive corrective action program to fix the failure modes discovered during FY09 testing and to increase reliability of the Class 1 Block 0 UAS.
- The Army Test and Evaluation Command (ATEC) conducted a Limited User Test (LUT 10) at White Sands Missile Range, New Mexico, in September 2010. LUT 10 was the second operational test of the E-IBCT systems and was intended to assess progress in E-IBCT operational effectiveness and suitability in a realistic operational environment.
- Based upon analyses of the results from LUT 10, DOT&E's current assessment of the Class 1 Block 0 UAS is that it did not demonstrate an adequate level of performance to be fielded to units and deployed in combat.

System

- The Class 1 Block 0 UAS design originates from the gasoline Micro Air Vehicle developed by the Defense Advanced Research Projects Agency.
- The Army intends to employ the Class 1 Block 0 UAS at the company/platoon level.
  - The Army intends the system to be man-portable in two custom Modular Lightweight Load-carrying Equipment packs weighing no more than 56 pounds each.
  - The flight endurance time is 40 minutes with a forward airspeed of up to 40 knots.
  - The aircraft can be launched in winds up to 15 knots and once airborne, operate in winds up to 20 knots at an altitude of 500 feet above ground level with a range of 4 kilometers.
- The Class 1 Block 0 UAS consists of an aircraft with a five horsepower gasoline-fueled ducted fan engine, a ground data terminal, an operator control unit, gimbaled payloads (electro-optical or infrared), avionics pod, digital data link radios, electric fueler, and support equipment.
- The electro-optical pod and infrared pod payloads are interchangeable sensors. The Class 1 Block 0 Aircraft can carry one sensor at a time.
- The Class 1 Block 0 UAS takes off and lands vertically, and once airborne, uses both autonomous and manual flight mode navigation.

Mission

Companies and platoons employ the Class 1 Block 0 UAS to conduct reconnaissance, surveillance, target acquisition, and force protection missions in support of operations in open, rolling, under-canopy terrain, and urban environments.

Major Contractors

- Prime/Lead System Integrator for E-IBCT: The Boeing Company, Integrated Defense Systems – St. Louis, Missouri
- Class 1 Block 0 UAS: Honeywell, Aerospace Division – Albuquerque, New Mexico

Activity

- The USD (AT&L) granted Milestone C approval for Early Infantry Brigade Combat Team (E-IBCT) Increment 1 on December 24, 2009. The decision included approval for Low-Rate Initial Production (LRIP) of equipment for one E-IBCT. As part of this decision, USD (AT&L) directed a second Defense Acquisition Board (DAB) be scheduled for December 2010 for an LRIP decision for the remainder of the E-IBCT program.
- The Class 1 Block 0 UAS is one of the planned E-IBCT Increment 1 capabilities.

- Since the Milestone C decision, the E-IBCT program has pursued an intensive effort to fix reliability deficiencies for all E-IBCT systems that were identified in operational and developmental testing in 2009. The program conducted Technical Test 1 (TT-1), a contractor/government developmental test, in July 2010 at White Sands Missile Range, New Mexico, to assess improvements in reliability.
- ATEC conducted LUT 10 at White Sands Missile Range, New Mexico, in September 2010 in accordance with the DOT&E-approved test plan. LUT 10 was the second operational test of the E-IBCT systems and was intended to assess progress in E-IBCT operational effectiveness and suitability in a realistic operational environment. During LUT 10, an infantry battalion consisting of two infantry companies equipped with E-IBCT systems executed a series of offensive, defensive, and stability missions during three 96-hour scenarios. The results of LUT 10 will be used to inform a DAB decision to purchase an additional two E-IBCTs as part of LRIP.

Assessment

- The Class 1 Block 0 has the capability to vertically launch, hover, and stare, and is best suited for complex urban terrain.
- During TT-1, the Class 1 Block 0 UAS demonstrated 107 hours Mean Time Between System Abort (MTBSA), exceeding its requirement of 23 hours MTBSA. It demonstrated 9.73 hours Mean Time Between Effective Function Failures (MTBEFF), not meeting its requirement of 11 hours MTBEFF. Effective Function Failures are less severe than system aborts, representing degradation in system performance as opposed to rendering the system unusable. The MTBEFF results reflect the program's priority on fixing the system aborts, which are the most serious failure modes.
- During LUT 10, the Class 1 Block 0 UAS provided some reconnaissance and surveillance support demonstrating limited tactical utility. The system's most significant contributions came during defensive operations. The air vehicle flight and sensor performance met most user requirements. Class 1 Block 0 UAS has limited range and endurance and is not reliable. Class 1 Block 0 UAS reliability demonstrated during the LUT (3.11 hours MTBSA and 2.57 MTBEFF) is well short of user threshold requirements (23 hours MTBSA and 11 hours MTBEFF), and has demonstrated little improvement over last year's LUT 09 performance (1.5 MTBSA and 1.47 MTBEFF).
- During LUT 10, the Class 1 Block 0 UAS experienced 19 system aborts. Three (16 percent) may be attributed to lost link and four (21 percent) to the fuel system design and fueling procedures. The lost link failures may be due to a loss of line-of-sight capability between the aircraft and the Ground Data Terminal. The four fueling-related failures corresponded with four aircraft crashes, potentially because there is no fuel gauge or fuel level sight glass on the aircraft. When preparing an aircraft for launch, the operator must know how much fuel is in the aircraft and manually adjust the starting fuel level within the operator control unit (OCU). The OCU then calculates the remaining fuel on board during the flight. Because the aircraft does not have a fuel gauge or fuel level sight glass and the operator must manually enter the amount of fuel estimated to be in the aircraft, the aircraft may be launched with less or more fuel on board than the operator believes.
- During LUT 10, the unit did not employ the system as a man-portable, on-the-move system, as the Army operational concept intends. The system is heavy, bulky, and hard to transport and was never backpacked during the LUT.
- System set-up to pass images through the Network Integration Kit is time-consuming and was not used with regularity during LUT 10. File compression of images taken by the Class 1 Block 0 to facilitate passage through the network degrades image quality.
- The Army has not reduced the acoustic signature of the aircraft. The Class 1 Block 0 UAS can be heard and seen from 2 and 4 kilometers respectively.
- Reliability and durability of the aircraft continues to be poor.
- Based upon analysis of the results from LUT 10, DOT&E's current assessment of the Class 1 Block 0 UAS is that it did not demonstrate an adequate level of performance to be fielded to units and deployed in combat.

Recommendations

- Status of Previous Recommendations. The Army addressed two of the six FY09 recommendations. Recommendations concerning assessing manpower requirements of the system and whether or not assigning it as a battalion asset, rather than a company/platoon level asset, would be more effective and suitable; reducing the acoustic and visual signature of the aircraft; improving the reliability and durability of the aircraft; and reducing the weight of the electric fueling system remain.
- FY10 Recommendations. The Army should:
  1. Improve the range, endurance, and reliability of the Class 1 Block 0 UAS.
  2. Reduce the aural signature of the aircraft.
  3. Consider including a telescopic Ground Data Terminal antenna to improve line-of-sight capability between the aircraft and the Ground Data Terminal.
  4. Consider a sight glass or fuel gauge capability for fueling the UAS.
  5. Consider reducing the weight of the Class 1 Block 0 UAS to improve the transportability of the system in the backpack configuration.
  6. Improve the capability to pass images through the network without degrading image quality.

Early Infantry Brigade Combat Team (E-IBCT) Unattended Ground Sensors (UGS)

Executive Summary

- Based on lessons learned from the LUT 09, the contractor made several improvements to tactical and urban Unattended Ground Sensors (UGS).
- In 2010, the Army conducted developmental testing and a Limited User Test (LUT) of the UGS at White Sands Missile Range, New Mexico.
- During LUT 10, the UGS demonstrated little tactical utility, providing little useful tactical intelligence to the test unit.

System

- Early Infantry Brigade Combat Team (E-IBCT) Increment 1 has two unattended ground sensors employed at the platoon and company level, Tactical-UGS (T-UGS) and Urban-UGS (U-UGS). These are designed to be capable of target detection, location, and classification. UGS include acoustic, seismic, magnetic, electro-optical/infrared, and radiological/nuclear sensors.
- T-UGS systems are self-organizing networks of remotely-deployed, long-range sensors designed to enhance perimeter defenses of forward operating bases and other tactical locations. They are meant to provide a gateway for transmission of information to the tactical network and fusion of data from its various sensors.
- T-UGS include intelligence, surveillance, and reconnaissance sensors, radiological and nuclear sensors, and electro-optical/infrared sensors. T-UGS are hand-emplaced and hand-retrieved at the end of missions.
- T-UGS improvements for LUT 10 include improved cable connectors, a swivel mount for the Passive Infrared (PIR) sensor, improved Soldier transport, and an additional seismic spike strap.
- U-UGS are small, leave-behind imaging and intrusion detection sensors (similar to commercial burglar alarms) that are used in buildings, caves, or tunnels. Information is transmitted to the tactical network via a gateway.
- U-UGS improvements for LUT 10 include a higher-resolution camera, improved multipurpose adhesive pads, better message completion rate, improved Soldier transport, and a new form factor gateway.

EO/IR - Electro-optic/Infrared
ISR - Intelligence, Surveillance, and Reconnaissance
RN- Radiological Nuclear
TEMS - Tactical Employment Mast System

Mission

Infantry companies and platoons use UGS to enhance remote perimeter defense, surveillance, target acquisition, situational awareness, and detection of radiological and nuclear contamination.

Major Contractor

Textron Defense Systems – Wilmington, Massachusetts

Activity

- The Under Secretary of Defense for Acquisition Technology and Logistics approved a Milestone C decision for E-IBCT Increment 1, including T-UGS and U-UGS, on December 24, 2009.
- The Army conducted Technical Test 1 (TT-1), a developmental test conducted at White Sands Missile Range, New Mexico, in July 2010 to assess improvements in UGS performance and reliability.

- The Army conducted LUT 10 in accordance with a DOT&E-approved Test and Evaluation Master Plan at White Sands Missile Range, New Mexico, in September 2010.
- LUT 10 was the second operational test of the UGS systems, and was intended to assess progress in UGS operational effectiveness and suitability. During LUT 10, an infantry battalion consisting of two infantry companies equipped with the UGS executed a series of offensive, defensive, and stability missions during three 96-hour scenarios.
- The results of LUT 10 will be used to inform a Defense Acquisition Board (DAB) decision whether to purchase additional UGS systems in the low-rate initial production (LRIP) phase or not.

Assessment

- Reliability test results from TT-1 indicate that both T-UGS and U-UGS showed notable improvements. During TT-1, the T-UGS exceeded system requirements for Mean Time Between System Aborts (MTBSA), achieving a point estimate of 595 hours compared to a requirement of 127 hours. The T-UGS also met reliability requirements regarding Mean Time Between Effective Function Failures (MTBEFF), achieving a point estimate of 46 hours compared to a requirement of 32 hours.
- The U-UGS also exceeded system requirements for MTBSA, achieving a point estimate of 503 hours compared to a requirement of 105 hours. U-UGS did not meet MTBEFF reliability requirements, achieving a point estimate of 21 hours compared to a requirement of 26 hours. Effective Function Failures (EFFs) are less-severe failures than system aborts, representing a degradation in system performance as opposed to rendering the system unusable.
- Developmental testing reliability results tend to be better than operational testing results. Generally, operational testing is conducted in a more complex and demanding operating environment than that found in developmental testing.
- During LUT 10, the T-UGS and U-UGS demonstrated little tactical utility, providing little useful tactical intelligence to the test unit.
- T-UGS and U-UGS imposed a significant burden on the test unit to emplace, operate, and retrieve the systems. Both systems are heavy, limited to line-of-sight, have difficulty connecting to the E-IBCT Network Integration Kit, and provide limited tactical utility in most operations.
- Images from T-UGS and U-UGS were often dark, blurry, and unusable.
- T-UGS and U-UGS were difficult to conceal in realistic tactical settings.
- During LUT 10, the T-UGS and the U-UGS met reliability requirements:
  - T-UGS demonstrated a MTBSA of 308 hours against a requirement of 127 hours, and a MTBEFF of 308 hours against a requirement of 32 hours.
  - U-UGS demonstrated a MTBSA of 157 hours against a requirement of 105 hours, and a MTBEFF of 79 hours against a requirement of 26 hours.
- The effectiveness of the UGS systems is dependent upon the availability of production-representative Joint Tactical Radio System (JTRS) radios, corresponding waveforms, and network management tools (to be provided by the JTRS program).

Recommendations

- Status of Previous Recommendations. The Army satisfactorily addressed the previous recommendations.
- FY10 Recommendations. None.

Enhanced AN/TPQ-36 Radar System (EQ-36)

Executive Summary

- The program conducted three Capability and Limitation (C&L) test events of the Quick Reaction Capability (QRC) EQ-36 Radar at Yuma Proving Ground, Arizona, from December 2009 to July 2010 to support radar fielding. The testing focused on target acquisition message processing with the Advanced Field Artillery Tactical Data System, integration with the Counter Rockets, Artillery, and Mortars system, and improvements made to system software.
- During the C&L test event conducted in July 2010, the QRC EQ-36 Radar system demonstrated poor reliability and performance. The radar experienced system aborts every 49 hours against a requirement of one system abort every 185 hours.
- The Army has fielded ten QRC EQ-36 radars to Brigade Combat Teams (BCTs) at Fort Hood, Texas; Fort Polk, Louisiana; Fort Knox, Kentucky; Fort Wainwright, Alaska; Fort Bragg, North Carolina; Fort Drum, New York; Fort Riley, Kansas; and Fort Carson, Colorado.
- The program will conduct a Source Selection Evaluation Board (SSEB) process from 3QFY11 through 4QFY11. The SSEB is intended to select a single contractor to move forward with the qualification and initial production of the EQ-36 Program of Record radar.

- The EQ-36 is transportable by C-17 aircraft, with battlefield mobility provided by two Family of Medium Tactical Vehicles (FMTVs) and operated by a crew of four Soldiers.
- The Army is developing and fielding 38 QRC EQ-36 radars to support an Urgent Material Request. Fielding to Central Command will begin by the end of 2010.
- The Army will select a contractor to produce the remaining 136 Program of Record EQ-36 radars based on the results of the SSEB in 4QFY11.

System

- The EQ-36 is a mobile radar system designed to detect, classify, and track projectiles fired from mortar, artillery, and rocket systems using a 90-degree or continuous 360-degree search sector.
- The radar will provide command and control nodes with targetable data against indirect fire systems with sufficient accuracy for effective counterfire.
- The system is designed to operate with the Indirect Fire Protection Capability System of Systems, providing accurate targeting data for the Counter Rockets, Artillery, and Mortars system.
- The Army intends to field the EQ-36 to the sensor platoons in BCTs and Fire Brigades to replace the current AN/TPQ-36 and AN/TPQ-37 Firefinder Radars.

Mission

Field Artillery units use the EQ-36 radar to protect friendly forces by detecting incoming rockets, artillery, and mortars by providing timely and accurate target location data for counter-fire engagements to defeat enemy indirect fire capabilities.

Major Contractors

- QRC EQ-36: Lockheed Martin Missile Systems and Sensors – Syracuse, New York
- The Army will determine the Program of Record EQ-36 contractor in FY11.

Activity

Quick Reaction Capability EQ-36 Radar

- In FY08, the Army approved an Operational Needs Statement for 12 QRC EQ-36 radar systems to support Operation Iraqi Freedom. Between October 2009 and June 2010, the Army approved procurement of 38 QRC EQ-36 systems to support combat operations.
- The program conducted two QRC EQ-36 Radar C&L test events at Yuma Proving Ground, Arizona, in December 2009 and January 2010. The testing focused on target acquisition message processing with the Advanced Field Artillery Tactical Data System and the QRC EQ-36 radar's ability to interface with the Counter Rockets,

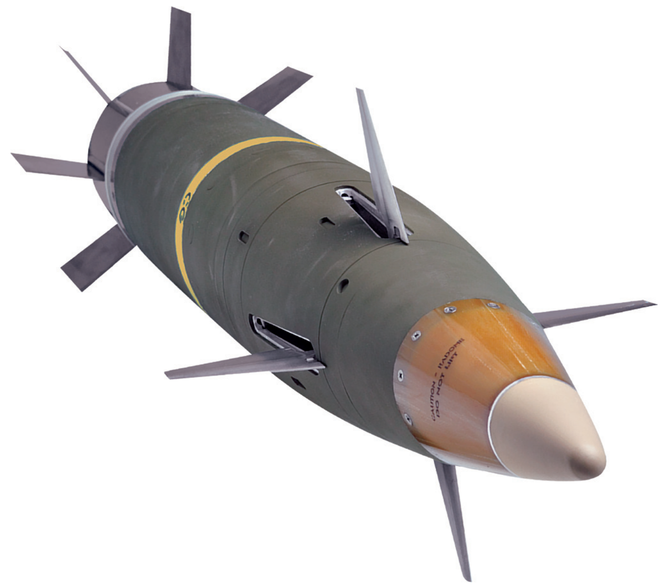
Artillery, and Mortars system. The program completed a third C&L test event in July 2010 to evaluate improved software for interfacing with the Counter Rockets, Artillery, and Mortars system.
- The Army has fielded ten QRC EQ-36 radars to Brigade Combat Teams (BCTs) at Fort Hood, Texas; Fort Polk, Louisiana; Fort Knox, Kentucky; Fort Wainwright, Alaska; Fort Bragg, North Carolina; Fort Drum, New York; Fort Riley, Kansas; and Fort Carson, Colorado.

Program of Record EQ-36 Radar
- In November 2009, the Program Executive Office reported the EQ-36 program achieved Milestone C in July 2008 and entered the Production and Deployment phase of the Acquisition Management System.
- In April 2010, the Milestone Decision Authority (MDA) approved the EQ-36 Acquisition Strategy.
- The Army approved the EQ-36 Radar Capabilities Production Document in 4QFY10.
- The Army plans to deliver the Test and Evaluation Master Plan for DOT&E approval in February 2011.
- In July 2010, the Army redesignated the program as an Acquisition Category (ACAT) II with receipt of additional research, development, testing, and evaluation funding. The MDA remains with the Program Executive Office Intelligence, Electronic Warfare, and Sensors.
- The program will conduct an SSEB process from 3QFY11 through 4QFY11. The SSEB is a full and open competition to select a single contractor to move forward with the qualification and initial production of the EQ-36 Program of Record.
- The SSEB includes a Live Ammunition System Demonstration at Yuma Proving Ground, Arizona. The Live Ammunition System Demonstration will compare the operational, live fire acquisition, and communication capabilities of the competing systems to the requirements of the full-rate system requirements. The Live Ammunition System Demonstration will support the first low-rate initial production decision of the Program of Record EQ-36 Radars.

Assessment
- During the January 2010 C&L test event, the QRC EQ-36 radar had difficulty detecting and accurately locating certain types of rockets and artillery rounds. The radar demonstrated integration difficulties with the Counter Rockets, Artillery, and Mortars system.
- Following the C&L testing, the Army identified several system deficiencies and took corrective actions to address performance, reliability, and integration with the Counter Rockets, Artillery, and Mortars system.
- The QRC EQ-36 Radar demonstrated performance improvements in the July 2010 C&L testing with the Counter Rockets, Artillery, and Mortars system integration. Reliability remains poor and below requirements.

Recommendations
- Status of Previous Recommendations. This is the first annual report for this program.
- FY10 Recommendations. The Army should:
  1. Develop a comprehensive reliability growth plan with achievable reliability growth expectations. Add dedicated reliability testing to the program schedule.
  2. Increase the operational realism of the Live Ammunition System Demonstration. The event supports the downselect to a single radar contractor and the first low-rate production decision for the Program of Record EQ-36 Radar.
  3. Continue thorough testing of each QRC EQ-36 software update.

Excalibur XM982 Precision Engagement Projectiles



Executive Summary

- The Army conducted the Excalibur Increment Ia-2 Initial Operational Test (IOT) at White Sands Missile Range, New Mexico, in February 2010 in accordance with DOT&E-approved test plans.
- Excalibur Increment Ia-2 is operationally effective and lethal. Excalibur Increment Ia-2 projectiles provide increased accuracy against point targets compared to unguided high-explosive artillery fires.
- Excalibur Increment Ia-2 allows cannon artillery units to effectively engage more point targets with better effects using fewer projectiles in complex urban terrain where standard unguided high-explosive projectiles cannot be used because of their ballistic dispersion.
- Overall, Excalibur Increment Ia-2 is operationally suitable. The projectile is reliable when fired with Modular Artillery Charge System (MACS) propellant charges 3 and 4, but is not reliable when fired with MACS propellant charge 5. Reliability shortfalls with MACS propellant charge 5 can be mitigated using straightforward tactics, techniques, and procedures.
- In August 2010, the Army selected Raytheon Missile Systems as the single contractor to move forward with the qualification and initial production of the Increment Ib projectile.

System

- Excalibur is a family of precision-guided, extended-range, 155-millimeter artillery projectiles.
- The Army is developing the high explosive, fragmenting projectiles (Block I) in three increments of increasing capability (Ia-1, Ia-2, and Ib).
- The projectiles are fin-stabilized and glide to their target. The Ia-1 projectiles use aerodynamic lift generated by canards to extend range out to 24 kilometers. The Ia-2 projectiles add base bleed technology to further increase range to beyond 30 kilometers. The Army intends the Increment Ib projectiles to reduce costs and improve projectile accuracy, range, and reliability.
- All variants use GPS and an Inertial Measurement Unit (IMU) to attack point targets with accuracy of less than 20 meters from the desired aim point.

Mission

- Field Artillery units use Excalibur to attack enemy targets in support of maneuver operations at a greater range and with increased accuracy than standard high-explosive munitions.
- Field Artillery units use Excalibur to support the close fight in urban and complex environments, striking critical targets that must be engaged at extended ranges or in areas where minimal collateral damage is desired.

Major Contractor

Raytheon Missile Systems – Tucson, Arizona

Activity

Increment Ia-1

- The Army continued fielding of Increment Ia-1 projectiles to Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) in September 2009 following the replacement of IMUs in the FY07 production lots.
- Paladin-equipped units in OIF have been using Excalibur since May 2007 to engage targets. As of October 2010, Field Artillery units have fired 87 projectiles with reported accuracy better than 10 meters and 87 percent reliability.
- M777A2 Lightweight 155 mm Howitzer-equipped artillery units have been using Excalibur in OEF since February 2008. As of October 2010, they have fired 115 projectiles with 87 percent reliability.

Increment Ia-2

- The Army conducted the Excalibur Increment Ia-2 Initial Operational Test (IOT) at White Sands Missile Range, New Mexico, in February 2010 in accordance with DOT&E-approved test plans.
- DOT&E completed an OT&E and LFT&E report in support of the Army's 2QFY11 full-rate production decision.
- The Army Vice Chief of Staff Capability Portfolio Review reduced the Increment Ia-2 procurement objective from 30,000 to 6,246 projectiles. This reduction caused a Nunn-McCurdy cost breach that delayed the Increment Ia-2 full-rate production decision from August 2010 to February 2011.
- The Army notified Congress of the Nunn-McCurdy breach in August 2010 and the program plans to complete recertification in January 2011.

Increment Ib

- The Army awarded two design and maturation contracts for full and open competition for Excalibur Increment Ib, in September 2008. The goal of the program is to reduce unit price and increase reliability.
- The companies evolved their proposed concepts and demonstrated them in a side-by-side live firing event in June and July 2010.
- In August 2010, the Army selected Raytheon Missile Systems as the single contractor to move forward with the qualification and initial production of the Increment Ib projectile. The Increment Ib Milestone C is scheduled for 3QFY12.

Assessment

Increment Ia-1

- Fielding Excalibur projectiles to artillery units in OIF in 2007 and OEF units in February 2008 has enhanced their ability to accurately strike targets while minimizing collateral damage. Army reporting from theater, reviewed by DOT&E, shows Increment Ia-1 has proven effective in combat even with limitations on its operational employment.

Increment Ia-2

- Excalibur Increment Ia-2 is operationally effective and lethal. Excalibur Increment Ia-2 achieved effects on 17 of 21 missions with a median miss distance of 3 meters for all reliable rounds during the IOT.
- Excalibur Increment Ia-2 is more lethal against personnel targets and some light material targets than standard high-explosive projectiles.
- Excalibur Increment Ia-2 is operationally suitable. The projectile is reliable when fired with MACS propellant charges 3 and 4, but is not reliable when fired with MACS propellant charge 5. As demonstrated in the IOT, nine of 18 projectiles fired with MACS propellant charge 5 were not reliable and did not reach their target.
- The reduced reliability with MACS propellant charge 5 has minimal operational impact dependent upon the friendly forces locations and theater Rules of Engagement. Field Artillery units can achieve 98 percent of the 30-kilometer threshold range by using MACS propellant charge 4. The Army has updated their tactics, techniques, and procedures to account for the lower reliability when firing MACS propellant charge 5.
- Excalibur Increment Ia-2 demonstrated poor reliability in extreme cold temperatures (-45 degrees Fahrenheit).
- Operational testing demonstrated unit leaders can use the command and control (C2) software to employ Excalibur Increment Ia-2. Current Forward Observer System C2 software does limit observer data entries when using Excalibur Increment Ia-2 against a single target with multiple aimpoints, resulting in increased fire mission processing timelines.
- Developmental and operational testing confirmed that with accurate target location, Excalibur Increment Ia-2 can meet its effectiveness requirements against countermeasured targets.

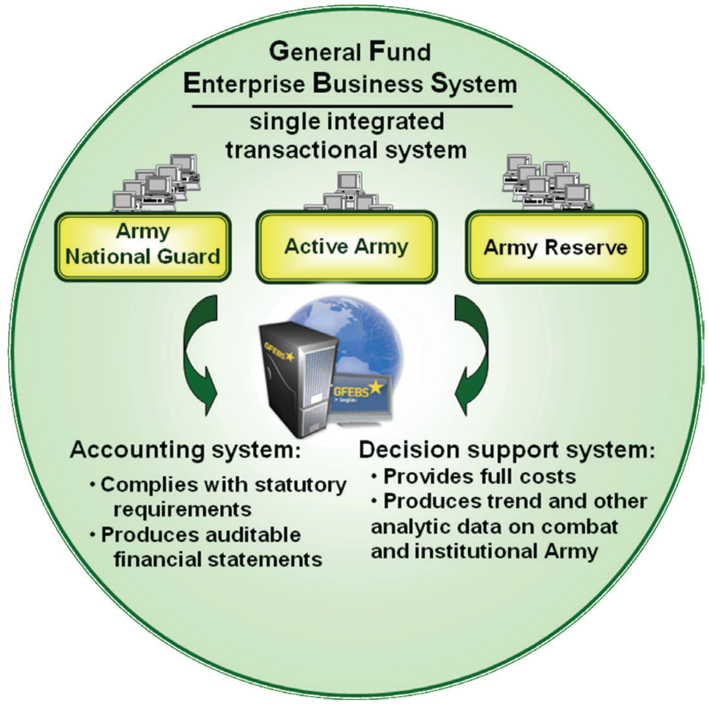
Recommendations

- Status of Previous Recommendations. The Army satisfactorily addressed all previous recommendations.
- FY10 Recommendations. The Army should:
  1. Improve Excalibur reliability with MACS propellant charge 5 during Increment Ib development in order to effectively achieve the objective range of 40 kilometers.
  2. Revise Forward Observer System and Advanced Field Artillery Tactical Data System software to incorporate a message format that accommodates multiple aimpoints for single calls for fire to reduce fire mission processing times.
  3. Continue testing Increment Ia-2 to determine Excalibur reliability at cold temperatures (between -45 degrees Fahrenheit and 0 degrees Fahrenheit).

General Fund Enterprise Business System (GFEBS)

Executive Summary

- The Army Test and Evaluation Command (ATEC) completed an IOT&E of Release 1.3 during June 29 through August 7, 2009. Based on the IOT&E results, DOT&E assessed General Fund Enterprise Business System (GFEBS) Release 1.3 as operationally effective with limitations, not suitable, and not survivable.
- While GFEBS Release 1.3 delivered the core financial management capabilities required by the Defense Finance and Accounting Service (DFAS) Guide to Federal Requirements for Financial Management Systems, it did not provide accurate and timely financial information for the Army leadership and could not support an unqualified financial opinion.
- Following correction of IOT&E deficiencies, ATEC completed a Limited User Test (LUT) of Release 1.4.1 from June 28 to August 10, 2010. The primary objectives of the LUT were to verify the fixes for Release 1.3 deficiencies and to evaluate new functionality. Based on the LUT results, DOT&E assessed GFEBS Release 1.4.1 as operationally effective, suitable, and survivable; but with limitations in all three areas.



System

- GFEBS is a Major Automated Information System for administering and managing the Army's general funds.
- GFEBS is designed to provide web-based real-time transactions and information accessible by all Army organizations worldwide, including the Army National Guard and the Army Reserve.
- GFEBS is intended to allow the Army to meet the requirements of the Federal Financial Management Improvement Act of 1996 and the Defense Finance and Accounting Service Guide to Federal Requirements for Financial Management Systems (the Blue Book).
- GFEBS has four software releases:
  - Release 1.1, which provided Real Property Inventory functionality, was developed for a technology demonstration only.
  - Release 1.2, the first fieldable release, was developed for a limited deployment at Fort Jackson, South Carolina, to replace the legacy Standard Finance System.
  - Release 1.3 provided additional capabilities to support a majority of the Army financial management functions.
  - Release 1.4 will provide full system capability and be fielded Army-wide.

Mission

- Army financial managers will use GFEBS to compile and share accurate, up-to-the-minute financial management data across the Army.
- The Army and DoD leadership will use GFEBS to access standardized, real-time financial data and information to make sound strategic business decisions.
- The Army will use GFEBS to satisfy congressional and DoD requirements for auditing of funds, standardization of financial ledgers, timely reporting, and reduction in costly rework.

Major Contractor

Accenture – Reston, Virginia

Activity

- ATEC completed an IOT&E of Release 1.3 from June 29 through August 7, 2009, at Fort Stewart, Georgia; Fort Benning, Georgia; Fort Jackson, South Carolina; Fort Monroe, Virginia; DFAS Indianapolis, Indiana; DFAS Rome, New York; Fort McPherson, Georgia; and Washington, D.C.
- ATEC also completed a LUT of Release 1.4.1 from June 28 through August 10, 2010, at Fort Benning, Georgia; Fort Bragg, North Carolina; Fort Campbell, Kentucky; Fort Jackson, South Carolina; Fort McPherson, Georgia; Fort Monroe, Virginia; Fort Stewart, Georgia;

Redstone Arsenal, Alabama; DFAS Rome, New York; DFAS Indianapolis, Indiana; and Army Installation Management Command headquarters plus other agencies in the Washington, D.C. area. The primary objectives of the LUT were to verify fixes of the deficiencies identified during the IOT&E and to evaluate new functionality provided in Release 1.4.1.
- ATEC conducted all testing in accordance with the DOT&E-approved Test and Evaluation Master Plan and Operational Test Agency Test Plan.

Assessment

- Based on the IOT&E results, DOT&E assessed GFEBS Release 1.3 as operationally effective with limitations, not suitable, and not survivable.
- While GFEBS Release 1.3 delivered the core financial management capabilities required by the DFAS Guide to Federal Requirements for Financial Management Systems, it did not provide accurate and timely financial information for the Army leadership and could not support an unqualified financial opinion. In addition, thousands of unmatched disbursements were reported during the IOT&E.
- The LUT results showed that GFEBS Release 1.4.1 was operationally effective, suitable, and survivable; but with limitations in all three areas.
- Users were able to accomplish their mission tasks with significantly higher success rates than before. Proficiency for the initial users seemed to have improved since the IOT&E in 2009. However, new users did not perform as well.
- The security posture of the system also improved. During the penetration testing, the Program Management Office staff and the Computer Emergency Response Team provided accurate and timely notifications of detectable scans and unauthorized actions.
- While system performance improved in most areas, several deficiencies remain:
  - The training program did not provide sufficient and specific instructions for users to understand how to perform their tasks using the system.
  - Users continued to have difficulties formatting and printing reports that met their needs. In addition, reports provided to Army leadership were not always accurate and timely and did not support unqualified audit opinions.
  - The large number of unmatched disbursements and manual workarounds significantly increased the user workload and temporary manpower requirements. Reduction of unmatched disbursements requires collaboration with external systems that provide transactional data to GFEBS.
  - Interoperability issues with the Defense Medical Logistics Standard Support System affected the operations of Medical Treatment Facilities and caused significant workload increase for the Army Medical Command.
  - The change management process to transition users from the legacy system to GFEBS, including training, needs improvement. Many users did not fully understand the GFEBS capabilities associated with the roles assigned to them and could not effectively perform their assigned roles after the transition.

Recommendations

- Status of Previous Recommendations. The program has made satisfactory progress on four of the five previous recommendations. The one remaining recommendation to improve training is still valid and requires additional attention.
- FY10 Recommendations. The Program Management Office should:
  1. Improve the GFEBS reporting capability to meet the user and Army leadership needs.
  2. Develop additional automated tools and continue working with partner systems to reduce the number of unmatched disbursements.
  3. Reduce the number of manual workarounds to reduce user workload.
  4. Work with external interface systems to improve interoperability.
  5. Team with functional sponsors to improve the transition process to increase productivity.

M855A1 Lead-Free 5.56 mm Cartridge

Executive Summary
- M855A1 completed LFT&E, including an investigation to fully understand and correct problems with the projectile's trajectory observed during FY09 operational testing at high temperatures.
- M855A1 is lethal.
- The Army authorized fielding in June 2010.

System
- The M855 A1 program evolved from an Army Armament Research, Development, and Engineering Center, Picatinny, New Jersey, program titled "Green Ammunition."
- The objectives of the Green Ammunition program are to reduce lead contamination on training ranges and reduce the lead hazard from the manufacturing environment while maintaining the performance of the current M855 cartridge. While the Green Ammunition program will produce other calibers of ammunition, the 5.56 mm projectile was the first to be developed due to its extensive use.
- The M855A1 cartridge is compatible with the M4 and M16 family of weapons, as well as the M249 Squad Automatic Weapon. This new cartridge is intended to be a direct replacement for the currently fielded M855 cartridge.
- The M855A1 is a three-part projectile consisting of a steel penetrator, a copper slug, and a reverse-drawn copper jacket.

Mission
Forces equipped with weapons that fire the M855A1 will engage enemy combatants during tactical operations in accordance with applicable tactics, techniques, and procedures.

Major Contractor
Alliant-Techsystems, Small Caliber Systems – Independence, Missouri

Activity
- During high temperature operational testing in FY09, the Army observed flight stability problems with the M855A1 projectile. The Army attributed the anomaly to the thermal behavior of the projectile's slug (the material used to fill the rear portion of the projectile) at high temperatures.
  - The Army Program Manager for Maneuver Ammunition Systems; the Army Research Laboratory's Weapons and Materials Research Directorate; the Army Armament Research, Development, and Engineering Center's Munitions Systems and Technical Directorate; and the prime manufacturer subsequently developed a material change to the projectile to address the anomaly.
  - The Army conducted additional validation testing in FY10 to verify that the material change adequately addressed the trajectory anomaly and to assure the lethality of the cartridge was maintained.
  - The Army approved fielding of the M855A1 as an Enhanced Performance Round via Engineering Change Proposal to the M855 in June 2010.
- DOT&E published a classified lethality report for the M855A1 in October 2010.

Assessment
The M855A1 demonstrated adequate performance and lethality.

Recommendations
- Status of Previous Recommendations. The Army satisfactorily addressed the FY09 recommendation.
- FY10 Recommendations. None.

MQ-1C Gray Eagle
(formerly Extended Range Multi-Purpose (ERMP))
Unmanned Aircraft System (UAS)

Executive Summary
- The Secretary of the Air Force approved renaming the MQ-1C Mission Design Series aircraft from Extended Range Multi-Purpose (ERMP) to Gray Eagle on August 19, 2010.
- In response to the Secretary of Defense's directive to increase intelligence, surveillance, and reconnaissance support in Iraq and Afghanistan, the Army is deploying two early versions of the Gray Eagle Unmanned Aircraft System (UAS) for operational use.
- Deployment of the Gray Eagle Quick Reaction Capability 1 and 2 (QRC 1 and 2) is taking place prior to completion of IOT&E and the full-rate production decision. The QRC 1 unit completed deployment in August 2009. The Army conducted a Limited User Test (LUT) of the QRC 2 capability in conjunction with training for unit deployment to Afghanistan from May to June 2010 and deployed the QRC 2 unit in 1QFY11.
- DOT&E completed an Operational Assessment in January 2010 supporting the Gray Eagle program of record Milestone C decision and an additional Operational Assessment in August 2010 assessing the QRC 2 unit's ability to accomplish its wartime mission based on its performance demonstrated during the LUT.

System
- The QRC 2 UAS is an early version of the Gray Eagle UAS program of record system.
- The QRC 2 unit has 17 military personnel and 29 Contractor Field Service Representatives.
- The Gray Eagle QRC 2 system consists of the following major components:
  - Four unmanned aircraft each with an AN/DAS-2 electro-optical/infrared with a Laser Range Finder/Laser Designator payload, and a Lynx II Synthetic Aperture Radar/Ground Moving Target Indicator (SAR/GMTI) sensor payload
  - Each aircraft has the ability to carry up to four Hellfire P+ missiles
  - Two Ground Control Stations designated as the One System Ground Control Station (OSGCS)

  - Two Tactical Common Data Links/Ground Data Terminals
  - One Satellite Communications Ground Data Terminal
  - An Automatic Take-off and Landing System (ATLS)
  - One General Atomics "Legacy" Ground Control Station with two C-Band Ground Data Terminals
- The QRC 2 system uses the "Legacy" MQ-1 Predator Ground Control Station for all ground and maintenance operations, as well as in case of emergency, loss of data link, or malfunction of the Automated Take-off and Landing System.

Mission
- The QRC 2 unit is to provide 22 hours of mission support per day conducting reconnaissance, surveillance, target acquisition, armed reconnaissance, attack, and communications relay to supported units, operating day and night based on the commander's priorities and scheme of maneuver.
- The QRC 2 unit is able to autonomously and cooperatively employ Hellfire missiles.

Major Contractor
General Atomics Aeronautical Systems, Inc., Aircraft Systems Group – Poway, California

Activity
- The Secretary of the Air Force approved renaming the MQ-1C Mission Design Series aircraft from ERMP to Gray Eagle on August 19, 2010.
- In response to the Secretary of Defense's directive to increase intelligence, surveillance, and reconnaissance support in Iraq

and Afghanistan, the Army is deploying two early versions of the Gray Eagle UAS for operational use.
- Deployment of the Gray Eagle QRC 1 and 2 is taking place prior to completion of IOT&E and the full-rate production decision. The QRC 1 unit completed deployment in August 2009. The Army conducted a LUT of the QRC 2 capability in conjunction with training for unit deployment to Afghanistan from May to June 2010. The Army deployed the QRC 2 unit in the 1QFY11.
- The Army conducted the QRC 2 LUT at Edwards AFB, California, and the National Training Center (NTC), Fort Irwin, California, May 19 through June 4, 2010. The QRC 2 unit was based at Edwards AFB, where each sortie originated and concluded. The QRC 2 unit conducted missions in support of the Army's 3rd Armored Cavalry Regiment, a brigade-sized unit training at the NTC approximately 110 kilometers away. The QRC 2 unit flew 181 flight hours and conducted missions at operational ranges exceeding 150 kilometers and at altitudes exceeding 22,000 feet above mean sea level. The Army conducted the QRC 2 LUT in accordance with the DOT&E-approved Test and Evaluation Master Plan and test plan.
- DOT&E completed an Operational Assessment in January 2010 supporting the Gray Eagle program of record Milestone C decision and an additional Operational Assessment in August 2010 assessing the QRC 2 unit's ability to accomplish its wartime mission and its performance demonstrated during the LUT.

Assessment

- The QRC 2 LUT is an excellent example of combining testing and training to support a rapid fielding initiative while simultaneously informing continued development.
- The Gray Eagle system has more capability and functionality today than it demonstrated in previous operational tests. Significant increases in capability demonstrated during the 2010 LUT include autonomous and cooperative Hellfire missile engagement capability; a Lynx II Synthetic Aperture Radar/Ground Moving Target Indicator payload; and the ability to conduct aircraft operations via satellite communications data link.
- The QRC 2 unit successfully completed 22 of 41 attempted missions during the LUT, resulting in a mission success rate of 54 percent.
- The QRC 2 unit demonstrated the capability to collect accurate and actionable combat information, but had poor capability to share that information with supported ground units. ARC-231 secure radio communications were not reliable over the line-of-sight data link and non-existent over the satellite communications data link. This precluded mission accomplishment in 6 of the 19 failed missions.
- During the LUT, remote video from Gray Eagle to the One System Remote Video Terminal was generally not available, not clear, and not reliable. Integration of Gray Eagle with a reliable remote video display system is not complete. Video integration problems accounted for two failed missions.
- Gray Eagle did not meet reliability requirements for the OSGCS, the aircraft, and the electro-optical/infrared sensor payload. The poor aircraft reliability was largely due to ARC 231 radio subsystem failures. The LUT Mean Time Between System Abort point estimate/requirement for the OSGCS is 20.1/300, the aircraft is 20.1/100, and the electro-optical/infrared payload is 90.5/250. Reliability problems accounted for six failed missions. The QRC 2 unit has an operational tempo requirement to provide 22 hours of mission support per day. The QRC 2-configured system demonstrated 78 percent operational availability during LUT compared to a requirement of 80 percent.
- Training afforded to the QRC 2 unit before the LUT was not complete. Soldiers did not receive training on fundamentals of reconnaissance, mission planning, set-up and operation of radios, distribution of video, or optimal employment of Gray Eagle. NTC observer controllers and personnel from the Training and Doctrine Command Capabilities Manager's office for UAS filled this gap during the test. The unit only received 110 of the 245 hours planned for the Doctrine, Tactics and Techniques training program due to an inability to fly because of strong winds and maintenance issues. Inadequate unit training or tactics accounted for four failed missions.
- Manning of the QRC 2 unit is not adequate to sustain the required operational tempo of 22 flight hours per day. Unit manning accounted for one failed mission.
- The operator's manual is not current and in some cases not accurate.
- The Automatic Take-off and Landing System and "Legacy" Ground Control Station worked as designed.
- The QRC 2 unit demonstrated effective target detection and recognition capability using the electro-optical/infrared sensor with Laser Range Finder/Designator. During the LUT, the QRC 2 unit had eight hits out of eight attempted live Hellfire missile engagements.
- The design of the OSGCS shelter has a number of features that reduce operator efficiency and increase operator stress and fatigue.
  - The payload video is presented to the operator on a small 5 by 7 inch window making it difficult to conduct reconnaissance tasks and identify targets.
  - The workspace allotted to each operator is limited. Operators reported inadequate space for manuals, checklists, mission orders, personal equipment, and legroom.
  - Air conditioning is required to maintain normal operation of the computers and avionics within the OSGCS. Air conditioning controls operate in either the on or off mode. There is no thermostat control allowing operators to control the internal OSGCS temperature. In order to stay warm, OSGCS operators wore hats, gloves, and cold weather gear.
  - Operator controls are not efficient. OSGCS employs a joystick that has no triggers or buttons that would allow one-handed control of the payload or aircraft. Both hands are required for many basic tasks as the operator

provides inputs to both the joystick and the keyboard while operating the system. A cyclic-type joystick, such as those found in Army helicopters, would allow for one-handed multifunction operation of the system.

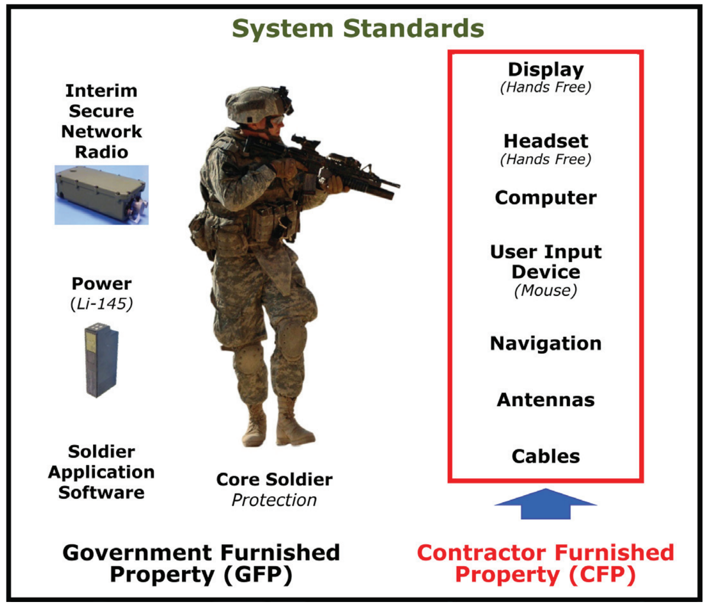
Recommendations

- Status of Previous Recommendations. The Army addressed two of the four FY09 recommendations. Recommendations concerning the completion of development and integration of secure satellite communications links and the improvement of Ground Control Station reliability and Ground Control Shelter design remain.
- FY10 Recommendations.
  1. The Army should modify and fix the communications design so the unit is able to communicate with supported ground elements through the satellite communications data link.
  2. The Army should develop, optimize, and publish standardized procedures for distribution of Gray Eagle video to One System Remote Video Terminal and similar remote video terminals.
  3. The Product Office should redesign the ground control station by accommodating Soldier feedback on the design of seats, keyboard, air conditioning, joystick, and displays.
  4. The Product Office should improve OSGCS reliability.
  5. The Product Office should improve the reliability of the ARC 231 radio subsystem on the aircraft.
  6. The Army should revise and expand the training program and update the operator's manual.
  7. The Army should increase the manning of the QRC 2 unit or reduce its operational tempo.

Nett Warrior Increment 1
(formerly Ground Soldier System)

Executive Summary
- In April 2009, the Army awarded three contracts for the technology development phase of Nett Warrior. In 3QFY11, the Army plans to award Nett Warrior low-rate initial production (LRIP) contracts based on the results of developmental and operational testing in 2010.
- The Army Test and Evaluation Command (ATEC) conducted developmental testing of Nett Warrior at Aberdeen Proving Grounds, Maryland, and Electronic Proving Ground, Arizona, from May through August 2010.
- A Nett Warrior Limited User Test (LUT) of three competing systems was conducted in October – November 2010 at Fort Riley, Kansas.
- A Milestone B or Milestone C decision for Nett Warrior is planned for 2QFY11.

System
- Nett Warrior Increment 1 is an integrated, dismounted Soldier situational awareness system for use by leaders during combat operations. It is designed to facilitate command, control, and sharing of battlefield information and integrate each leader into the digitized battlefield. The Army intends to use Nett Warrior to provide position location information down to the team leader level. Nett Warrior consists of:
  - A hands-free display and headset to view information
  - A computer to process information and populate the display
  - An interface device (mouse) for user-screen interaction
  - A system power source
  - A software operating system
  - A networked radio transmitter/receiver to send and receive information
  - Antennas and cables
- On the Army's birthday in June 2010, the Ground Soldier System was formally renamed the "Nett Warrior" program in honor of World War II Medal of Honor recipient, Colonel Robert Nett.
- The system includes a series of contractor-developed sub-systems or components combined with Government Furnished Property (GFP) components and software. These components are meant to be integrated into a system with a consistent and intuitive interface for use under battlefield conditions.



- Future increments of Nett Warrior will integrate Rifleman Radio, improved batteries, and initiatives to reduce weight and space.

Mission

Infantry units will use Nett Warrior to provide increased situational awareness and enhanced communications. This will increase their ability to close with and engage the enemy to defeat or capture him, or to repel his assault by fire, close combat, and counter-attack.

Major Contractors
- General Dynamics C4 Systems – Scottsdale, Arizona
- Raytheon – Plano, Texas
- Rockwell Collins – Cedar Rapids, Iowa

Activity
- Three contractors conducted developmental testing from February to April 2010.
- ATEC conducted developmental testing of Nett Warrior at Aberdeen Proving Grounds, Maryland, from May to August 2010.
- A Nett Warrior LUT was conducted in October – November 2010 at Fort Riley, Kansas. This LUT is the first operational test of the systems. During LUT 10, three infantry companies each equipped with one system will rotate through a series

of offensive, defensive, and stability missions in open, constricted, and urban terrain during three 96-hour scenarios.

Assessment

- During developmental tests in May – June 2010, none of the contractor-provided Nett Warrior systems met the threshold for Mean Time Between Essential Function Failure (MTBEFF) required to advance to operational testing in October.
- During additional program manager-conducted developmental testing in August 2010, all three contractors improved their reliability and proceeded to operational testing in October – November 2010.
- The results of the October – November 2010 LUT will be used to determine whether Nett Warrior meets reliability and suitability thresholds to proceed to a Milestone B or Milestone C in 2QFY11.

Recommendations

- Status of Previous Recommendations. This is the first annual report for this program.
- FY10 Recommendation.
  1. The Army should continue with scheduled developmental and operational testing to assess improvements needed for system reliability.

Patriot / Medium Extended Air Defense System (MEADS)

Executive Summary

- The Army conducted five major developmental Patriot flight test missions and a Post-Deployment Build (PDB)-6.5 Limited User Test (LUT) operational test in FY10.
- The second guided flight of the Patriot Advanced Capability-3 (PAC-3) Missile Segment Enhancement (MSE) interceptor achieved a successful intercept of a ballistic missile target with the second of two interceptors ordered to launch.
- PDB-6.5 flight tests with PAC-2 missiles conducted in December 2009 and March 2010 were successful.
- A PAC-2 missile flight test in October 2009 and a PAC-3 missile flight test in December 2009 were successful.

System

- The Patriot is a mobile air and missile defense system that counters missile and aircraft threats. The system includes the following:
  - C-band phased-array radars for detecting, tracking, classifying, identifying, and discriminating targets
  - Battalion and battery battle management elements
  - Communications Relay Groups and Antenna Mast Groups for communicating between battery and battalion assets
  - A mix of PAC-3 hit-to-kill missiles and PAC-2 blast fragmentation warhead missiles for negating missile and aircraft threats
    - The newest version of the PAC-3 interceptor is the Cost Reduction Initiative (CRI) missile. In addition, the Army is developing the PAC-3 MSE missile with increased battlespace defense capabilities and an improved lethality enhancer.
    - Earlier versions of Patriot interceptors include the Patriot Standard missile, the PAC-2 Anti-Tactical Missile (ATM), and the Guidance Enhanced Missile (GEM) family (includes the GEM-T and GEM-C missile variants).
- The Medium Extended Air Defense System (MEADS) is intended to be a more deployable, mobile, and capable air and missile defense system than Patriot. Planned MEADS developments include the following:
  - Battle management, command, control, communications, computers, and intelligence elements; Ultra High Frequency-band 360-degree surveillance radars; X-band 360-degree multi-function fire control radars; and missile launchers and reloaders
  - MSE missiles developed under the Patriot program

Mission

Combatant Commanders using Patriot have the capability to defend deployed forces and critical assets from missile and aircraft attack and to defeat enemy surveillance air assets (such as unmanned aerial vehicles) in all weather conditions, clutter, and electronic countermeasure environments. Combatant Commanders will use MEADS to provide maneuver forces with continuous 360-degree protection against missile and aircraft threats.

Major Contractors

- Lockheed Martin Missile and Fire Control – Dallas, Texas
- MEADS International, Inc. – Orlando, Florida
- Raytheon Integrated Defense Systems – Tewksbury, Massachusetts

Activity

- The Army conducted the PDB-6.5 LUT at White Sands Missile Range (WSMR), New Mexico, from November 2009 to July 2010. DOT&E approved deviations from the 2004 Patriot Test and Evaluation Master Plan (TEMP) because the software changes between PDB-6 and PDB-6.5 were less extensive than had been anticipated in 2004. The PDB-6.5 LUT did not include a sustained operations phase or an interoperability phase and the PDB-6.5 testing included four developmental/operational test flight tests instead of four developmental test flight tests and three operational test flight tests. These deviations were documented in a 2009 Memorandum of Understanding.

- During the ATM-48 flight test at WSMR in October 2009, Patriot fired two GEM-T interceptors and killed a high-speed tactical ballistic missile with the second interceptor.
- During production configuration flight test PC-08 at WSMR in December 2009, Patriot fired two PAC-3 CRI missiles and intercepted a short-range ballistic missile target with the first interceptor.
- During PDB-6.5 flight test P6.5-3A at WSMR in December 2009, Patriot fired a Standard missile and two PAC-2 missiles against a low-altitude cruise missile target using miss bias and maximum fuze delay to prevent the interceptors from killing the target.
- During the second intercept attempt for the MSE missile (Flight Test 7-2A) at WSMR in February 2010, Patriot attempted to fire two MSE interceptors at a ballistic missile target. The second MSE intercepted the target; the first interceptor failed to launch.
- During PDB-6.5 flight test P6.5-2 at WSMR in March 2010, Patriot fired a GEM and a PAC-2 missile at one ballistic missile target and then fired a GEM-C and PAC-2 missile at a second ballistic missile target, intercepting and killing the first target with a GEM and killing the second target with a PAC-2 missile.
- The next Patriot operational test, the PDB-7 LUT, is scheduled to begin in 4QFY11.

Assessment

- The PDB-6.5 LUT was the first operational test to use two synchronized hardware-in-the-loop systems, which allowed the integrated air picture from two batteries to be presented to the battalion. The Patriot PDB-6.5 system showed improvements in performance against some threat types but degradations in performance against other threat types.
  - The total Patriot system performance against anti-radiation missiles and air-to-surface missiles could not be determined because Patriot interceptor lethality data does not yet exist for these threats.
  - The total Patriot system performance against cruise missiles, fixed-wing aircraft, or unmanned aerial vehicles could not be determined because the Lower Tier Project Office has not performed the simulation runs necessary to characterize Patriot interceptor lethality against these threats.
  - Patriot failed to meet the firing battery reliability requirement and PDB-6.5 testing was not adequate to determine Patriot maintainability or operational availability.
  - Patriot system complexity has exceeded the current operator capabilities and training.
  - Information assurance testing revealed some improvements, but the crew had pre-knowledge of the penetration test. Testing, therefore, provided biased data with regard to operator responses to cyber attacks.
- During the ATM-48 missile flight test, a transmitter arc experienced in the Patriot ground radar during the engagement of the ATM-48 target with the first GEM-T interceptor led to a larger miss distance than had been expected for the first interceptor. However, while the fuze exhibited anomalous behavior, the first GEM-T still intercepted the ATM-48 target. The second GEM-T interceptor killed the target, achieving a successful miss distance and exhibiting the expected fuze geometry.
- During flight test PC-08, both PAC-3 CRI missiles performed in good agreement with preflight predictions. The first CRI missile intercepted and destroyed the target.
- During PDB-6.5 flight test P6.5-3A, the Army was not able to address the objective of fully exercising post-intercept engagement decision and weapons assignment logic because the Patriot system dropped track on the target just after the first planned intercept event. Aside from this problem, all three engagements were successfully accomplished as planned.
- During flight test 7-2A, Patriot demonstrated the capability to kill a tactical ballistic missile target with an MSE interceptor in the extended MSE battlespace. The in-flight interceptor performance was consistent with preflight predictions and body-to-body impact was achieved, resulting in the destruction of the target. Patriot was to have fired two MSE missiles during this flight test, but the first MSE suffered a seeker reset and failed to launch. The cause of this seeker reset is still under investigation.
- During PDB-6.5 flight test P6.5-2, Patriot demonstrated the capability to kill a tactical ballistic missile target with a GEM interceptor and then engage and kill a second tactical ballistic missile target in the presence of the debris cloud from the first intercept. Three of the four interceptors behaved nominally, but the GEM-C fired against the second target exhibited a fuze anomaly that resulted in a missile self-destruct prior to target intercept. The PAC-2 missile fired against the second tactical ballistic missile target did successfully destroy the target.
- The Missile Defense Agency (MDA) plans to conduct the first Ballistic Missile Defense System operational flight test (FTO-01) in FY12. FTO-01 will include Aegis, Terminal High-Altitude Area Defense (THAAD), and Patriot intercept attempts against three ballistic missiles. Although Patriot and THAAD can together provide a robust defense if Patriot is able to intercept threats that THAAD does not kill, MDA and the Army are not currently planning to demonstrate this capability in FTO-01.

Recommendations

- Status of Previous Recommendations. The Army satisfactorily addressed two of the previous ten open recommendations. Recommendations concerning conducting Patriot testing during Joint and coalition exercises; upgrading the Patriot hardware-in-the-loop systems to model electronic countermeasures and identification, friend or foe systems; updating the Patriot Test and Evaluation Master Plan; conducting a Patriot flight test against an anti-radiation missile target; providing probability of kill tables for all required threats prior to the start of operational tests; reviewing the risks of not conducting all flight tests against ballistic missiles using two interceptors; planning to conduct an IOT&E prior to the MSE full-rate production decision; and conducting a robust Force Development Experiment prior to PDB-7 operational testing still remain.

- FY10 Recommendations. In addition to addressing the above recommendations, the Army should:
  1. Improve Patriot training to provide the level of expertise required for PDB-6.5 operations.
  2. Conduct future Patriot information assurance testing as an integrated part of operational testing rather than as a dedicated information assurance test so the crews will not know when to expect cyber attacks.
  3. Have Patriot participate with live interceptors in THAAD flight testing to demonstrate that Patriot can intercept targets not killed by THAAD.

Precision Guidance Kit (PGK)

Executive Summary

- The Precision Guidance Kit (PGK) Increment 1 program conducted Government Developmental Tests between February – August 2010. The testing focused on performance, mission processing, reliability, accuracy, and environmental conditioning.
- The program demonstrated interoperability of all 155 mm high-explosive projectiles with appropriate fire control systems and firing platforms during integrated government testing. The high-explosive projectiles include the M107, M795, and the M549A1 Rocket Assisted Projectile.
- PGK Increment 1 achieved lower than expected reliability for all three 155 mm high-explosive projectiles. Current Milestone C reliability projections of 63 percent show the program is not on track to achieve the required 92 percent system reliability at Initial Operating Capability (IOC).

System

- The PGK is a fuze that attaches to 155 mm artillery projectiles to improve the ballistic accuracy of the current inventory of Field Artillery projectiles.
- The Army plans to develop PGK in three increments:
  - Increment 1: 155 mm High Explosive projectiles (50 meter accuracy)
  - Increment 2: 105 mm High Explosive projectiles (30 meter accuracy)
  - Increment 3: All 105 mm and 155 mm High Explosive and cargo projectiles (30 meter accuracy)
- All increments use GPS data to correct the projectiles' range and azimuth when attacking targets. The Army intends Increment 1 to provide an accuracy of 50 meters or less from the desired aim point. The planned accuracy for Increments 2 and 3 is 30 meters or less.
- The PGK will operate with existing and developmental artillery systems that have digital fire control systems and inductive fuze setters such as the M777A2 Light Weight Towed Howitzer and the M109A6 Paladin Self-Propelled Howitzer.

Mission

Field Artillery units will use PGK to provide indirect fire support with 30 - 50 meters accuracy to combat maneuver units in all types of weather and terrain. Artillery units will use PGK to achieve comparable effects of conventionally fuzed projectiles using fewer rounds and reducing collateral damage.

Major Contractor

Alliant-Techsystems Advanced Weapons Division – Plymouth, Minnesota

Activity

- The PGK Increment 1 program conducted Government Developmental Tests from February through August 2010. The testing focused on performance, mission processing, reliability, accuracy, and environmental conditioning.
- Recurring reliability failures during Government Developmental Tests and identification of the same failure modes from previous Contractor Developmental testing resulted in suspension of program testing pending completion of failure mode analysis and corrective action.
- Suspension of testing shifted the Milestone C decision beyond the Acquisition Program Baseline threshold of October 2010. The Army will decide on the path forward to address reliability failures in January 2011.
- Delays in the PGK Increment 1 schedule led the program office to delay initiation of the PGK Increment 2 program. The PGK Increment 2 Milestone A was delayed from April 2010 to early 2011.

- In June 2010, with receipt of additional incremental funding, the Army redesignated the program as Acquisition Category (ACAT) II and authorized PGK Increment 2 to continue preparations for Milestone A.

Assessment

- PGK Increment 1 has three Milestone C Entrance Criteria: interoperability, reliability, and accuracy. The program has successfully demonstrated interoperability.
- The program demonstrated interoperability of all 155 mm high-explosive projectiles with appropriate fire control systems and firing platforms during integrated government testing. The high-explosive projectiles include the M107, M795, and the M549A1 Rocket Assisted Projectile.
- PGK Increment 1 continues to experience lower than expected reliability for all three 155 mm high-explosive projectiles. Current reliability projections of 63 percent are below the Milestone C reliability entrance criterion and do not support achieving the 92 percent reliability requirement at IOC.
- The program is meeting accuracy requirements for two of the three 155 mm high-explosive projectiles at low- and mid-quadrant elevations below 800 mils (low-angle fire). PGK Increment 1 has not demonstrated accuracy requirements for the M107 high-explosive projectile. The program has not achieved accuracy requirements for any of the three high-explosive projectiles when fired at high quadrant elevations above 800 mils (high-angle fire).

Recommendations

- Status of Previous Recommendations. The Army satisfactorily addressed all previous recommendations.
- FY10 Recommendations.
  1. The Army should continue to closely monitor the program and determine the operational impacts of the delayed testing and Milestone C.
  2. Develop and implement through testing a plan to address PGK recurring reliability failures.

Shadow Tactical Unmanned Aircraft System (TUAS)

Executive Summary

- The Shadow Tactical Unmanned Aircraft System (TUAS) program completed IOT&E in May 2002, supporting a full-rate production decision in September 2002. Since that milestone and through the end of FY10, the Shadow TUAS Program Office has fielded 99 Shadow systems. The Army has received 85; the Marine Corps, 11; the Army National Guard Bureau, 2; and the Program Office has retained one system for continued testing. The Shadow fleet has flown over 540,000 flight hours.
- The program employs a block upgrade and an evolutionary acquisition approach. To complement this approach, the T&E Working Integrated Product Team (WIPT) is using a corresponding test strategy as part of a continuous evaluation as the system receives upgrades in capability. DOT&E approved the Shadow TUAS Test and Evaluation Management Plan (TEMP) update on March 17, 2010.
- The Army conducted the TUAS Laser Range Finder/Designator Limited User Test (LUT) in June 2010.

System

- Shadow is a small, lightweight TUAS that consists of the following major components:
  - Four unmanned aircraft, each equipped with an electro-optical (EO)/Infrared (IR) payload. Two of the four EO/IR payloads are equipped with a Laser Range Finder/Designator capability
  - Each aircraft has an integral Single Channel Ground and Airborne Radio System communications relay capability
  - Two Ground Control Stations designated as the One-System Ground Control Station (OSGCS)
  - One Portable Ground Control Station
  - Four One-System Remote Video Terminals
- The Shadow unit is a platoon-size organization with 22 personnel assigned.
- The Shadow platoon is designed to provide coverage to a brigade area of interest for up to 4 hours at a range out to 50 kilometers from the launch and recovery site. The maximum range is 125 kilometers (limited by data link capability).

- Operations are generally conducted from 8,000 to 10,000 feet above ground level during the day and 6,000 to 8,000 feet above ground level at night.
- The aircraft uses a hydraulic/pneumatic launcher and is recovered on a runway using the Tactical Automatic Landing System. An arresting cable/arresting hook system shortens the necessary runway landing length.
- The Army intends for the Laser Range Finder/Designator to provide the ground maneuver brigade commander the capability to conduct cooperative Hellfire missile engagements.

Mission

The Shadow TUAS platoon is to provide responsive Reconnaissance, Surveillance, and Target Acquisition, Cooperative Attack, Battle Damage Assessment, and Communications Relay support to the brigade.

Major Contractor

AAI Corporation, Inc. – Hunt Valley, Maryland

Activity

- Shadow TUAS completed IOT&E in May 2002, supporting a full-rate production decision in September 2002. Since that milestone and through the end of FY10, the Shadow TUAS Program Office has fielded 99 Shadow systems. The Army has received 85; the Marine Corps, 11; the Army National Guard Bureau, 2; and the Program Office has retained one system for continued testing. The Shadow fleet has flown over 540,000 flight hours. Twenty-four deployed systems currently support combat operations.
- The program employs a block upgrade and an evolutionary acquisition approach. To complement this approach, the T&E WIPT is using a corresponding test strategy as part of

a continuous evaluation as the system receives upgrades in capability. DOT&E approved the Shadow TUAS TEMP update on March 17, 2010.
- The Army conducted the Shadow TUAS LUT at the Yuma Proving Grounds, Yuma, Arizona, in June 2010, in accordance with the DOT&E-approved TEMP and test plan. The LUT enabled the evaluation and assessment of the unit's ability to employ the system with upgrades such as the EO/IR sensor with laser designator, the OSGCS, the 1101 engine, and the communications relay package in an operational environment. The test was supported by three Kiowa Warrior Aircraft and a section of a 155 mm Paladin Field Artillery Battery. During the test, the Shadow TUAS platoon conducted reconnaissance, surveillance, and target acquisition, laser designation for cooperative Hellfire missile engagements with the Kiowa Warrior aircraft, non-line-of-sight call for fire artillery missions, force protection, battle damage assessment, and communications relay missions. The Shadow test unit flew 112 flight hours during the LUT.

Assessment
- The Shadow TUAS has more capability and functionality today than it demonstrated in previous operational testing. Significant increases in capability demonstrated in the June 2010 LUT include cooperative Hellfire missile engagement via the Plug-In Optronic Payload (POP) 300D laser designator and communications relay.
- The unit was effective in conducting cued reconnaissance and surveillance missions. However, the Shadow platoon demonstrated little independent reconnaissance and surveillance capability. Throughout the LUT, the ground tactical operations center directed Shadow operators where to fly and what to observe, precluding the unit from demonstrating the full tactical employment capability of an organization equipped with this system. Soldiers were trained on how to fly the system with the improved capabilities, not on how to employ the system. Training provided to the unit by the Army on the fundamentals of reconnaissance was poor.
- The unit demonstrated the ability to conduct cooperative Hellfire missile engagements with Kiowa Warrior helicopter crews. During these cooperative engagements, the Shadow TUAS operator laser designated the target while the Kiowa Warrior helicopter crews launched the missile. During the live Hellfire missile engagements, 7 of the 10 missiles hit the intended target. On one of the three misses, the missile was characterized as a "bad" missile that had erratic and uncontrolled flight after leaving the launch rail. The missile impacted the ground without incident. During the other two misses, the Shadow POP 300D payload lost its tracking capability while the missile was in flight, and the Kiowa Warrior self-designated the target to complete the missile fly-out.
- DOT&E observed during test that 30 percent of successful engagements, either live missile or simulated, required multiple passes. This is due to the design of the payload, which requires the Shadow aircraft to close to within 4 kilometers of the target to provide sufficient laser energy for the Hellfire missile to have a high probability of hitting the intended target. Shadow operators flew the aircraft to within 2 kilometers of the target during most engagements, well within aural and visual detection range of the system from ground observation, putting the aircraft at risk of being engaged by threat weapons systems and/or compromising the mission. The POP 300D payload did perform as designed.
- Median Target Location Error (TLE) for the POP 300D payload at standoff slant ranges of 3 to 5 kilometers was 76.5 meters. The TLE requirement is less than 80 meters. There was no degradation in capability from the POP 300 to the new POP 300D payload.
- The LUT was the first time that the Advanced Field Artillery Tactical Data System electronic messaging capability between artillery and Shadow units was demonstrated in operational testing. The Shadow unit demonstrated the ability to conduct a second round fire-for-effect mission in cooperation with the artillery unit during the LUT.
- The Shadow TUAS communications relay capability is provided by the use of two radios onboard the aircraft, one in each wing tip. The frequencies of each radio are selected by the Shadow operators in the ground control stations and are able to be reset during flight. Communications may be either secure (hop set frequency where the radio continuously "hops" from one frequency to the next) or non-secure (set single frequency). The Shadow TUAS unit demonstrated during the LUT that when each of the two radios is set to a different, non-secure single frequency, the system can provide the communications relay capability. The secure hop set frequency capability was not demonstrated during test.
- Operator controls are not efficient. OSGCS employs a joystick that has no triggers or buttons allowing one-handed control of both the payload and aircraft. Both hands are required for many basic tasks as the operator provides inputs to the joystick, laser designation button, and the keyboard while operating the system. A cyclic-type joystick, such as those found in Army helicopters, would allow for one-handed multifunction operation of the system.
- The Shadow TUAS did not meet reliability requirements as measured by Mean Time Between System Abort (MTBSA). During the LUT, the MTBSA was 14.4 hours, compared with a requirement of 20 hours. The system, due to subsystem redundancy, did meet availability requirements. The system demonstrated an overall availability of 99 percent. The system availability requirement is 80 percent.

Recommendations
- Status of Previous Recommendations. The Army satisfactorily addressed the two recommendations from the FY06 DOT&E Annual Report. There was no annual report written for this system in FY07-09 due to lack of operational testing during that time period.
- FY10 Recommendations. The Army should:
  1. Reassess, revise, and expand the training provided during institutional and New Equipment Training of Shadow units

to include fundamentals of reconnaissance and cooperative engagement missions.

2. Evaluate the adequacy of the current design of the POP 300D payload on the aircraft, which requires Shadow to close within 4 kilometers of a target to provide sufficient laser energy to have a high probability of hit during Hellfire missiles engagements.
3. Improve training for the communication relay capability and confirm its operation in secure hop set frequency mode prior to fielding.
4. Redesign the ground control station by accommodating Soldier feedback on the design of the keyboard, joystick, and laser designation button.

Spider XM7 Network Command Munition

Executive Summary

- Spider provides capabilities not available with previous anti-personnel land munition systems.
- Following the FOT&E conducted in March 2009, in accordance with DOT&E-approved test plans, the Army identified system shortcomings and took corrective actions to address the areas of employment concept, system complexity, and training shortfalls.
- The Army conducted a second "man-in-the-loop" FOT&E, in accordance with DOT&E-approved test plans, at Fort Leonard Wood, Missouri, in May 2010.
- DOT&E intends to publish its report on Spider XM7 early in calendar year 2011. Based on analysis conducted to date, Spider is operationally effective and lethal when operated with efficient operator-observer communications and clearly defined Rules of Engagement. Spider is not operationally suitable. The system remains difficult to sustain in an operational environment.
- The program will not achieve IOC with the fielding of 111 systems by the end of 2010 to support the 2004 National Landmine Policy that discontinues use of all persistent landmines by 2010. The Army plans to achieve IOC in April 2011.

System

- The Army intends Spider to be the landmine alternative to satisfy the anti-personnel munition requirements outlined in the 2004 National Landmine Policy, which directs DoD to:
  - End use of persistent landmines after 2010
  - Incorporate self-destructing and self-deactivating technologies in alternatives to current persistent landmines
- The Army intends to achieve an IOC with Spider in 2011.
- Spider no longer has the capability to engage targets autonomously. All engagements use "man-in-the-loop" control to engage targets.
- A Spider munition field includes:
  - Up to 63 Munition Control Units (MCU), each housing up to six miniature grenade launchers or munition adapter modules for remote electrical and non-electrical firing capabilities
  - A remote control station, used by the operator to maintain "man-in-the-loop" control of all munitions in a field

  - A communications relay device known as a "repeater" for use in difficult terrain or at extended ranges
- The Army intends to employ Spider in all environments and in all terrains.
- Spider incorporates self-destructing and self-deactivating technologies to reduce residual risks to non-combatants.

Mission

Maneuver or engineer units employ Spider as a contributor to a force protection obstacle or as a standalone force protection system to accomplish the following missions:

- Protect the Force
- Shape the Battlefield
- Provide Early Warning
- Delay and Attrite Enemy Forces

Major Contractors

- Command and Control hardware and software: Textron Defense Systems – Wilmington, Massachusetts
- Munition Control Unit and Miniature Grenade Launcher: Alliant-Techsystems Advanced Weapons Division – Plymouth, Minnesota

Activity

- Following the FOT&E conducted in March 2009, the Army took corrective actions to address the shortfalls in employment concept, system complexity, and training.
- DOT&E approved an updated Test and Evaluation Master Plan in April 2010. The update addressed integration of the Spider Standoff Capabilities Enhancement program initiated in FY08 to mitigate the loss of the autonomous operations mode, and follow-on testing to demonstrate corrective actions in an operationally realistic environment.

- The Army conducted a second “man-in-the-loop” FOT&E at Fort Leonard Wood, Missouri, in May 2010.
- The Army approved a funding plan in July 2010 to provide interim training support at Home Station, Combat Training Centers, and in theater for Spider training. The training plan goal is to prepare Soldiers scheduled for overseas deployment to employ Spider systems in combat by addressing system complexities from individual, collective, and combined arms perspectives.

Assessment

- DOT&E intends to publish its report on Spider XM7 early in calendar year 2011. The following assessment is based on analysis conducted to date.
- Spider provides enhanced capabilities not previously available with anti-personnel land munition systems:
  - “Man-in-the-Loop” positive control of both lethal and non-lethal munitions
  - Remote electrical and non-electrical firing capabilities for munitions and demolitions to a range of four kilometers
  - Capability to fire a single munition or multiple munitions at the same time
  - Capability to collect situational awareness information through tripline activation by threat personnel
- Spider is operationally effective and lethal.
  - Soldiers emplaced on time, maintained, and achieved lethal effects in 15 of 16 Spider munition field missions during the May 2010 FOT&E.
  - The level of Spider effectiveness is dependent on the efficiency of operator-observer communications, clearly defined Rules of Engagement, and training.
  - Changes in employment concepts and increased focus on non-Spider specific tasks such as establishing an observation post and maintaining tactical communications will enable units to effectively employ Spider as part of a protective obstacle.
  - Spider is lethal. The demonstrated effects of the Spider munitions in the May 2010 FOT&E against simulated threat personnel achieved Army lethality requirements.
- Spider is not operationally suitable. The system continues to be difficult to sustain in an operational environment:
  - The Army requires individual Spider MCUs to be reused up to seven times before repair. In the May 2010 FOT&E, only nine of 30 MCUs met this reuse requirement.
  - Spider MCUs will sterilize and no longer function when subjected to tampering. During the May 2010 FOT&E, 22 of 43 new MCUs were sterilized due to non-tampering actions caused by software and safety feature complexity.
  - The Army’s maintenance and logistical systems require more assets to support Spider fielding due to high sterilizations and unmet reuse requirements.
- The Spider system requires three different types of rechargeable and non-rechargeable batteries when commercial or vehicle power is not available. Battery management increases a unit’s logistical burden. During a 60-hour operation, a platoon size unit employing a 20 MCU Spider munition field with a repeater may use up to 86 non-rechargeable batteries, costing $2,400.
- Spider skills are perishable and require periodic sustainment training, thus increasing a unit’s training burden.
- The program will not achieve IOC with the fielding of 111 systems by the end of 2010 to support the 2004 National Landmine Policy that discontinues use of all persistent landmines by 2010. The Army plans to achieve IOC in April 2011.

Recommendations

- Status of Previous Recommendations. The Army satisfactorily addressed all previous recommendations.
- FY10 Recommendations. The Army should:
  1. Develop, implement, and verify through testing, a plan to address MCU sterilization and reliability.
  2. Improve Spider reuse capability inclusive of Soldier actions in operating the system. Consider software changes that eliminate the possibility of sterilizations during unit emplacement and recovery operations.
  3. Continue to improve the suitability of Spider by reducing system complexity in the hands of Soldiers. Provide a more thorough and efficient sustainment training program.
  4. Review the Spider design with a goal of reducing the need for three different types of batteries.

Stryker Family of Vehicles – Double V-Hull (DVH)


M1134 Anti-Tank Guided Missile Vehicle


M1132 Engineer Squad Vehicle


M1127 Reconnaissance Vehicle


M1129 Mortar Carrier Vehicle


M1130 Commanders Vehicle


M1131 Fire Support Vehicle


M1133 Medical Evacuation Vehicle


M1126 Infantry Carrier Vehicle

Executive Summary

- The Army initiated the Stryker Double V-Hull (DVH) program in response to an Operational Needs Statement from Afghanistan, noting the commander's concerns regarding Stryker force protection/survivability shortfalls against underbody Improvised Explosive Devices (IEDs) and blast threats.
- The Army plans to pre-position Stryker vehicles with the double V-hulls for Operation Enduring Freedom (OEF) beginning in 3QFY11.
- Multi-phase operational and LFT&E programs, meant to demonstrate the Stryker DVH's improved capability against the aforementioned threats while maintaining needed cross-country mobility, are being conducted to support decisions to continue production and to field the systems in January and June 2011, respectively.

System

- The Army intends for the Stryker DVH to provide improved survivability against IED and blast threats, beyond the protection provided by current Stryker vehicles with OEF kits.
- The Stryker DVH Infantry Carrier Vehicle (ICV) is the base variant for seven additional configurations: the Anti-Tank Guided Missile (ATGM) Vehicle, the Commander's Vehicle (CV), the Engineer Vehicle Squad (ESV), the Fire Support Vehicle (FSV), the Mortar Carrier (MC), the Medical Evacuation Vehicle (MEV), and the Reconnaissance Vehicle (RV).
- At present, the Army does not plan to field Stryker DVH versions of the Mobile Gun System (MGS) and the Nuclear, Biological, Chemical Reconnaissance Vehicle (NBCRV) in the OEF theater of operation.
- The DVH configuration consists of a redesigned lower hull, energy attenuating seats, and an up-armored driver's station. An upgraded suspension and driveline are incorporated because of the additional weight associated with the changes.

Mission

The DVH-equipped Stryker Brigade Combat Team (SBCT) has the same mission profile as a non DVH-equipped SBCT. The SBCT conducts operations across the depth and breadth of an area of operations, against both traditional and asymmetric adversaries. Though optimized for small-scale contingencies, the Army intends the SBCT to engage in all types of military conflicts, including Major Theater Wars when augmented or when operating as part of a larger force.

Major Contractor

General Dynamics Land Systems – Sterling Heights, Michigan

Activity

- DOT&E approved the Army's Operational and LFT&E Concept Plan for the Stryker DVH program on June 28, 2010. The plan outlined the Army Test and Evaluation Command's (ATEC) proposal for a three phase (Phase 0, I, and II) test program. The intent of this three-phased program is to characterize the effectiveness, suitability, and survivability of the Stryker DVH in comparison to the baseline vehicle with OEF kits.

- In July 2010, the Army began executing system-level ballistic testing against baseline Stryker vehicles equipped with OEF kits to characterize the capability of kitted baseline vehicles against underbody threats.
- Testing against two DVH Infantry Carrier Vehicle (ICV) structures, (rolling chassis), began in August of 2010. ATEC continues to refine the LFT&E program based on demonstrated performance and emerging threat information.
- The Army will begin operational testing of DVH Strykers in January 2011 to characterize any degradation to reliability, availability, and maintainability and cross-country mobility.
- The Army is currently developing a surrogate for the OEF Home-Made Explosive (HME) threat, to use in multiple armored vehicle test programs, including Stryker DVH.

Assessment

- For the purposes of the LFT&E program, DOT&E expected both rolling chassis structures to be similarly configured with production seating, floor plates, engine bulkhead panels, hatches, suspension, and driveline components. The two rolling chassis were neither structurally the same, nor were they consistently configured with the expected production hardware. Although this increased the limitations associated with this test phase, testing is still expected to provide useful information and insights regarding the system's response to and protection afforded against underbody threats.
- The Stryker DVH system should be evaluated to determine the protection it affords against the HME threat. The HME surrogate needs to be fully characterized – to include the establishment of net explosive weight equivalence factors – prior to incorporating HME into any test programs.
- Due to limited test resources, Stryker DVH post-damage repair may result in significant LFT&E program schedule delays. This may compromise the amount of information available to support critical acquisition and deployment decision points.

Recommendations

- Status of Previous Recommendations. This is the first annual report for this program.
- FY10 Recommendations. The Army should:
  1. Complete Phase 0, I, and II test and evaluation programs, to include the comparison of the DVH to the baseline Stryker vehicles, prior to deployment.
  2. Incorporate the HME threat into the LFT&E system-level program following adequate characterization and establishment of net explosive equivalence factors.
  3. Address the vulnerabilities revealed in the Phase 0 portion of the LFT&E program against the OEF-kitted baseline Strykers to improve the protection afforded to personnel against underbody threats by the vehicles currently deployed.

Stryker Mobile Gun System (MGS)

Executive Summary

- The 2008 Secretary of Defense Report to Congress stated that full-rate production of the Stryker Mobile Gun System (MGS) will not be approved until the identified deficiencies are corrected. The Army delayed the FY09 MGS full-rate production decision until FY12.
- The program manager postponed the developmental/operational mission equipment package (MEP) reliability test scheduled for September 2010 until spring/summer 2011.
- DOT&E assesses the program has mitigated, by either material fixes or changes to tactics, techniques, and procedures, 11 of the 23 deficiencies identified in the 2008 Secretary of Defense Report to Congress.

System

- The Stryker Family of Vehicles consists of two variants on a common vehicle platform: Infantry Carrier Vehicle (ICV) and the MGS. There are eight configurations of the ICV variant.
- The MGS required a separate acquisition decision because the system needed additional development.
- The MGS mission equipment includes the following:
  - M68A2 105 mm cannon system with an ammunition handling system
  - Coaxial 7.62 mm machine gun and a secondary M2HB, .50-caliber machine gun
  - Full solution fire control system with two-axis stabilization
  - Low-profile turret meant to provide survivability against specified threat munitions
- The system integrates the Driver's Vision Enhancer and Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance components as government-furnished equipment.
- The MGS provides the three-man crew with varying levels of protection against small-arms, fragmenting artillery, mines, and rocket-propelled grenades (RPGs). RPG protection is provided by add-on slat armor (high hard steel arranged in a spaced array).

Mission

- The Stryker Brigade Combat Team uses the MGS to create openings in walls, destroy bunkers and machine gun nests, and defeat sniper positions and light armor threats. The primary weapon systems are designed to be effective against a range of threats up to T-62 tanks.
- The MGS operates as a three-vehicle platoon organic to the Stryker infantry company or as a single vehicle in support of a Stryker infantry platoon.

Major Contractor

General Dynamics Land Systems – Sterling Heights, Michigan

Activity

- The program manager postponed the developmental/operational MEP reliability test scheduled for September 2010 until spring/summer 2011, with the extended low-rate initial production (E-LRIP) vehicles due to quality problems on the restarted production line.
- There were numerous system aborts during contractor testing as well as an improperly applied vehicle weld, which led to the decision to continue contractor testing to determine root cause for the failures.
- The Army Test and Evaluation Command (ATEC) conducted Engineering Change Order validation testing from September 2009 to March 2010 to assess reliability and performance effects of an air conditioner kit and changes to production configuration components. This event supported planned future Engineering Change Order validation testing on E-LRIP vehicles from the restarted production line.
- Delays in delivery of the Stryker reactive armor tiles (SRAT II) and in live fire test planning caused a delay in the execution of the live fire testing for SRAT II. The Stryker Double V-Hull LFT&E program continues to delay the Stryker MGS SRAT II LFT&E program.
- To support a ballistic vulnerability assessment of the MGS with SRAT II, the Army completed initial risk reduction testing

of SRAT II tiles in July 2010 and began risk reduction testing on an MGS ballistic hull and turret in September 2010.
- While the Army approved the plan for the area of the vehicle to be covered by SRAT II in December 2009, the integration of SRAT II on the MGS has not yet occurred.
- The Army, in consultation with DOT&E, submitted the third and fourth reports to Congress in January 2010 and July 2010, updating the status of actions taken by the Army to correct or mitigate all Stryker MGS deficiencies as directed in Section 115 of the Duncan Hunter National Defense Authorization Act for FY09.

Assessment
- Overall, the program has mitigated, by either material fixes or changes to tactics, techniques, and procedures, 11 of the 23 deficiencies identified in the 2008 Secretary of Defense Report to Congress. Of the remaining 12 deficiencies, solutions for nine deficiencies have been identified by the program, but the corrective actions have not yet been accomplished and validated. DOT&E considers the three deficiencies – gun pod protection, MEP reliability, and long term RPG protection – to be the highest priority for correction.
- In the 2007 Beyond Low-Rate Initial Production (BLRIP) Report, DOT&E assessed the MGS as not operationally effective when operating in a degraded capacity. The current protection of the gun pod meets the approved requirement; however, DOT&E assesses the gun pod can be easily disabled causing, the MGS to operate in a degraded capacity. When that occurs, the MGS is not operationally effective. Not upgrading gun pod protection increases MGS vulnerability, which increases the likelihood of the MGS operating in a degraded capacity. The Army has no plans to improve the gun pod's protection.
- The C-130 Transportability Key Performance Parameter is a design constraint that limits MGS capabilities. Because of size and weight constraints for transporting equipment on the C-130, there is a limitation on the size and weight of the MGS. This limit results in several survivability deficiencies including the Commander's Weapon Station, protection of 105 mm ammunition, gun pod protection, and hydraulic circuit separation. These deficiencies will potentially be addressed as part of the Stryker Modernization Program, with Milestone B planned for in FY11.

Recommendations
- Status of Previous Recommendations. The Army satisfactorily addressed one recommendation from FY09. The postponement of the MEP reliability gunnery event and delay in SRAT II testing result in the remaining recommendations not yet being addressed by the program.
- FY10 Recommendations. As part of our coordination with the Army as directed in Section 115 of the FY09 National Defense Authorization Act, DOT&E recommended that the Army:
  1. Continue to improve MEP reliability and verify corrective actions during an operational gunnery event.
  2. Finalize configuration for SRAT II and schedule live fire testing in order to validate the SRAT II design and configuration.
  3. Increase gun pod protection.
  4. Develop an audio or visual cue to indicate low ammo to the gunner for the 7.62 mm coaxial machine gun.
  5. Proceed with the Stryker Modernization Program to completely fix deficiencies identified in DOT&E's 2007 BLRIP report that require an integrated solution.

Stryker Nuclear, Biological, and Chemical Reconnaissance Vehicle (NBCRV)

Executive Summary

- Based on emerging test results, the Stryker Nuclear, Biological, and Chemical Reconnaissance Vehicle (NBCRV) demonstrated improved reliability during the IOT&E conducted in September and October 2010. The point estimate for mean miles between operational mission failure of the base vehicle increased from 243 miles during IOT&E in 2006 to 902 miles during IOT&E in 2010. The point estimate for the mean time between operational mission failure of the mission equipment package increased from 79 hours in the 2006 IOT&E to 158 hours in the 2010 IOT&E. The 2010 operational test was conducted with an NBCRV equipped with slat armor as shown.
- The weight of the a second armor kit, Stryker Reactive Armor Tile Generation II (SRAT II), caused driveshaft and half-axle failures during NBCRV SRAT II durability testing, which will adversely affect operational effectiveness, suitability, and survivability.

System

- The NBCRV is one of nine configurations of the Infantry Carrier Vehicle variant of the Stryker family of vehicles. Chemical, biological, and radiological sensors and communications systems are integrated with the Stryker vehicle to perform chemical, biological, radiological, and nuclear (CBRN) detection, identification, marking, sampling, and reporting of these hazards.
- The NBCRV provides the four-member crew with levels of protection against small-arms, fragmenting artillery, mines, and rocket-propelled grenades (RPGs). RPG protection is currently provided by add-on slat armor (high hard steel arranged in a spaced array).
- The NBCRV is equipped with a filtering and over-pressure system that provides its crew protection from CBRN threats.
- The CBRN Mission Equipment Package includes the following:
  - Joint Biological Point Detection System
  - Joint Service Lightweight Standoff Chemical Agent Detector
  - Chemical and Biological Mass Spectrometer II
  - Chemical Vapor Sampling System
  - NATO standard markers and deployment system
  - Automatic Chemical Agent Detector Alarm
  - AN/VDR-2 and AN/UDR-13 Radiological detectors
- A NBCRV team consists of a Stryker NBCRV and a four person crew.
  - The Stryker Brigade Combat Team (BCT) has one platoon of three NBCRV teams.
  - The Heavy BCT has one squad of two NBCRV teams.
  - The Division or Corps Chemical Company has six NBCRV teams.

Mission

CBRN reconnaissance units conduct surveillance, and route, zone, and area reconnaissance to determine the presence and extent of CBRN contamination using the CBRN reconnaissance techniques of search, survey, surveillance, and sampling. A CBRN reconnaissance unit, as part of an early entry combat force, is capable of limited independent operations.

Major Contractor

General Dynamics Land Systems – Sterling Heights, Michigan

Activity

- General Dynamics Land Systems conducted a Design Failure Modes Effects Analysis to discover failure modes, and to design and implement corrective actions.
- The program conducted reliability growth testing at Yuma Proving Ground, Arizona, from May to December 2009 with

the NBCRV equipped with slat armor to assess design changes and improvements in reliability.
- The program conducted reliability testing on the NBCRV equipped with SRAT II at Yuma Proving Ground, Arizona, from May to July 2010 to assess the impact on system reliability caused by the addition of SRAT II.
- The Army Test and Evaluation Command conducted a 72-hour operational test of the NBCRV equipped with SRAT II, a driver comparison test of NBCRV equipped with each of the two add-on armor kits, and a Joint Biological Point Detector System Field Training Exercise from July to October 2010. Two of three test events were conducted in accordance with the DOT&E approved TEMP and test plan.
- The Army Test and Evaluation Command conducted a second phase of IOT&E at Dugway Proving Ground, Utah, from September 20 to October 1, 2010. The test was conducted in accordance with the DOT&E approved TEMP and test plan.
- In June 2010, the Army completed the first phase of additional controlled damage experimentation in support of the NBCRV LFT&E program.
- The Army completed initial risk reduction testing of SRAT II tiles in July 2010 and began risk reduction testing of a ballistic hull in September 2010 to support a ballistic vulnerability assessment of the NBCRV with SRAT II.
- Delays in delivery of the SRAT II and live fire test planning caused a delay in the execution of the live fire testing for SRAT II. The Stryker Double V-Hull LFT&E program continues to delay the Stryker NBCRV SRAT II LFT&E program.

Assessment
- Based on emerging results from IOT&E conducted in September and October 2010, the NBCRV demonstrated improved base vehicle and mission equipment package reliability. The point estimate for mean miles between operational mission failure of the base vehicle increased from 243 miles during 2006 IOT&E to 902 miles during the 2010 IOT&E. The point estimate for the mean time between operational mission failure of the mission equipment package increased from 79 hours in the 2006 IOT&E to 158 hours in the 2010 IOT&E.
- During developmental reliability growth testing, the NBCRV demonstrated base vehicle reliability of 1,600 mean miles between operational mission failure.
- The 2010 operational test was conducted with an NBCRV equipped with slat armor. A second armor kit that could be used in place of the slat armor, the SRAT II, adds an additional 7,600 pounds to the weight of the base vehicle. This weight led to driveshaft and half-axle failures during NBCRV SRAT II durability testing. Additional developmental testing of the vehicle equipped with SRAT II is required to understand the conditions that lead to these failures and their operational impact.

Recommendations
- Status of Previous Recommendations. The Army satisfactorily addressed previous recommendations.
- FY10 Recommendation.
  1. The program should address driveline and suspension failures caused by the weight of the SRAT II kit prior to fielding this kit with the NBCRV.

Warfighter Information Network – Tactical (WIN-T)

Executive Summary

- Warfighter Information Network – Tactical (WIN-T) Increment 2 supported voice, video, and data communications during the March 2009 Limited User Test (LUT). The network had deficiencies in reliability, ability to support on-the-move communications, training provided to Soldiers, communications speed, network operations, and information assurance.
- The Department of Defense delayed the program's Milestone C until February 2010 to allow the Army time to resolve program problems and to prepare a plan to improve deficiencies identified during the WIN-T Increment 2 LUT.
- The February 2010 Defense Acquisition Board (DAB) approved WIN-T Increment 2 Milestone C and authorized the Army to procure a partial Low-Rate Initial Production (LRIP) (160 of 400 communications nodes). The Milestone C decision directed the Army to improve WIN-T Increment 2 reliability and performance.
- The September 2010 WIN-T Increment 2 Acquisition Decision Memorandum (ADM) recognized that WIN-T Increment 2 met its performance goals within the limited technical testing environment of the Army's risk reduction developmental test events. The network did not meet its reliability goals. The ADM directed the Army to continue to improve WIN-T Increment 2 reliability and performance and to report the results of these improvements to the Overarching Integrated Process Team (OIPT) Chair, DOT&E, and the Director, Developmental Test and Evaluation (DDT&E).
- The program has executed a plan to fix, test and verify closure of the 16 identified WIN-T Increment 2 failure modes to improve reliability per the ADM. The program's goal is to complete this action by January 2011.

System

- WIN-T is a three-tiered communications architecture (space, terrestrial, and airborne) designed to be the Army's high-speed and high-capacity tactical communications network.
- The Army intends WIN-T to provide reliable, secure, and seamless communications for units operating at theater level and below.
- The WIN-T program consists of four Increments:
  - Increment 1: "Networking at the Halt" enables the exchange of voice, video, data, and imagery throughout the tactical battlefield using a Ku- and Ka- satellite-based network.
  - Increment 2: "Initial Networking on the Move" provides command and control on the move down to the company level for maneuver brigades and implements an improved network security architecture.
  - Increment 3: "Full Networking on the Move" provides full mobility command and control for all Army field commanders, from theater to company level. Network reliability and robustness are enhanced with the addition of the air tier transport layer which consists of networked airborne communications relays.
  - Increment 4: "Protected Satellite Communications on the Move" includes access to the next generation of protected communications satellites while retaining all previous on-the-move capabilities.

Mission

Commanders at theater and below will use WIN-T to:

- Integrate satellite-based communications capabilities into an everything-over-Internet Protocol network to provide connectivity, while stationary, across an extended, non-linear battlefield and at remote locations (Increment 1).
- Provide division and below maneuver commanders with mobile communications capabilities to support initial command and control on the move (Increment 2).
- Provide all maneuver commanders with mobile communications capabilities to support full command and control on the move, including the airborne relay and protected satellite communications (Increments 3 and 4).

Major Contractor

General Dynamics, C4 Systems – Taunton, Massachusetts

Activity

- The Army conducted a combined WIN-T Increment 2 and Increment 1b LUT at Fort Stewart, Georgia; Fort Lewis, Washington; and Fort Gordon, Georgia, in March 2009.
- The WIN-T Increment 2 OIPT delayed the program's Milestone C until February 2010. The OIPT took this action to allow the Army time to resolve contracting delays, interoperability issues with future WIN-T radio systems, and to prepare a plan to improve reliability and performance deficiencies identified during the WIN-T Increment 2 LUT. The OIPT developed WIN-T Increment 2 reliability and performance goals that were sufficient to assure confidence that the Army could meet its requirements at IOT&E.
- From December 2009 through July 2010, the Army executed a series of risk reduction developmental testing events to improve WIN-T Increment 2 reliability and performance. Risk reduction developmental testing events 1 - 3 were conducted at the contractor's facility in Massachusetts. Risk reduction developmental testing event 4 was conducted at Aberdeen Proving Ground, Maryland, and included on-the-move operations with fielded Army command and control systems.
- The WIN-T Increment 2 risk reduction developmental tests were limited in scope and environment due to the following:
  - The network was significantly smaller than the 2009 WIN-T Increment 2 LUT.
  - Field Service Engineers operated and maintained the WIN-T assemblages.
  - Some non-production-representative systems used commercial air conditioners and generators.
  - Message traffic was simulated and did not represent the traffic of a fielded network.
  - Test events were conducted as scripted engineering technical tests.
  - Commercial power was used to a far greater extent than actual field operations.
- On February 2, 2010, the Defense Acquisition Executive (DAE) chaired the WIN-T Increment 2 DAB to review the Army's request for Milestone C approval. The resulting March 9, 2010, ADM approved LRIP of 160 communications nodes and directed the Army to improve reliability and performance deficiencies to meet DAB goals. The ADM established a future In Progress Review (IPR) of reliability and performance improvements, and to decide whether to procure the remaining 240 LRIP communications nodes.
- On September 3, 2010, the DAE published an ADM that approved the remaining LRIP and recognized that WIN-T Increment 2 met limited performance goals, but did not meet its reliability goals in the risk reduction developmental test events. The ADM directed the Army to continue its work on reliability and performance, and to report the results to the OIPT Chair, DOT&E and the DDT&E.
- The program has executed a plan to fix, test and verify closure of the 16 identified WIN-T Increment 2 failure modes to improve reliability per the ADM. The program reports its progress monthly and maintains a goal to complete this action by January 2011.

Assessment

- The DOT&E WIN-T Increment 2 Operational Assessment, dated January 14, 2010, assessed results from the WIN-T Increment 2 LUT as supportive of voice, video, and data communications. However, the network needs improvement in the following areas:
  - Reliability
  - Ability to support on the move communications
  - Training provided to Soldiers due to complexity of the system
  - Speed of communications due to network routing
  - Network Operations Management
  - Information Assurance
- The risk reduction developmental testing events revealed the following:
  - WIN-T Increment 2 did not demonstrate sufficient improvement to meet reliability goals.
  - WIN-T Increment 2 met performance goals under the limited test environment.
- The network requires improvements in reliability and performance to meet the demanding environment of combat operations.
- The Army needs to develop and approve requirements documents for WIN-T Increment 1b and Increment 3 to support planning for operational tests in FY12-13.
- The Army needs to complete the Milestone C update of the WIN-T Increment 2 Test and Evaluation Master Plan (TEMP) to support IOT&E and needs to develop a WIN-T Increment 3 TEMP.

Recommendations

- Status of Previous Recommendations. The Army is addressing all previous recommendations.
- FY10 Recommendations. The Army should:
  1. Correct all deficiencies identified during the WIN-T Increment 2 LUT. This plan should include improvements in performance and a reliability growth plan for all configuration items.
  2. Assure that sufficient resources including test units, configuration items, and training areas for full spectrum, on-the-move operations are allocated for future operational test events to satisfy WIN-T's theater and below network requirements.
  3. Complete requirements documents for Increment 1b and Increment 3, update the Increment 2 TEMP, and develop an Increment 3 TEMP.

Navy Programs

Navy Programs

Acoustic Rapid Commercial Off-the-Shelf (COTS) Insertion (A-RCI) for Sonar AN/BQQ-10 (V)

Executive Summary

- The Acoustic Rapid Commercial Off-the-Shelf (COTS) Insertion (A-RCI) Sonar is an improvement over the legacy sonar systems it replaces. The Navy's practice of bi-annually updating the A-RCI software and hardware qualitatively appears to improve technical performance, but insufficient test data exist to measure and quantify the improved mission capability.
- The Navy completed operational testing of the A-RCI Advanced Processor Build 2007 version (APB-07) system in FY10 and is expected to issue a report in FY11.
- DOT&E's preliminary analysis of operational test results found the APB-07 system provides performance similar to previous APBs.

System

- A-RCI is an open architecture sonar system intended to maintain an advantage in acoustic detection of threat submarines.
- A-RCI uses legacy sensors and replaces central processors with COTS computer technology and software. The program includes the following:
  - A sonar system for the *Virginia* class submarine
  - A replacement sonar system retrofitted into *Los Angeles*, *Ohio*, and *Seawolf* class submarines
  - Biannual software upgrades, (APBs), and hardware upgrades, Technology Insertions (TIs). While using the same process and nomenclature, these APBs and TIs are distinct from those used in the AN/BYG-1 Combat Control System program.
- The Navy intends the A-RCI upgrades to provide expanded capabilities for anti-submarine warfare, high-density contact management, and mine warfare, particularly in littoral waters and against diesel submarines.
- A-RCI processes data from the submarine's acoustic arrays (i.e., spherical array, hull array, wide aperture array, and high frequency array) along with submarine's two towed arrays (i.e., the fat line array consisting of the TB-16 or TB-34 and the thin line array consisting of the TB-23, TB-29, or TB-33).

Mission

The Navy's intent for submarine crews equipped with the A-RCI sonar is to complete the following submarine force missions:

- Search, detect, and track submarine and surface vessels in open-ocean and littoral sea environments without being counter-detected
- Search, detect, and avoid mines and other submerged objects
- Covertly conduct intelligence, surveillance, and reconnaissance efforts
- Covertly execute Naval Special Warfare missions
- Perform under-ice operations

Major Contractor

Lockheed Martin Maritime Systems and Sensors – Washington, District of Columbia

Activity

- The Navy completed operational testing of A-RCI APB-07 in October 2010. APB-07 testing of the passive sonar capability included Anti-Submarine Warfare (ASW) search testing against a nuclear submarine target and High-Density Surface Contact Management testing in October 2009. This testing was combined with the operational test of the newly-developed TB-34 towed array. APB-07 testing of the high-frequency mine-detection sonar occurred in June 2010. Testing was conducted in accordance with a DOT&E-approved test plan.
- DOT&E approved the A-RCI APB-07 Test and Evaluation Master Plan (TEMP) in June 2009. For the first time, the scope of the testing was expanded to combine A-RCI testing with the AN/BYG-1 Combat Control System and the new TB-34 towed array. Although the Navy planned to complete A-RCI APB-07 operational testing before the first submarine

with the system deployed, this did not occur due to a lack of available test assets.

- The Navy began installing the A-RCI APB-09 system on operational submarines (initial installation on USS *North Carolina* – a *Virginia* class submarine) in 2010. DOT&E expects to approve the A-RCI APB-09 TEMP early in FY11. Developmental testing of the APB-09 system began in 4QFY10 and is expected to continue through 2QFY11. Operational testing of the APB-09 system is scheduled to occur in FY11.

Assessment

- The Navy's practice of bi-annually updating the A-RCI software and hardware qualitatively appears to improve technical performance, but insufficient test data exists from APB to APB to measure and quantify the improved mission capability across the mission areas.
- The Navy's schedule-driven process prevents operational test results from directly supporting development of the follow-on APBs. The Navy completed operational testing of the A-RCI APB-07 system in 2010. Due to the combination of late completion of testing and the Navy's practice of issuing an updated version every two years, data from APB-07 operational testing has not been included in the development of APB-09 or APB-11, which are either already complete or nearing completion.
- Preliminary test results do not indicate that APB-07 demonstrates a measurable improvement over previous software versions. DOT&E's assessment of the A-RCI sonar system remains the following:
  - A-RCI passive sonar capability is effective against older classes of submarines in most environments, but is not effective in some environments against modern threats of record.
  - A-RCI is not effective in supporting operator situational awareness and contact management in areas of high contact density.
  - A-RCI high-frequency mine performance is not effective for transiting a minefield, and appears to meet threshold requirements in some environments, but not in others.
  - A newly introduced mine detection capability, although unable to be fully utilized, appears to provide significant potential for improving these operations.
  - Overall, A-RCI continues to be not suitable due to problems with software reliability. APB-07 appears to have poorer reliability than previous builds.
- The A-RCI program's schedule of producing bi-annual upgrades to software and hardware results in requirements documents and TEMPs being developed and approved in parallel with APB development and installation. As a result, the fleet assumes additional risk since most operational testing is not completed before the system is initially deployed.
- The Navy has achieved some testing efficiencies by combining operational testing of several programs into consolidated test events. Since testing is interdependent, the consolidation of A-RCI, TB-33, TB-34, and AN/BYG-1 TEMPs into an Undersea Enterprise Capstone document would increase testing efficiency and enable a full end-to-end evaluation of submarine capability in the applicable mission areas.

Recommendations

- Status of Previous Recommendations. The Navy has made progress in addressing 7 of the 15 previous recommendations. Two of the outstanding recommendations are classified and are contained in the October 2009 Beyond Low-Rate Initial Production report. The remaining recommendations are:
  1. Evaluate the covertness of the High Frequency sonar during a future submarine-on-submarine test.
  2. Investigate the software reliability problems and institute measures to improve system software and recording devices' reliability.
  3. Implement a reliability growth program.
  4. Evaluate the ability of A-RCI to detect and classify a snorkeling SSK operating in littoral waters containing several diesel-powered vessels.
  5. Consider investing in improvements to the Onboard Trainer to improve trainer reliability and target realism.
  6. Develop operationally relevant metrics to evaluate A-RCI performance to allow for comparison testing between APBs and an assessment of the system's planned improvements as well as overall performance.
- FY10 Recommendation.
  1. The Navy should consolidate the A-RCI, TB-33, TB-34, and AN/BYG-1 TEMPs into an Undersea Enterprise Capstone document.

Aegis Modernization Program

Executive Summary

- Operational testing of Aegis Guided Missile Cruisers (CGs 52-58) upgraded with Aegis Warfare System (AWS) Advanced Capability Build 2008 (ACB08) commenced in July 2010 and is expected to be completed in 3QFY11.
- The analysis of test data collected during the Undersea Warfare, maintainability, and information assurance portions of operational testing is still in progress. No preliminary evaluation is available. DOT&E expects to issue a test report in 4QFY11.

System

- The Navy's Aegis Modernization program provides updated technology and systems for existing Aegis Guided Missile Cruisers (CG 47) and Destroyers (DDG 51). This planned, phased program provides similar technology and systems for new Destroyers.
- The AWS, carried on DDG 51 Guided Missile Destroyer and CG 47 Guided Missile Cruisers, integrates the following components:
  - AWS AN/SPY-1 three-dimensional (range, altitude, and azimuth) multi-function radar
  - SQQ-89 Undersea Warfare suite that includes the AN/SQS-53 sonar, SQR-19 passive towed sonar array (DDGs 51-78, CGs 52-73), and the SH-60B or MH-60R Helicopter (DDGs 79 and newer have a hangar to allow the ship to carry and maintain its own helicopter)
  - Close-In Weapon System
  - Five-inch diameter gun
  - Harpoon anti-ship cruise missiles (DDGs 51-78, CGs 52–73)
  - Vertical Launch System that can launch Tomahawk land-attack missiles, STANDARD surface-to-air missiles, Evolved SeaSparrow Missiles, and Vertical Launch Anti-Submarine Rocket missiles
- The AWS on Baseline 2 Aegis Guided Missile Cruisers (CGs 52-58) was upgraded with commercial off-the-shelf hardware running the AWS software Advanced Capability Build 2008 (ACB08).
- The AWS on new construction Aegis Guided Missile Destroyers (DDGs 103-112) is Baseline 7.1R.

Mission

The Maritime Component commander can employ AWS-equipped DDG 51 Guided Missile Destroyers and CG 47 Guided Missile Cruisers to:

- Conduct Anti-Air Warfare, Anti-Surface Warfare, and Anti-Submarine Warfare.
- Conduct Strike Warfare when armed with Tomahawk missiles
- Conduct offensive and defensive warfare operations simultaneously.
- Operate independently or with Carrier or Expeditionary Strike Groups, as well as with other joint or coalition partners.

Major Contractors

- General Dynamics Marine Systems Bath Iron Works – Bath, Maine
- Northrop Grumman Shipbuilding – Pascagoula, Mississippi
- Lockheed Martin Maritime Systems and Sensors – Moorestown, New Jersey

Activity

- Commander, Operational Test and Evaluation Force (COTF) conducted all portions of the planned operational test of AWS ACB08 with the exception of air defense testing scheduled to be conducted in 3QFY11. Undersea Warfare testing was conducted on USS *Philippine Sea* (CG 58) at the Atlantic Undersea Test and Evaluation Center (AUTEC) in July 2010. Information Assurance testing and maintainability testing (i.e., maintenance demonstration) were conducted on USS *Mobile Bay* (CG 53) in September 2010. COTF conducted the testing in accordance with the DOT&E-approved test plan.

- Based on test results to date, the Navy is evaluating whether to deploy one AWS ACB08-equipped Cruiser in 1QFY11, prior to the completion of air defense, surface warfare, and suitability operational testing in 3QFY11.
- The Navy completed repair of critical software faults discovered during earlier developmental testing that ultimately prevented operational testing of the AWS Baseline 7.1R. In August 2010, the Navy certified baseline 7.1R for shipboard installation and continued testing. The Navy intends to deploy one AWS Baseline 7.1R-equipped Destroyer in 1QFY11, prior to the conduct of operational testing scheduled to be conducted in 1QFY12.
- The Navy is updating its Test and Evaluation Master Plan (TEMP) to incorporate follow-on AWS baseline ACB 2012 (ACB12). ACB12 is intended as a family of baselines that will include DDG (51-90) with Ballistic Missile Defense (BMD) capability, CG (59-69) without BMD, and CG (67, 70, 72, and 73) with BMD.

Assessment

The analysis of test data collected during the Undersea Warfare, maintainability, and information assurance portions of AWS ACB08 operational testing is still in progress. No preliminary evaluation is available. DOT&E expects to issue a formal test report in 4QFY11.

Recommendations

- Status of Previous Recommendations. The Navy satisfactorily addressed one of the previous five recommendations. The following recommendations remain valid:
  1. The Navy should complete all planned key operational tests of AWS Baseline 7.1 in accordance with the DOT&E-approved TEMP and test plan.
  2. The Navy should continue to improve the AWS ability to counter high-speed surface threats in littoral waters and Standard Missile reliability.
  3. The Navy should correct the AWS and AN/SPY-1D(V) radar training and human systems integration deficiencies in addition to providing appropriate tactical documentation to support effective combat system employment
- FY10 Recommendation.
  1. The Navy should work to synchronize the conduct and reporting of OT&E with intended ship deployment schedules to assure that future AWS baselines complete OT&E prior to initial deployment.

AGM-88E Advanced Anti-Radiation Guided Missile (AARGM) Program

Executive Summary

- The Navy postponed the operational test readiness review for IOT&E from September 2009 to February 2010 because of continuing hardware and software deficiencies discovered in developmental test.
- IOT&E started in June 2010 after DOT&E required additional low-rate initial production (LRIP) missiles that included firmware and hardware corrections not included in the production-representative model (PRM) missiles. IOT&E began with four LRIP missiles and eight PRM missiles.
- During IOT&E, the AARGM experienced six operational missile failures during captive carry flight test (four PRM failures and two LRIP failures). AARGM completed 12 percent of the 100 planned sorties, accumulating 48.1 hours of missile operating time.
- Following the six missile failures, the Navy de-certified the AARGM for IOT&E and focused on fault identification and correction of deficiencies.
- DOT&E rescinded the IOT&E Test Plan approval, requiring the Navy to re-plan testing using LRIP missiles incorporating all of the discovered corrections of deficiencies.

System

- The AARGM is the follow-on to the AGM-88B/C/D High Speed Anti-Radiation Missile using a modified AGM-88B/C/D missile body and fins. AARGM is carried on F/A-18C/D/E/F/G platforms.
- The AARGM changes will incorporate Millimeter Wave (MMW), GPS, digital Anti-Radiation Homing (ARH), a Weapon Impact Assessment (WIA) Transmitter, and an Integrated Broadcast Service Receiver (IBS-R).
  - MMW technology allows enhanced target discrimination during terminal guidance of the weapon.
  - ARH improvements include an increased field-of-view and larger frequency range.
  - The GPS allows position accuracy in location, time, and WIA transmissions.
  - The IBS-R allows reception of national broadcast data.

Mission

- Units equipped with AARGM conduct pre-planned, on-call, and time-sensitive anti-radiation targeting for the degradation and destruction of radio frequency-enabled surface-to-air missile systems.
- Commanders use the AARGM to provide real-time weapons impact assessment via a national broadcast data system.

Major Contractor

Alliant Techsystems, Defense Electronics Systems Division – Woodland Hills, California

Activity

- The Navy postponed the operational test readiness review for IOT&E from September 2009 to February 2010 due to continuing hardware and software deficiencies discovered in developmental test.
- The Navy clarified the Capability Production Document requirements by approving the following changes: 1) defer one Key Performance Parameter target to FOT&E; 2) clarify the target environment; and 3) clarify reactive targeting language. These substantial changes were required to better explain or defer the missile performance requirements before the start of IOT&E.
- The Navy planned for the use of 11 PRM and two LRIP missiles for the IOT&E. DOT&E learned late that the majority of the PRMs included firmware and hardware deficiencies; these deficiencies were corrected in the LRIP design. All of the PRMs were prone to WIA overheat failure if temperatures exceeded a specific value, and half of the missiles had electrical servo-motor connections that were

prone to break, resulting in steering failure. Therefore, the PRMs would not provide adequate confidence in the full-rate production decision following IOT&E.
- DOT&E did not concur that the PRMs were adequate for IOT&E. The Navy agreed to include two additional LRIP missiles and fewer PRM missiles for the IOT&E, with a final configuration of four LRIP and eight PRM missiles.
- The Navy started AARGM IOT&E in June 2010 at Air Test and Evaluation Squadron Nine (VX-9) in China Lake, California, with two LRIP and eight PRM missiles. The remaining two LRIP missiles arrived shortly after the start of test.
- Commander, Operational Test Force (COTF) conducted testing in accordance with the DOT&E-approved test plan. IOT&E was appropriately scoped and resourced with 10 live missile firings, along with captive carry, reliability, and compatibility testing in operational environments against threat-representative targets. COTF representatives validated and accredited targets for AARGM before the start of IOT&E.
- As of August 2010, AARGM suffered six operational missile failures during captive carry flight test, with VX-9 publishing eight anomaly reports.
- In September 2010, the Navy de-certified the AARGM for IOT&E, stopping test and evaluation before a live fire test event to resolve the identified deficiencies and to prepare for the eventual re-start of the IOT&E.
- The Navy completed 12 percent of 100 planned sorties, accumulating 48.1 hours of missile operating time before stopping test.
- As a result of the missile failures and de-certification of AARGM, DOT&E rescinded the IOT&E Test Plan approval, requiring the Navy to correct all the discovered deficiencies before returning to test with LRIP missiles.

Assessment
- The six operational missile failures during captive carry flight test included three unrecoverable weapon failure indications, a communications hold failure, a guidance and control section failure, and an emitter misidentification of an unambiguous target.
  - Four of the eight PRM missiles and two of the four LRIP missiles experienced failures that would have resulted in mission abort.
  - Four of the weapons failed on their first captive carry flight, one failed on the second flight, and one failed on the third flight. This indicates the AARGM design is prone to early failures.
- Failures and deficiencies identified during IOT&E indicate developmental testing was insufficient to characterize system performance and will require root-cause corrective action for each failure before returning to test and evaluation.

Recommendations
- Status of Previous Recommendations. The Navy satisfied the FY09 recommendation to accredit the surrogate targets to be used in operational testing, but did not complete the recommendation to fully characterize the MMW and ARH sensors in developmental testing to prevent discovery of deficiencies in operational test and evaluation.
- FY10 Recommendations.
  1. The Navy must fully characterize the MMW and ARH sensors in developmental test prior to the restart of formal operational test in order to ensure that operational test and evaluation is a period of confirmation vice discovery.
  2. All future operational test assets should be conducted using LRIP missiles incorporating correction of deficiencies.

AIM-9X Air-to-Air Missile Upgrade

Executive Summary

- The AIM-9X program continues OT&E of hardware and software upgrades to the fielded missile.
- Hardware and software upgrades now under development are planned to address parts obsolescence problems and provide multiple new capabilities. Operational testing during FY10 assessed the AIM-9X Block II missile with Operational Flight Software (OFS) 9.2 hardware upgrades, as well as surface attack capabilities inherent in the AIM-9X Block I missile with OFS 8.220.
- Operational testing of Block II, OFS 9.2 captive-carry hardware showed those missiles have no degradation relative to the Block I, OFS 8.212 missile. An Operational Utility Evaluation (OUE) of surface attack capabilities suggest that the AIM-9X Block I, OFS 8.220 is effective under a limited set of conditions in which successful target acquisition is attained.
- The Navy rebaselined the program (as a result of service funding, cost, and schedule overruns) and classified as a new program entering pre-Milestone C.

System

- AIM-9X is the latest generation short-range, heat-seeking, air-to-air missile. The currently fielded version of the missile is AIM-9X Block I, OFS 8.212, which includes limited lock on-after-launch, full envelope off-boresight capability without a helmet-mounted cueing system, and increased flare rejection performance.
- AIM-9X is highly maneuverable, day/night capable, and includes the warhead, fuse, and rocket motor from the previous AIM-9M missile.
- AIM-9X added a new imaging infrared seeker, vector controlled thrust, digital processor, and autopilot.
- F-15C/D, F-16C/D and F/A-18C-F aircraft can carry the AIM-9X, and the missile includes a container for storage and maintenance.
- AIM-9X Block II is the latest hardware version and is designed to prevent parts obsolescence and provide processing capability for the upcoming OFS 9.3XX software upgrade. The Block II missile includes a new processor, a new ignition battery for the rocket motor, ignition safety device, data link, and warhead fuze. OFS 9.208 is the current software OFS version completing OT for the Block II missile and provides similar capabilities as the currently fielded Block I, OFS 8.212.
- OFS 9.3XX will be a software-only upgrade to the Block II missile, and will add trajectory management to improve range, data link with the launching aircraft, improved lock-on-after-launch, target reacquisition, improved fuzing, and surface attack.

Mission

Air combat units use the AIM-9X to:

- Conduct short-range offensive and defensive air-to-air combat.
- Engage multiple enemy aircraft types with passive infrared guidance in the missile seeker.
- Seek and attack enemy aircraft at large angles away from heading of the launch aircraft.

Major Contractor

Raytheon, Missile Systems – Tucson, Arizona

Activity

- Operational testing for Block II, OFS 9.2 began in September 2010. Captive-carry missions were flown using the F-18 at the Naval Air Weapons Center, China Lake, California, and using the F-15/F-16 at Eglin AFB, Florida.
- Technical delays in fuze development led to splitting operational testing into two phases. The first phase involves captive-carry missiles only, and will support a decision to field captive air training missiles. A second phase will involve captive-carry missions, as well as four live fire events, to support an operational fielding decision in FY12.
- The Air Force conducted an OUE of the AIM-9X Block I, OFS 8.220 missile for surface attack capability in March and

May 2010. The testing consisted of seven captive carry events and six live fire events. Of those six live fire shots, four scored direct hits of the ground mobile targets, one hit a different target than fired against, and one lost track on the selected target.

- The Navy rebaselined the program and classified it as a new program entering pre-Milestone C. The new program is designated AIM-9X Block II with the first software designated OFS 9.3. This decision was primarily driven by cost per unit increase due to the new DSU-41 fuze, reductions in service funding, the Block II, OFS 9.3XX costs, and schedule overruns. Milestone C is now scheduled for summer 2011.

Assessment

- The OUE results suggest OFS 8.220 is effective under a limited set of conditions in which a successful target acquisition is attained.
- Initial results from operational testing suggest that the Block I (-2), OFS 9.2 captive carry missiles will have no degradation relative to the Block I, OFS 8.212 missile. The Block II, OFS 9.3 development and test schedule is overlapping with the Block I (-2), OFS 9.208 test. A successful OFS 9.3 development may lead to cancellation of the second phase of OFS 9.2 operational testing and cancellation of the Block I (-2), OFS 9.208 missile fielding in favor of the Block II, OFS 9.3 missile fielding.

Recommendations

- Status of Previous Recommendations. The one FY09 recommendation regarding future testing including sufficient captive-carry and live fire shots to demonstrate the new capabilities remains valid.
- FY10 Recommendations. None.

AN/BYG-1 Combat Control System

Executive Summary

- Although the Navy planned to complete AN/BYG-1 Advanced Processor Build (APB) 2007 version testing before the first APB-07 submarine deployed, this did not occur due to a lack of an available submarine test asset. Subsequently, the Navy completed testing in September 2010.
- The Navy completed development of the APB-09 version and operational testing is planned for FY11.

System

- AN/BYG-1 is an open-architecture submarine combat control system for analyzing and tracking submarine and surface ship contacts, providing situational awareness, as well as the capability to target and employ torpedoes and missiles.
- AN/BYG-1 replaces central processors with commercial off-the-shelf computer technology and software. The Navy installs improvements to the system via an incremental development program. The program includes the following:
  - A combat control system for the *Virginia* class submarine
  - A replacement combat control system backfit into *Los Angeles*, *Ohio*, and *Seawolf* class submarines
  - Biannual software upgrades called APBs and hardware upgrades called Technology Insertions (TI). While using the same process and nomenclature, these APBs and TIs are distinct from those used in the Acoustic Rapid Commercial-Off-the-Shelf (COTS) Insertion (A-RCI) program.
- The Navy intends improvements to provide expanded capabilities for anti-submarine and anti-surface warfare, high density contact management (HDCM), and the targeting and control of submarine weapons.
- The Navy is also developing AN/BYG-1 for use on the Royal Australian Navy *Collins* class diesel electric submarines.

Mission

Submarine crews equipped with the AN/BYG-1 combat control system are able to complete the following submarine force missions:

- Analyze submarine sensor contact information to track submarine and surface vessels in open-ocean and littoral sea environments.
- Employ heavyweight torpedoes against submarine and surface ship targets.
- Receive strike warfare tasking, plan strike missions, and employ Tomahawk land attack cruise missiles.
- Receive and synthesize all organic sensor data and external tactical intelligence to produce an integrated tactical picture.

Major Contractors

- General Dynamics Advanced Information Systems – Fairfax, Virginia
- General Dynamics Advanced Information Systems – Pittsfield, Massachusetts

Activity

- Although the Navy planned to complete AN/BYG-1 APB-07 testing before the first APB-07 submarine deployed, this did not occur due to a lack of an available submarine test asset.
- The Navy conducted an AN/BYG-1 APB-07 Anti-Submarine Warfare search rate test, an HDCM operational test, and a Strike Warfare test in October 2009 in accordance with the DOT&E-approved Test and Evaluation Master Plan (TEMP) and test plan. The test events were combined with the testing of the A-RCI APB 07 sonar upgrades and the new TB-34 towed array. The Navy conducted a second HDCM test event in May 2010, in conjunction with Low Cost Conformal Array operational testing, to test specific features of the APB-07 software that were not tested in the initial event.
- The Navy conducted an Information Assurance vulnerability evaluation of APB-07 in October 2009, and completed the Information Assurance testing with a penetration test of the system in December 2009.
- The Navy began installing the AN/BYG-1 APB-09 system on operational submarines in 2010. DOT&E expects to sign the AN/BYG-1 APB-09 TEMP in FY11.

Assessment

- The Navy's practice of bi-annually updating the BYG-1 software and hardware appears to qualitatively improve technical performance, but insufficient test data exists from

APB to APB to measure and quantify the improved mission capability across the mission areas.

- Preliminary test results on APB-07 performance indicate the following:
  - BYG-1 APB-07 performance in the HDCM scenarios was mixed. While improvements were observed, the test ship was not able to meet the BYG-1 target localization requirements when operating either at periscope depth or deep.
  - Information Assurance testing was inadequate to fully evaluate the system. The vulnerability evaluation uncovered some potential vulnerable areas in the system, but the penetration test was unable to breach the system. However, this conflict could not be resolved because the Navy Information Operations Command (NIOC) did not release their penetration testing methodology and it could not be determined to what level the penetration test attempted to exploit the potential vulnerabilities. NIOC did not want their techniques released to future test platforms in order to maintain the effectiveness of their test techniques.
  - Overall, AN/BYG-1 APB-07 appears to be suitable, demonstrating above-threshold reliability and availability.
- The APB-07 Information Assurance test revealed some discrepancies between how NIOC shares information between the acquisition and testing communities. DOT&E is working with the Office of the Secretary of Defense for Acquisition, Technology and Logistics; the Commander, Operational Test and Evaluation Force; and NIOC to assure data are shared similarly between the communities and that future test events will provide sufficient data to adequately evaluate and report on the systems being tested.
- Despite completing test events in October 2009 and May 2010, the Navy has not completed data reconstruction and has not provided all relevant data to DOT&E.
- The Navy has achieved some testing efficiencies by combining operational testing of several programs into consolidated test events. Since testing is interdependent, the consolidation of A-RCI, TB-33, TB-34, and AN/BYG-1 TEMPs into an Undersea Enterprise Capstone document would increase testing efficiency and enable a full end-to-end evaluation of submarine capability in the applicable mission areas.

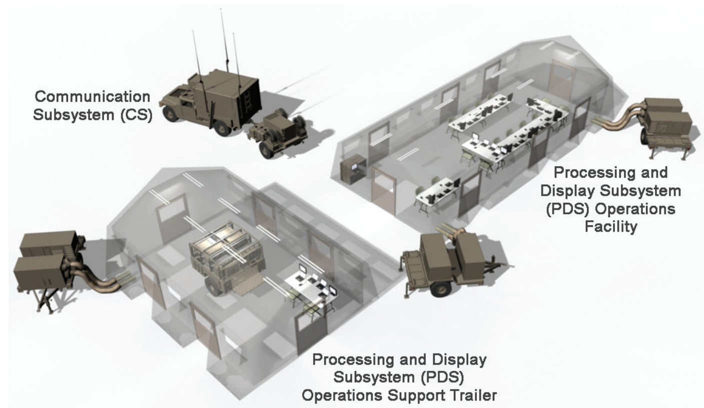
Recommendations

- Status of Previous Recommendations. The Navy has satisfactorily addressed all but three previous recommendations. Recommendations that still need to be addressed involve developing requirements to allow APB comparison, developing platform level metrics, and implementing an event-based schedule.
- FY10 Recommendations. The Navy should:
  1. Assure that sufficient data are collected during future penetration tests such that the attack can be reconstructed in detail.
  2. Address the major deficiencies found during the Information Assurance vulnerability evaluation.
  3. Assure data collection occurs in a manner that supports a complete and timely assessment.
  4. Consolidate the A-RCI, TB-33, TB-34, and AN/BYG-1 TEMPs into an Undersea Enterprise Capstone document.

Common Aviation Command and Control System (CAC2S)

Executive Summary

- The Marine Corps restructured the Common Aviation Command and Control System (CAC2S) program in April 2009 following a Critical Change Report to Congress. The Navy, as the Milestone Decision Authority (MDA), rescinded Milestone C in December 2009.
- The restructured CAC2S program divided Increment 1 into a two-phased approach.
- The Marine Corps Operational Test and Evaluation Activity conducted a CAC2S Phase 1 operational assessment in August 2010. The operational assessment report is expected to support the program's Phase I Milestone C acquisition decision in 1QFY11.
- The Marine Corps runs the risk of not testing all required Phase 1 operational capabilities prior to the 3QFY11 IOT&E.
- The Marine Corps currently does not have an alternate IOT&E test venue and runs the risk of not completing an adequate test should the currently planned live exercise preclude full execution of all operational test requirements due to real-world training priorities.



System

- CAC2S will provide Marine Corps operators with the ability to share mission-critical voice, video, sensor, and command and control (C2) data and information in order to integrate aviation and ground combat planning and operations in support of the Marine Air-Ground Task Force (MAGTF).
- CAC2S will consist of tactical shelters, software, and common hardware. The hardware components are expeditionary, common, modular, and scalable, and may be freestanding, mounted in transit cases, or rack-mounted in shelters and/or general purpose tents that are transported by organic tactical mobility assets.
- CAC2S Increment 1 is comprised of three functional subsystems:
  - Processing and Display Subsystem (PDS) – Provides the operational command post and functionality to support mission planning, decision making, and execution tools for all aspects of Marine Aviation.
  - Communication Subsystem (CS) – Provides the capability to interface with internal and external communication assets and the means to control their operation.
  - Sensor Data Subsystem (SDS) – Provides an open architecture interface capable of integrating emerging active and passive sensor technology for organic and non-organic sensors of the Marine Air Command Control System (MACCS).
- CAC2S Increment 1, Phase 1 will include the PDS and CS to establish the baseline Direct Air Support Center (DASC) for the Marine Air Support Squadron and limited Tactical Air Operations Center (TAOC) mission capability for the Marine Air Control Squadron (MACS). Phase 2 will be enhanced by the SDS and should meet remaining MACCS aviation battle management C2 requirements.

Mission

- The MAGTF commander will employ CAC2S to integrate Marine Corps aviation into joint and combined air/ground operations in support of Operational Maneuver From the Sea, Sustained Operations Ashore, and other expeditionary operations. The CAC2S will support the MAGTF C2 concept and will provide an expeditionary and common joint air command and control capability.
- CAC2S will enable the MAGTF commander to execute command and control of assigned assets afloat and ashore in joint, allied, or coalition operational environments by providing a display of a common, near real-time integrated tactical picture. The picture will facilitate the control of friendly assets and the engagement of threat aircraft and missiles and have access to theater and national intelligence sources from a single, multi-function C2 node.

Major Contractors

Phase 1
- Government Integrator: Naval Surface Warfare Center – Crane, Indiana
- Component Contractor: Raytheon-Solipsys – Fulton, Maryland
- Component Contractor: General Dynamics – Columbia, Maryland

Phase 2
- To be determined (Contract Award planned for FY11)

Activity

- The Marine Corps restructured the CAC2S program and divided Increment 1 into two phases. The MDA approved a new Phase 1 Acquisition Strategy in August 2010 and scheduled Milestone C for 1QFY11. The Marine Corps began developmental testing of CAC2S Phase 1 in July 2010.
- The Marine Corps Operational Test and Evaluation Activity observed the developmental test and conducted a dedicated CAC2S Phase 1 operational assessment in August 2010.
- The operational assessment was conducted in accordance with a DOT&E-approved test plan and consisted of operationally realistic scenarios with only a DASC element operating the CAC2S. The operational assessment did not assess the system employment in a limited TAOC configuration. The operational assessment results will support the Milestone C decision for acquisition and production of five Limited Deployment Units (LDUs) for use during the IOT&E in 3QFY11.
- The Marine Corps is working to finish the CAC2S Phase 1 Test and Evaluation Master Plan (TEMP) to support the Milestone C decision currently scheduled for November 2010.

Assessment

- Evaluation of the CAC2S Phase 1 operational assessment is in-progress and is expected to be completed 1QFY11 to support the Milestone C and LDU acquisition decision.
- The Marine Corps runs the risk of not testing the operational capability and integration of the CAC2S Phase 1 with the TAOC until IOT&E. Only the DASC functionality was evaluated during the operational assessment in August 2010.
- The Marine Corps currently does not have an alternate IOT&E test venue and runs a risk of not completing an adequate test should the currently planned live exercise preclude full execution of all operational test requirements due to real-world training priorities.
- The Marine Corps faces scheduling challenges on completing the TEMP prior to the scheduled Milestone C.

Recommendations

- Status of Previous Recommendations. This is the first annual report since restructuring of the program.
- FY10 Recommendations.
  1. The Program Office should consider an additional event prior to IOT&E that tests the operational functionality, integration, and employment of the CAC2S with both the DASC and TAOC.
  2. The Program Office should plan and resource an alternate IOT&E test venue should the currently planned live exercise venue not provide the requisite test environment.
  3. Update the CAC2S TEMP to provide clear expectations and priorities for testing and fielding prior to the Milestone C.

Common Submarine Radio Room (CSRR) (includes Submarine Exterior Communications System (SubECS))

Executive Summary

- The Navy is conducting operational testing of Increment 1 Version 2 of the Common Submarine Radio Room (CSRR) on an *Ohio* class SSGN. Testing is scheduled to be completed in FY11.
- The Navy should re-evaluate the Extremely High Frequency (EHF) communications infrastructure and system architecture in light of the increased importance of EHF communications to submarine operations. The architecture does not enable EHF communications to be re-established rapidly when interrupted.

System

- CSRR/Submarine Exterior Communications System (SubECS) is an umbrella program that integrates modern antennas, radios, cryptographic equipment, and messaging systems to form a submarine communications system.
- It is intended to provide a common communication system across all classes of submarines and is designed to support the steady infusion of new technology with incremental modernization and replacement of obsolete equipment.
- The program establishes common hardware and software baselines.
- *Virginia* class CSRR (designated SubECS) is developed and integrated as part of new construction. Other submarine radio rooms are being replaced with CSRR variants during maintenance periods to establish a common radio room baseline.
- The Navy intends future CSRR improvements to address obsolescence issues and add new communications capabilities as they mature.

Mission

The submarine Commanding Officer uses the CSRR/SubECS for communications and information dissemination in order to accomplish assigned missions. The Navy intends to use the CSRR capabilities to manage, control, and disseminate command, control, communications, computers, and intelligence information routed to and from submarines.

Major Contractor

Lockheed Martin Maritime Systems and Sensors – Washington, District of Columbia

Activity

- DOT&E approved Revision 4 to the CSRR Test and Evaluation Master Plan in December 2009. This revision addresses the FOT&E for the Increment 1 Version 2 upgrades to the baseline CSRR.
- The Navy conducted at-sea Integrated Testing of the Increment 1 Version 2 CSRR in April and May 2010. The Navy plans to complete dedicated at-sea operational testing in early FY11.
- In July 2010, the Navy issued an interim fielding decision to field Increment 1 Version 2 on three submarines (SSGN 726, SSGN 729, and SSN 23) before operational testing was complete.
- The Navy conducted an Information Assurance vulnerability evaluation of the CSRR in April 2010. The Navy plans to complete the Information Assurance testing with a penetration test of the CSRR in early FY11.
- The Navy plans to accelerate fielding of the CSRR on older *Los Angeles* class submarines, installing the first *Los Angeles* class variant in 2012 rather than 2015.

Assessment

- The Navy has planned adequate operational testing for Increment 1 Version 2.
- Although operational testing has not been completed, Integrated Testing results suggest that the new capabilities incorporated into Increment 1 Version 2 have been successfully installed and generally perform as expected, while the legacy capability has not been degraded.

- The Information Assurance vulnerability evaluation found that the CSRR routers are well configured to protect tactical computers. However, several computers on the CSRR network contained critical vulnerabilities and were running operating systems no longer supported by the vendor, making patching of the vulnerabilities difficult.
- The baseline CSRR adequately implements EHF, but successful EHF communications are highly dependent upon satellite availability and adequate shore support. The testers observed, and the crews reported, frequent problems conducting EHF communications. Contributing to these problems, the Navy's EHF architecture does not appear to be optimized to support rapid restoration of communications following an inadvertent interruption. In recent years, EHF connectivity has become increasingly important to submarine operations.

Recommendations

- Status of Previous Recommendations. The Navy has adequately addressed two of the three previous recommendations. The Navy still needs to re-evaluate the EHF communications infrastructure and system architecture so that EHF communications can be restored rapidly once interrupted.
- FY10 Recommendations. The Navy should consider:
  1. Upgrading all computers in CSRR to operating systems supported by the vendor.
  2. Instituting a comprehensive vulnerability patching process for CSRR computers that are accessible by the external network.

CVN 78 *Gerald R. Ford* Class Nuclear Aircraft Carrier

Executive Summary

- The Navy completed an early operational assessment (OT-B2) of the CVN 78 in June 2010. This assessment highlights areas of risk for the program as development and construction of the first ship proceed.
- The program continues to have challenges with integration of the Joint Strike Fighter (JSF).
- Long-standing development/integration discrepancies associated with the ship's self-defense system must be resolved for this system to provide satisfactory defense for the ship.
- Launch system and arresting gear test and development schedule challenges remain to meeting scheduled installation dates onboard the ship.
- The Navy is continuing development of the Virtual Carrier model that will be used to supplement live testing during IOT&E to evaluate the Sortie Generation Rate Key Performance Parameter. To be effective, this model must utilize realistic assumptions about asset availability onboard ship when modeling sortie generation rate scenarios.

System

- The CVN 78 *Gerald R. Ford* Class Nuclear Aircraft Carrier program is designing and building the new class of nuclear powered aircraft carrier. The CVN 78 *Gerald R. Ford* Class program name replaces the previous CVN 21 program designation. It has the same hull form as the *Nimitz* Class, but many ship systems inside the hull are new, including the nuclear plant and the flight deck.
- The newly designed nuclear power plant is intended to reduce reactor department manning by 50 percent and produce significantly more electricity when compared to a current CVN 68 Class ship.
- The CVN 78 will incorporate electromagnetic catapults (instead of steam powered), and have a smaller island with a dual band radar (a phased array radar which replaces/combines five legacy radars as compared to current aircraft carriers).
- The Navy redesigned weapons stowage, handling spaces, and elevators to reduce manning, increase safety, and increase throughput of weapons.
- The Integrated Warfare System is intended to be adaptable to technology upgrades and varied missions throughout the ship's projected operating life, and to include increased self-defense capabilities when compared to current aircraft carriers.
- CVN 78 is designed to increase the sortie generation capability of embarked aircraft to 160 sorties per day and be able to surge to 270 sorties per day (threshold values) as compared to the nominal historical sortie generation rate for CVN 68 *Nimitz* class of 120 sorties per day/240 sorties for 24-hour surge.
- Initial Operational Capability for CVN 78 is planned for FY16. Full Operational Capability is planned for FY18 after Milestone C.

Mission

Carrier Strike Group Commanders will use the CVN 78 to:

- Conduct power projection and strike warfare missions using embarked aircraft.
- Provide force protection of friendly units.
- Provide a sea base as both a command and control platform and an air-capable unit.

Major Contractor

Northrop Grumman Shipbuilding – Newport News, Virginia

Activity

- Commander, Operational Test and Evaluation Force completed an early operational assessment (OT-B2) and issued their report June 2010. This assessment will support the planned program review in FY12, but does not support a specific acquisition decision. All testing was conducted in accordance with the DOT&E-approved Test and Evaluation Master Plan (TEMP) and Test Plan.

- The Navy is continuing to develop the Virtual Carrier model for analysis of the sortie generation rate (SGR) capability of the ship. Spiral 8 model results were captured in OT-B2. Seventeen spirals are planned.
- The Navy commissioned the Electromagnetic Aircraft Launch System (EMALS) System Functional Design (SFD) test site in September 2010 and is performing EMALS testing with no-load and dead loads at Joint Base McGuire-Dix-Lakehurst, New Jersey.
- The Navy is performing testing of the advanced arresting gear (AAG) on a jet car track at Joint Base McGuire-Dix-Lakehurst, New Jersey.
- The Navy completed initial testing of the Dual Band Radar (DBR) system at the Surface Combat Systems Center in Wallops Island, Virginia. The Navy is assessing the test data to determine if further DBR testing will be necessary in FY12.
- The Navy has taken action on upgrading the single transmit/receive channel for Common Data Link (CDL) used for tactical information exchange between the ship and embarked aircraft. The Navy has designed a four-channel system for installation in CVN 79 and retrofit to CVN 78 post-delivery.
- The CVN 78 *Gerald R. Ford* Class Carrier Program Office is revising the TEMP in an effort to align planned developmental test with corresponding operational test phases.
- The Navy continues to develop an alternative approach to conducting the Full Ship Shock Trial (FSST). The Navy will conduct a traditional FSST if the alternative approach is not technically feasible or costs more than $65 million.

Assessment

- The Navy began CVN 78 construction in 2008 and plans to deliver the ship in September 2015. Current progress supports this plan, but the EMALS/AAG, DBR, and Integrated Warfare System are significant risk areas.
- The CVN 78 program continues to have challenges with F-35 Joint Strike Fighter (JSF) integration. The thermal footprint from the main engine exhaust, shipboard noise levels, and information technology requirements need work. Design changes may be required for the jet blast deflectors, and active cooling may be required in the flight deck just forward of the jet blast deflector.
- As a cost-saving measure, an adjustment to the DDG-1000 ship program in 2010 eliminated the volume search radar (VSR) component of the DBR, leaving only multi-function radar; however, the DBR test plan remained unchanged, with the DDG-1000 program responsible for all DBR developmental testing. CVN 78 plans to leverage the DDG-1000 DBR test data as a means of conserving resources. The DDG-1000 DBR test program concluded testing in September 2010 and has temporarily closed the DBR test site at Wallops Island Engineering Test Center. The Navy plans to re-open the site in FY12 and is assessing the completeness of the DBR test data from initial testing. The Navy will conduct any follow-on DBR testing in FY12 after re-opening the DBR test site. Significant additional DBR testing will likely result in cost growth and DBR test completion delays for the CVN 78 program.
- Numerous integrated warfare system items are of concern, including:
  - The ship self-defense combat systems on aircraft carriers have historically had reliability and weapon system integration shortcomings. While the Navy has made efforts, it has not yet developed a detailed plan to address these concerns on CVN 78.
  - The Navy lags in developing a new anti-ship ballistic missile target and in obtaining a capability to launch four simultaneous supersonic sea-skimming targets. Both are required to assess effectiveness of ship self-defense.
  - Cooperative Engagement Capability (CEC) is in the CVN 78 warfare system baseline. DBR will be capable of providing fire-control quality, high data rate information for relay by CEC. Future Aegis upgrades may allow Aegis ships to use fire-control data from CVN 78. However, it is not clear whether the Navy will implement this capability on CVN 78 and what impact it may have on the integrated warfare system test planning and the CVN 78 primary mission.
  - CVN 78 will continuously and simultaneously use DBR for both air traffic control and warfare, whereas separate legacy systems perform these missions individually. Merging these previously separate missions into a single system requires significant testing and integration. Testing is currently scheduled shipboard pier-side, instead of making more complete use of the land-based Wallops Island facility; this complicates the test-fix-test timeline.
- The current state of the Virtual Carrier model does not fully provide for an accurate accounting of SGR due to a lack of fidelity regarding manning, equipment availability, and weather conditions.
- EMALS experienced two notable hardware/software incidents that caused test delays at the SFD test site in Lakehurst. One incident involved an un-commanded armature retraction due to a software anomaly in the asset protection module. The second anomaly involved the loss of an encoder from the catapult armature during a dead-load test. Both anomalies have been resolved. EMALS has started performance verification testing with dead loads at the SFD site, and AAG is nearing the start of Jet Car Track Site dead load testing. Required In Yard Date (RIYD) for these systems continues to drive the development schedule; however, to date development and testing remains on track.
- The alternative Full Ship Shock Trial (FSST) method offers potential for utilizing advanced finite element modeling and simulation to augment live testing. This will require significant time and financial resources to conduct an appropriate validation, verification, and accreditation (VV&A).

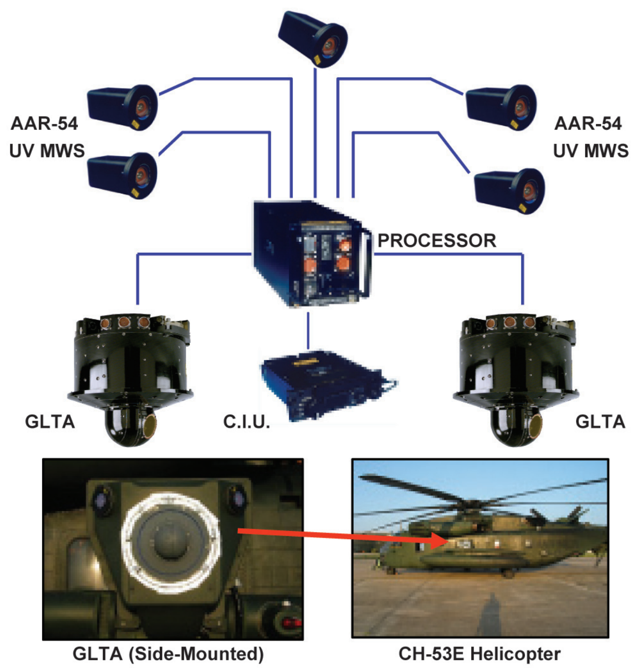
Recommendations

- Status of Previous Recommendations. The Navy satisfactorily addressed all FY09 recommendations.
- FY10 Recommendations. The Navy should:
  1. Resolve integration challenges with JSF.
  2. Finalize plans that address CVN 78 integrated warfare system engineering and ship's self-defense system discrepancies.
  3. Develop and procure an anti-ship ballistic missile target, and pursue range upgrades to allow up to four supersonic sea-skimming targets to be launched simultaneously.
  4. Continue the work of the SGR Test Strategy Integrated Product Team to develop a realistic model for determining the sortie generation rate while utilizing realistic assumptions regarding equipment availability, manning, and weather conditions.
  5. Identify contingency timelines for EMALS/AAG systems to permit more flexibility and mitigate schedule risk in the development of those systems.
  6. Ensure adequate VV&A of FSST modeling and simulation prior to any final decisions on FSST alternatives.

Department of the Navy Large Aircraft Infrared Countermeasures (DoN LAIRCM)

Executive Summary

- DOT&E submitted a Department of the Navy's Large Aircraft Infrared Countermeasure (DoN LAIRCM) CH-53E Beyond Low-Rate Production (BLRIP) Report to Congress in December 2009. DOT&E found the system operationally effective and suitable in most environments, but highlighted a critical classified performance shortfall in some environments.
- The Navy updated their missile warning software to address the critical performance shortfall and other minor problems identified during the CH-53E IOT&E. The Navy later conducted a Verification of Correction of Deficiencies (VCD) T&E, a live fire missile test, and a shipboard test to verify the resolution of the system's critical performance shortfall. Subsequently, the Navy fielded the updated software on the CH-53E aircraft and incorporated it into the CH-46E FOT&E.
- The Navy completed the CH-46E FOT&E in May 2010. Test results demonstrated improved system performance with the upgraded missile warning software.
- The CH-53D FOT&E has been cancelled due to the Marine Corps decision to retire the CH-53D fleet beginning FY12.



C.I.U. - Control Interface Unit
GLTA - Guardian Laser Turret Assembly
MWS - Missile Warning System
UV - Ultraviolet

System

- The DoN LAIRCM system, a variant of the Air Force LAIRCM system, is a defensive system for Marine Corps helicopters designed to defend against surface-to-air infrared missile threats. It combines the derivative AAR-54 two-color infrared Missile Warning Sensor (MWS) with the Guardian Laser Transmitter Assembly (GLTA). The GLTA is equipped with a four-axis, stabilized gimbal system, an AN/AAR-24 Fine Track Sensor, and a ViperTM laser. The MWS detects an oncoming missile threat and sends the information to the system processor which, in turn, notifies the crew through the control interface unit and at the same time directs the GLTA to slew to and begin jamming the threat.
- The Navy plans to procure and install 156 systems for the CH-53E, CH-46E, and CH-53D platforms.

Mission

Combatant Commanders will use DoN LAIRCM to provide automatic protection of rotary wing aircraft against shoulder fired, vehicle-launched, and other infrared-guided missiles. Commanders will use such protection during normal take-off and landing, assault landing, tactical descents, re-supply, rescue, forward arming and refueling, low-level flight, and aerial refueling.

Major Contractor

Northrop Grumman, Electronic Systems, Defensive Systems Division – Rolling Meadows, Illinois

Activity

- The Navy conducted all testing in accordance with DOT&E approved test plans and Test and Evaluation Master Plan.
- The Navy conducted live fire missile testing using DoN LAIRCM updated software in October 2009.
- The Navy conducted a VCD T&E in November 2009, using a CH-46E aircraft to resolve problems identified during the CH-53E IOT&E.

- DOT&E submitted a DoN LAIRCM CH-53E BLRIP report to Congress in December 2009.
- The Navy conducted shipboard operational compatibility tests on the flight deck of the USS *Kearsarge* in December 2009, using a CH-46E aircraft.
- DOT&E approved a DoN LAIRCM CH-46E FOT&E plan on January 26, 2010, requiring the Commander, Operational Test and Evaluation Force to include a maintenance demonstration on the CH-46E, using pre-faulted weapons replaceable assemblies to allow an adequate evaluation of the DoN LAIRCM's built-in-test and maintenance procedures.
- The Navy completed FOT&E on the CH-46E aircraft in May 2010.
- DOT&E approved a DoN LAIRCM CH-53D FOT&E plan in July 2010, but the CH-53D FOT&E was delayed until FY11 because of an aircraft maintenance problem related to the aircraft and not DoN LAIRCM.
- The CH-53D FOT&E has been cancelled due to the Marine Corps decision to retire the CH-53D fleet beginning FY12.

Assessment

- DOT&E evaluated DoN LAIRCM on the CH-53E and determined the system was operationally effective in most environments, but a major classified system deficiency inhibited the system from being operationally effective in all environments. DOT&E determined the system was operationally suitable. Operational testing was adequate to evaluate the effectiveness of DoN LAIRCM against the types of threats encountered in Operation Iraqi Freedom and Operation Enduring Freedom.
- The results from the Navy VCD T&E using a CH-46E aircraft indicated the correction to the major deficiency identified in the CH-53E IOT&E was effective.
- The December 2009 CH-46E shipboard compatibility test was incomplete and therefore inadequate. Flight tests were not accomplished in proximity of the ship and therefore, potential electromagnetic interference and compatibility problems could not be determined or effects of salt spray on the MWS sensors or the GLTA. Also, the Multi-role Electro-Optical End-to-end (MEON) tester (used to stimulate the missile warning system) could not be used on the ship due to lack of space on-deck.
- The CH-46E FOT&E results demonstrated improved system performance compared to results from the CH-53E IOT&E. The FOT&E was adequate to evaluate the effectiveness of the DoN LAIRCM as installed on the CH-46E.
- Live fire missile testing after the system software had been updated demonstrated improved missile warning performance.
- The Navy fielded DoN LAIRCM as an early operational capability on the CH-53E, which deployed to U.S. Central Command in 2009. In 2010, the Navy sent personnel to the deployed location to collect additional effectiveness and suitability data. Aircrew and maintenance training was enhanced through this deployment resulting in improvements in operational effectiveness and reliability growth.

Recommendations

- Status of Previous Recommendations. The Navy and Marine Corps satisfactorily addressed three of the four previous recommendations. The Navy successfully completed a comprehensive FOT&E on the CH-46E, but was unable to complete the FOT&E for the CH-53D due to airframe cracks found in the aircraft tail-boom section.
- FY10 Recommendation. The Navy/Marine Corps should:
  1. Conduct shipboard testing of the DoN LAIRCM system on at least one of the three helicopter platforms to ascertain compatibility with the shipboard environment.

Distributed Common Ground System – Navy (DCGS-N)

Executive Summary

- The Commander, Operational Test and Evaluation Force (COTF) conducted IOT&E of the Distributed Common Ground System – Navy (DCGS-N) Increment 1, Block 1 in September 2009.
- DOT&E evaluated DCGS-N Increment 1, Block 1 to be effective and suitable for employment by the Navy to conduct intelligence missions.

System

- DCGS-N is the Navy Service component of the DoD DCGS family of systems, providing multi-Service integration of Intelligence, Surveillance, Reconnaissance, and Targeting (ISR&T) capabilities.
- DCGS-N will ultimately be hosted by Consolidated Afloat Networks and Enterprise Services (CANES), but until CANES can be fielded, DCGS-N Increment 1 works with the currently fielded Integrated Shipboard Network System (ISNS) and Sensitive Compartmented Information (SCI) Networks.
- Increment 1 is developed in two blocks: Block 1 delivers initial capability and Block 2 continues the effort to further expand on the Block 1 effort to decouple the software from unique hardware in preparation for hosting on CANES in Increment 2.
- DCGS-N Increment 1 uses commercial off-the-shelf and mature government off-the-shelf software, tools, and standards. It interoperates with the DCGS family of systems via implementation of the DCGS Integration Backbone and Net-Centric Enterprise Services standards.
- DCGS-N Increment 1, Block 1 Early Adopters (EA) Engineering Change Proposal (ECP) will update DCGS-N so that it can continue to work with the ISNS and SCI Networks as they are updated. The Navy is updating the ships with ISNS and SCI Networks with components that are considered to be low risk. These are called "Early Adopter" of CANES because these components are expected to become part of CANES later. This will reduce the risk for the CANES program, and deliver the necessary updates to the ships faster and more efficiently.

Mission

- The operational commander will use DCGS-N to participate in the Joint Task Force-level targeting and planning processes and to share and provide Navy-organic ISR&T data to Joint Forces.
- Users equipped with DCGS-N will:
  - Identify, locate, and confirm targets through multi-source intelligence feeds
  - Update enemy track locations and provide situational awareness to the Joint Force Maritime Component Commander by processing data drawn from available sensors

Major Contractor

BAE Systems, Electronics, Intelligence and Support (EI&S) – San Diego, California, and Charleston, South Carolina

Activity

- COTF conducted IOT&E of DCGS-N Increment 1, Block 1 in September 2009. The IOT&E used data from the developmental test conducted in a lab environment throughout system development, and onboard USS *Harry S. Truman* in May 2009. The program manager conducted the onboard developmental test and it was witnessed by COTF.
- DOT&E submitted a memorandum report on results and recommendations from the DCGS-N Increment 1, Block 1 IOT&E to the Milestone Decision Authority on February 18, 2010.
- The Milestone Decision Authority signed the Full Deployment Decision Acquisition Decision Memorandum on April 27, 2010.
- DOT&E approved the COTF Risk Assessment on the Block 1 EA ECP.
- COTF intends to conduct an operational test for DCGS-N Increment 1, Block 1 EA ECP in 1QFY12.

Assessment

- DOT&E evaluated the DCGS-N Increment 1, Block 1 system to be effective and suitable. It can support all Navy ISR&T missions.
- The Navy employed an efficient integrated T&E strategy that measured system performance operated by sailors in a developmental test that was conducted in a lab environment, followed by a validation during the embarked phase of developmental testing. This strategy reduced the risk and data requirement for the IOT&E conducted at sea.
- DOT&E agreed that the appropriate level of testing for EA ECP is a full operational test.

Recommendations

- Status of Previous Recommendations. The Navy addressed all previous recommendations.
- FY10 Recommendations. None.

E-2D Advanced Hawkeye

Executive Summary

- The E-2D Advanced Hawkeye continues to improve in aircraft and radar system performance as well as resolving outstanding deficiency reports.
- The Commander, Operational Test and Evaluation Force (COTF) began an operational assessment in August 2010.
- The Navy's E-2D Integrated Test Team (ITT) is performing development and integration testing at Naval Air Station (NAS) Patuxent River, Maryland.
- The E-2D program is integrating Cooperative Engagement Capability (CEC) hardware and software into the E-2D.

System

- The E-2D Advanced Hawkeye is a carrier-based Airborne Early Warning and Command and Control aircraft.
- Significant changes to this variant of the E-2 include replacement of the radar system, the communications suite, and the mission computer, as well as the incorporation of an all-glass cockpit.
- The radar upgrade replaces the E-2C mechanical scan radar with a radar array that has combined mechanical and electronic scan capabilities.
- The upgraded radar provides significant improvement in Hawkeye littoral, overland, clutter management, and surveillance capabilities.

Mission

The Combatant Commander, whether operating from the aircraft carrier or from land, will use the E-2D Advanced Hawkeye to accomplish the following missions:

- Theater air and missile sensing and early warning
- Battlefield management, command, and control
- Acquisition, tracking, and targeting of surface warfare contacts
- Surveillance of littoral area objectives and targets
- Tracking of strike warfare assets.

Major Contractor

Northrop Grumman Aerospace Systems – Bethpage, New York

Activity

- Air Test and Evaluation Squadron One (VX-1) performed the first set of operational assessment OT-C1 flights from August 15-21, 2010 at NAS Jacksonville, Florida, and the remaining events from November 1-9 at NAS Fallon, Nevada, and NAS Point Mugu, California. Results from the operational assessment will support the acquisition decision in 2QFY11 for E-2D Low-Rate Initial Production Lots 3 and 4. COTF is conducting the operational assessment in accordance with the DOT&E approved TEMP and test plan.
- DOT&E approved the E-2D TEMP page change. The page change added a description of and clarified entrance and exit criteria for the FY10 operational assessment.
- CEC Engineering Test and Evaluation on E-2D, a precursor to Development Test and Evaluation (DT&E), was initiated July 2010. E-2D CEC DT&E is scheduled to begin February 2011. Two E-2D test aircraft are currently CEC-equipped.
- The E-2D program developed a radar reliability growth program and growth curves.

Assessment

- Until DOT&E can analyze the complete data from the operational assessment OT-C1, a comprehensive assessment of E-2D performance cannot be provided. Based upon developmental test data, radar detection and accuracy performance have the potential to be operationally adequate.
- Completion of CEC integration and testing may delay the start of IOT&E currently scheduled for 1QFY12. CEC is necessary for E-2D to demonstrate its Net-Ready Key Performance Parameter.
- The radar system reliability, specifically radar mean time between failures (MTBF), does not currently meet established requirements (46.7 hours MTBF as of November 2010), and must continue to improve to meet the interim requirement of 65 hours MTBF by March 2011 and threshold requirement of 81 hours MTBF by IOT&E. However, radar reliability has been improving, and as of June 2010, is tracking on the reliability growth curve established in 2010.
- As a result of the delivery schedules for the Hawkeye Integrated Training System for Aircrew and Maintenance

(HITS-A and HITS-M), operational test personnel will not be able to completely resolve the Maintainability and Training Critical Operational Issues during IOT&E. However, HITS-A and HITS-M will be available for operational evaluation during FOT&E.

Recommendations

- Status of Previous Recommendations. The Navy satisfactorily addressed the FY09 recommendation.
- FY10 Recommendations.
  1. The E-2D program office should continue to improve radar reliability.
  2. The Navy and E-2D program office should take all necessary steps to ensure CEC integration is completed in time to support adequate DT&E prior to the start of IOT&E.

EA-6B Upgrades / Improved Capability (ICAP) III

Executive Summary
- The Navy demonstrated that the EA-6B Improved Capability (ICAP) III Block 4 weapon system is operationally effective and operationally suitable during FY10 FOT&E. This evaluation included an assessment of the USQ-113(V)4 communications jammer dual jam mode of operation.

System
EA-6B
- The EA-6B aircraft is a four-seat, carrier/land-based, tactical jet aircraft equipped with an onboard receiver, external jamming pods, a communication jammer, and High-Speed Anti-Radiation Missiles (HARMs).
- The EA-6B is the Navy's fielded Airborne Electronic Attack (AEA) platform. The Navy is currently replacing the EA-6B Fleet with the EA-18G Growler.

ICAP III Block 1 (FY05) design improvements provided:
- Enhanced reliability
- A new receiver, processor, and antenna system (ALQ-218)
- New tactical displays/interfaces
- New joint mission planner
- Better external communications

ICAP III Block 2 (FY06) added the following to Block 1:
- Improved battle space management capabilities with the Multi-Function Information Distribution System (MIDS)/ digital link
- Further improved joint mission planner

ICAP III Block 3 (FY09) added the following to Block 2:
- Upgraded messaging capability for MIDS/digital link
- Capability to employ the Low Band Transmitter (LBT)
- Upgraded end-to-end automatic reactive jamming capability
- Still further improved joint mission planner
- Improved software to introduce corrections and enhancements previously integrated in older EA-6B systems

ICAP III Block 4 (FY10) added the following to Block 3:
- An upgraded Digital Flight Control System and new Power Trim Indicators
- Control Display Navigation Unit-900A
- Dual frequency USQ-113(V)4 communications jammer
- ALE-47 countermeasures dispensing system
- LITENING Pod for Marine Corps Prowlers only

ICAP III Block 5 (FY11) will add the following to Block 4:
- Addresses high priority software deficiencies via Candidate Change List (CCL) Implementations & Correction of Deficiencies (CODs).
- ALE-47 Mission Data File (MDF) Update
- USQ-113(V)4 software update that includes improved simultaneous (dual frequency) jamming capability
- MIDS-LVT (Multifunctional Informational Distribution System – Low Volume Terminal) Functionality Enhancements
- Joint Mission Planning System (JMPS)/Mission Planning Data update to support post-flight processing of ALQ-218 Data Extraction (DX).

Mission
EA-6B
- Combatant commanders use the EA-6B to support friendly air, ground, and sea operations by suppressing enemy radars and communications.
- Commanders use the EA-6B capabilities to suppress enemy radar-guided threats with HARM and to jam integrated air defenses, in addition to supporting emerging asymmetric missions.

ICAP III
- Units equipped with EA-6B ICAP III use its improvements to provide:
  - Counters to emerging threats
  - More flexible and effective protection of strike aircraft
  - More accurate HARM targeting
  - Enhanced situational awareness via MIDS for improved battle management, plus enhanced connectivity to national, theater, and tactical strike assets
  - Selective reactive jamming capability to allow automatic detection and jamming of threats as they become active
  - Streamlined mission planning and post flight analysis

Major Contractor
Northrop Grumman – Bethpage, New York

Activity

ICAP III Block 4

- The Commander, Operational Test and Evaluation Force (COTF) conducted operational test of the Block 4 configuration from January to April 2010. COTF released its test report in August 2010.
- In order to arrive at a common fleet-wide configuration, the program office incorporated the software currently used in ICAP II aircraft into ICAP III Block 4 aircraft. Block 4 also incorporated the USQ-113(V)4 dual-frequency communication jammer, and provided further improved crew-vehicle interface performance.
- COTF had previously tested Block 4 hardware upgrades in ICAP II developmental and operational testing.
- The Navy conducted testing in accordance with the DOT&E-approved TEMP and test plan.

ICAP III Block 5

- DOT&E approved a fifth revised TEMP (Revision E) in August 2010 that included additional detail of testing for the ICAP III Block 5 configuration.
- Block 5 upgrades will continue to enhance crew vehicle interface performance through improving the overall Electronic Warfare Battle Management (EWBM) display and control in the cockpit.
- In September 2010, DOT&E removed the EA-6B ICAP III from oversight.

Assessment

ICAP III Block 4

- The Navy demonstrated that the EA-6B Improved Capability (ICAP) III Block 4 weapon system is operationally effective and operationally suitable during FY10 FOT&E. This evaluation included an assessment of the USQ-113(V)4 communications jammer dual jam mode of operation.
- The conduct of the Block 4 operational test was hampered by lack of test aircraft availability. Due to Fleet aircraft requirements, the Navy allocates only one test aircraft for the operational test squadron. The Navy operational test squadron has been successful in garnering Fleet squadrons as "trusted agents" to assist with aircraft availability, but this process is unpredictable. The Navy acknowledges this limitation to test, which will remain a factor until the retirement of the EA-6B aircraft.
- Block 4 continues to suffer from problems with the Joint Mission Planning System – Maritime (JMPS-M). Two of the three major deficiencies in JMPS-M reported in previous ICAP III testing remained unresolved.
- Block 4 does not meet the threshold requirements in threat geolocation and built-in-test probability of correct detection, and suffered from deficiencies in the digital flight control system parts reliability and central display navigation unit display. The Navy program office is resolving these deficiencies.

ICAP III Block 5

- The Block 5, an all-software configuration, should enhance the combat effectiveness of the ICAP III system and resolve Fleet-identified deficiencies in the aircraft software.
- Test aircraft availability, as addressed above, will impact the test and development schedule of this configuration.

Recommendations

- Status of Previous Recommendations. There was no FY09 report for EA-6B Upgrades. The Navy satisfactorily addressed the two FY08 recommendations.
- FY10 Recommendations.
  1. The Navy should continue to plan, conduct, and analyze ICAP III testing as a total system evaluation in a mission environment. Deficiencies revealed during Block 4 testing need to be corrected under Block 5 and verified through testing.
  2. The Navy should improve test aircraft and facility readiness to support timely execution of ongoing ICAP III developmental and operational testing.

EA-18G Growler (Electronic Attack Variant of F/A-18)

Executive Summary

- The Navy conducted Verification of Correction of Deficiencies (VCD) testing on the EA-18G from September 2009 to January 2010 to resolve suitability problems identified during 2008 IOT&E.
- DOT&E evaluated the VCD test results and concluded the EA-18G is operationally effective, but still not operationally suitable. The VCD test results did confirm significant progress on improving suitability, but additional development and testing are needed.
- The Navy has scheduled EA-18G FOT&E in early FY11.

System

- The EA-18G Growler is a carrier-based radar and communication jammer aircraft.
- The two-seat EA-18G replaces the Navy's four-seat EA-6B. The new ALQ-218 receiver, improved connectivity, and linked displays are the primary design features implemented to reduce the operator workload in support of the EA-18G's two-person crew.
- Integration of the Airborne Electronic Attack (AEA) system into the F/A-18F includes:
  - Modified EA-6B Improved Capability III ALQ-218 receiver system
  - Advanced crew station
  - Legacy ALQ-99 jamming pods
  - Communication Countermeasures Set System
  - Expanded digital Link 16 communications network
  - Electronic Attack Unit
  - Interference Cancellation System that supports communications while jamming
  - Satellite receive capability via the Multi-mission Advanced Tactical Terminal
- Additional systems include:
  - Active Electronically Scanned Array radar
  - Joint Helmet-Mounted Cueing System
  - High-Speed Anti-Radiation Missile (HARM)
  - AIM-120 Advanced Medium-Range Air-to-Air Missile (AMRAAM)

Mission

- Combatant Commanders use the EA-18G to support friendly air, ground, and sea operations by countering enemy radar and communications.
- In particular, Commanders use EA-18G to:
  - Jam integrated air defense systems
  - Support non-integrated air defense missions and emerging non-lethal target sets
  - Enhance crew Situational Awareness and mission management
  - Enhance connectivity to national, theater, and tactical strike assets
  - Provide enhanced lethal suppression through accurate HARM targeting
  - Provide the EA-18G crew air-to-air self-protection with AMRAAM

Major Contractor

The Boeing Company, Integrated Defense Systems – St. Louis, Missouri

Activity

- The EA-18G Program was approved for full-rate production (FRP) in November 2009. The program reached initial operational capability (IOC) in October 2009.
- The Navy conducted post-IOT&E VCD testing from September 2009 to January 2010 to resolve suitability problems identified during the 2008 IOT&E. VCD flight testing included over 150 flight hours and over 89 sorties, and all test objectives were completed.
- The VCD testing primarily assessed software improvements designed to resolve maintainability shortfalls in ALQ-218 built-in-test (BIT) performance and its interface with the legacy ALQ-99 jamming pods.

- In November 2009, DOT&E observed VCD testing at Nellis AFB, Nevada, and performed a site visit to Naval Air Station (NAS) Whidbey Island, Washington, to assess the impact of suitability improvements on EA-18G Fleet introduction.
- In May 2010, DOT&E released a VCD Test Report memorandum to the Navy that assessed the performance of the suitability improvements and provided the Navy with recommendations for FOT&E scheduled for early FY11.
- The Navy conducted testing in accordance with the DOT&E-approved TEMP and test plan.

Assessment

- The EA-18G remains operationally effective, but is still not operationally suitable, although there have been notable improvements.
- The VCD test results provide strong evidence that aircraft software stability is improving, particularly related to BIT maturation, but additional development and flight testing is required to confirm the problems have been resolved.
- EA-18G FOT&E, scheduled to begin 1QFY11, will provide the Navy an additional opportunity to assess efforts to fix these suitability issues, particularly with the latest software load that indicated significant progress with fixing maintainability problems.
- The Navy's ability to conduct problem-solving demonstrated to date is likely to result in maturation of BIT software.

Recommendations

- Status of Previous Recommendations. The Navy is satisfactorily addressing the previous nine recommendations, to include continued testing to resolve EA-18G maintainability shortfalls. However, not all suitability issues have been resolved, and additional testing during FOT&E is required to confirm the issues have been resolved. Recommendations for improving electronic warfare remain from FY09 as well.
- FY10 Recommendations. The Navy should:

EA-18G Aircraft

1. Continue to improve maintainability and BIT software maturity by reporting key suitability parameters during FOT&E, such as Mean Flight Hours Between Operational Mission Failures and Mean Corrective Maintenance Time for Operational Mission Failures to monitor reliability and maintainability.
2. Collect sufficient data during FOT&E to verify that BIT Mean Flight Hours Between False Alarm, percent correct detection, and percent correct false isolation meet or exceed threshold requirements.
3. Continue to improve maintenance documentation and diagnostic tools to assess the ALQ-218 and ALQ-99 pod health.
4. Further assess EA-18G operational performance and effectiveness by collecting ALQ-218 geolocation and Selective Reactive Jamming Response performance data.
5. Evaluate the EA-18G AEA system performance in support of strike aircraft in accordance with the Joint AEA framework.

Electronic Warfare Warfighting Improvements

6. Continue to support ongoing DoD efforts to investigate, evaluate, and make recommendations to improve Enterprise Electronic Warfare test capabilities associated with open-air ranges, test and evaluation facilities, concepts, processes, and procedures.
7. Continue to assess requirements to improve Electronic Warfare modeling and simulation capabilities to support ground testing of future AEA capabilities, to include multi-signal threat environments.
8. Continue to assess the need for and benefits of building a more capable threat range at NAS Whidbey Island, Washington.

Expeditionary Fighting Vehicle (EFV)

Executive Summary

- The prime contractor continues to construct seven redesigned prototype Expeditionary Fighting Vehicles (EFVs) ("SDD-2" vehicles) to support developmental and operational testing that is scheduled for FY10 through FY14.
- None of the planned operational testing in the Test and Evaluation Master Plan (TEMP) was accomplished in FY10 due to delayed development of the modified hardware and software.
- Poor reliability has been the EFV program's greatest challenge, and delays in delivering SDD-2 vehicles with the required software have postponed reliability growth testing.

System

- The EFV is an amphibious combat vehicle for the Marine Corps.
- The Marines intend the EFV to be capable of high-speed water transit at over 20 knots and have land mobility capabilities comparable to the M1A1 tank after transitioning out of the water.
- The EFVC (command variant) is operated by a crew of three and transports a commander and a staff of eight Marines.
- The EFVP (personnel variant) is operated by a crew of three and carries a reinforced rifle squad of 17 Marines.
- The EFVP has a stabilized 30 mm chain gun and coaxial 7.62 mm machine gun in the turret.

Mission

- Units equipped with EFVs will transport elements of an amphibious assault force from ships over the horizon to inland objectives.

- Commanders will use the:
  - Personnel variant as an armored fighting vehicle ashore in support of land combat, providing transportation, protection, and direct fire support.
  - Command variant to provide command, control, and communications capabilities to support ground combat tactical command posts.

Major Contractor

General Dynamics Land Systems – Woodbridge, Virginia

Activity

- The Marine Corps did not accomplish any of the planned EFV operational testing specified in the TEMP in FY10.
- The prime contractor, General Dynamics Land systems, continues to construct seven redesigned prototype EFVs ("SDD-2" vehicles) to support developmental and operational testing that is scheduled for FY10 through FY14. These vehicles have been delivered and are in developmental testing.
- The Marine Corps conducted ballistic testing using two early prototype vehicles ("SDD-1" vehicles) during FY10. Threats included roadside and underbody mines and IEDs representing threats encountered in current combat operations. The testing provided valuable insights on the response of the vehicle and crew to these and other large overmatching threats.
- The program conducted System Data Exchange testing on two SDD-1 vehicles in support of Net-Ready certification.
- The EFV Program Office announced its intention to incorporate a new, different aluminum alloy in the hull structure of the vehicle. This design change will be introduced in the first low-rate initial production (LRIP) vehicles. The hull alloy redesign is being undertaken as an effort to absorb more energy and address crew/vehicle response to emerging underbody threats.

Assessment

- Continuing delays in the modification of SDD-1 vehicles to support testing, the production of SDD-2 vehicles, and the fielding of vehicle software updates significantly delayed/reduced testing in FY10. The program cancelled all SDD-1 vehicle testing on September 23, 2010. Developmental testing continues on SDD-1 vehicles with Marine Corps Operational

Test and Evaluation Activity observing. The program tested day/night multi-vehicle directional stability and control, and the effectiveness of an exhaust system redesign.

- Poor reliability has been the EFV program's greatest challenge, and delays in delivering SDD-2 vehicles with the required software have postponed reliability growth testing. Although there has been no system-level reliability testing since CY06 and none will start until 1QFY11, component-level testing and other "design for reliability" efforts are ongoing. The program is required to demonstrate a mean time between operational mission failure of 22 hours or higher using SDD-2 vehicles before the Milestone C LRIP decision. The user-required mean time between operational mission failure for full-rate production vehicles is 43.5 hours.
- A TEMP-specified developmental testing event using SDD-2 vehicles to examine high-angle firing engagements (such as those that might be required during fighting in urban areas) was not conducted due to lack of availability of a suitable test site. Information from this event was needed to support DOT&E's operational assessment for the LRIP decision. The program continues to seek a feasible test site for the event.
- Three developmental/operational test events that the program planned to conduct in FY09 using modified SDD-1 vehicles were postponed until FY10. The three events had been expected to provide information to reduce risk for the SDD-2 vehicle design, but will not do so. One of these three postponed events – a Hot Weather developmental/operational test to examine corrective fixes associated with the ammunition feed system, the environmental control system, and specific electronic subsystems – was cancelled in FY10 because of problems uncovered during the preceding developmental test. The other two deferred developmental/operational test events, which will assess weapon station performance and waterborne directional stability, were postponed again until 1QFY11.
- The FY11 start date for the next operational assessment (which will use three SDD-2 personnel variants and one command and control variant) continues to slip several additional months, but is still expected to be completed within the Acquisition Program Baseline's specified schedule window.
- Introduction of a new hull alloy during LRIP poses risk of unforeseen fabrication and structure durability issues. This change also reaffirms the necessity for use of production-representative LRIP test articles in the IOT&E and LFT&E program.

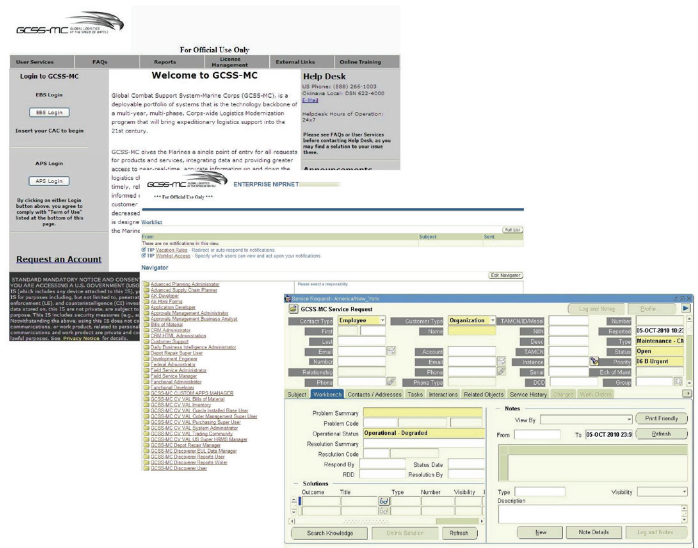
Recommendations

- Status of Previous Recommendations. The EFV Program Office did not address the first FY09 recommendation concerning the need to demonstrate the weapon system's capability in the water in order to meet the user requirement to support forcible entry operations. In response to the second FY09 recommendation, the Program Office has begun designing a protective underbody appliqué for installation and use during land operations in order to provide increased protection against IEDs and mines. Given the possible impact of an underbody appliqué on other aspects of the vehicle's performance, the design, construction, integration, and testing of the appliqué should be completed as soon as possible and adequately tested.
- FY10 Recommendations.
    1. The program should demonstrate the water gunnery capability before the Milestone C LRIP decision.
    2. Deferred FY10 OT&E events should be completed as soon as possible and before the FY11 operational assessment. Implementing this recommendation requires the successful completion of planned prerequisite developmental testing.

Global Combat Support System – Marine Corps (GCSS-MC)

Executive Summary

- In November 2009, the Marine Corps Operational Test and Evaluation Activity (MCOTEA) conducted a developmental/operational test of Release 1.1 with representative users in a laboratory environment in Dumfries, Virginia. The developmental/operational test was adequate to demonstrate the readiness to proceed to IOT&E.
- MCOTEA conducted the IOT&E of Release 1.1 from May 24 – August 6, 2010, in Dumfries, Virginia, and in Okinawa, Japan, with actual users in a live environment at the Third Marine Expeditionary Force (III MEF).
- Based on the IOT&E data, DOT&E assessed the system to be operationally effective and operationally suitable.



System

- The Global Combat Support System – Marine Corps (GCSS-MC) is the Marine Corps component of the joint GCSS Family of Systems. Its evolutionary acquisition strategy comprises three blocks, with Block 1 having two sub-releases that support garrison and deployed operations. Each subsequent Block will build on the Block 1 functions and capabilities and retire additional legacy systems.
- GCSS-MC is a commercial off-the-shelf Enterprise Resource Planning (ERP) system that uses the Oracle E-Business Suite to provide logistics chain management.

Mission

- The Marine Air-Ground Task Force will use GCSS-MC to obtain a strategic and tactical view of logistics chain management in both garrison and deployed expeditionary environments.
- The initial block provides request management, supply, maintenance, financial management, and system administration functions.

Major Contractor

Oracle Corporation – Reston, Virginia

Activity

- In November 2009, MCOTEA conducted a developmental/operational test event for GCSS-MC Release 1.1 with representative users in a laboratory environment in Dumfries, Virginia. This test event provided information in support of a Milestone C limited deployment decision.
- MCOTEA Information Assurance (IA) evaluators conducted independent verification and validation testing to assess system survivability at locations in Virginia during the period spanning May 3-28, 2010.
- MCOTEA conducted an IOT&E of Release 1.1 from May 24 – August 6, 2010, in Dumfries, Virginia, and in Okinawa, Japan, with actual users in a live environment at III MEF.

Assessment

- The developmental/operational test was adequate to demonstrate that Release 1.1 was potentially effective. The developmental/operational test uncovered some IA vulnerabilities in the government laptops, but these were corrected prior to the IOT&E.
- Based on IOT&E results, DOT&E assessed the system to be operationally effective and operationally suitable.
- During the IOT&E, Release 1.1 reduced supply times, improved financial responsiveness, and increased the accuracy of certain maintenance-related information compared to the legacy systems. However, there were difficulties with the GCSS-MC interfaces with the web-based Storage, Retrieval, Automated Tracking, Integrated System (STRATIS) and with

the Total Force Structure Management System (TFSMS) that resulted in inventory inaccuracies Additional personnel resources will be needed for manual intervention to address the interface shortfalls.
- Release 1.1 demonstrated high availability. The system experienced nine operational mission failures but only one affected the entire system. Operational mission performance failed only 0.2 percent of the time.
- More than 100 trouble tickets reported to the Helpdesk remained open at the end of test. Eight of these were severity level two deficiencies. Many trouble tickets cited long delay times that could indicate inadequate network communications.
- Helpdesk policies and procedures were not available in sufficient detail and resulted in the Helpdesk sometimes closing trouble tickets before they were resolved to the users' satisfaction.
- While the formal classroom training appeared to be adequate to meet the threshold requirements, 35 percent of the users felt confident that the training prepared them to operate the system in their assigned role.
- The IA penetration team determined the IA risk to GCSS-MC to be low based on the system's ability to protect, detect, react, and restore information. However, the testing did not include an IA penetration test on the Defense Information Systems Agency (DISA) Defense Enterprise Computing Center in Mechanicsburg, Pennsylvania, which hosts GCSS-MC. Furthermore, there is no disaster recovery plan in place to protect vital logistics business processes in the event of catastrophic destruction of the host location. GCSS-MC data, however, are backed up and stored at an alternate DISA location and can be used to restore services in case of host location destruction.

Recommendations
- Status of Previous Recommendations. This is the first annual report for this program.
- FY10 Recommendations. The Marine Corps should:
  1. Develop a plan for improving interfaces, training, and helpdesk procedures.
  2. Address the disaster recovery plan and arrange for a comprehensive IA test, including a penetration test in conjunction with testing of Release 1.2.

Global Command and Control System – Maritime (GCCS-M)

Executive Summary

- The Navy's Commander, Operational Test and Evaluation Force (COTF) conducted operational tests on the Global Command and Control System – Maritime (GCCS-M) Release v4.0.3, v4.0.3.1, and v4.1 in FY10. Testing was adequate and conducted in accordance with DOT&E-approved test plans.
- DOT&E determined that GCCS-M v4.0.3 and v4.0.3.1 were effective and suitable for Group Level and Force Level ship configurations, respectively. Results of the GCCS-M v4.1 operational tests are pending.

System

- GCCS-M is a command, control, communications, computers, and intelligence system consisting of software, procedures, standards, and interfaces that provide an integrated near real-time picture of the battlespace used to conduct joint and multi-national maritime operations. The Navy's Networks, Information Assurance, and Enterprise Services Program Office, PMW 160, provides hardware and hosting services for the GCCS-M software system, to include either the Integrated Ship Network System (ISNS) infrastructure or the Common Computing Environment (CCE) / Consolidated Afloat Networks Enterprise Services (CANES) infrastructure.
- GCCS-M Increment 2 is being operationally tested at the Force, Group, and Unit Levels. Force Level includes aircraft carrier (CVN), amphibious assault (LHA and/or LHD), and command ships. Group Level includes guided missile cruisers (CG) and destroyers. Unit Level includes guided missile frigates, dock landing ships, amphibious transport docks, and patrol coastal crafts.
- GCCS-M Increment 2 consists of two distinct types of software:
  - A solution for the aircraft carrier, amphibious command ship (LCC), and amphibious assault ship providing capability based on the GCCS-Joint software baseline.
  - A solution for the guided missile cruiser and below providing capability based on the eXtensible Common Operational Picture (XCOP) software baseline.

- The Navy intends to release the Group and Unit Level solution in a three configuration phased approach, starting with the solution for the patrol coastal ships, then the full Unit Level ships, and finally the Group Level ships.

Mission

- U.S. maritime commanders utilize GCCS-M to exercise command and control over forces in support of maritime operations.
- Commanders at all echelons use GCCS-M to:
  - Provide a single, integrated, scalable command and control, communications, computers, and intelligence system.
  - Support the decision-making process.
  - Process, correlate, and display geographic track information on friendly, hostile, and neutral land, sea, air, and space forces, integrated with available intelligence and environmental information.

Major Contractor

Northrop Grumman Mission Systems – San Diego, California

Activity

- Operational testing of GCCS-M Release v4.0.3, v4.0.3.1, and v4.1 conformed to the DOT&E-approved test plan and was adequate.
- COTF conducted the GCCS-M 4.0.3 system operational test October – November 2009 onboard the USS *Cape St George* (Group Level) while the ship was underway conducting naval surface fire support qualifications. The maritime commander conducted surveillance and defense exercises in conjunction with units from the U.S. Coast Guard and the Canadian Navy.
- COTF conducted the GCCS-M 4.0.3.1 system operational test in May 2010 onboard the USS *Abraham Lincoln* (Force Level) while the ship was underway conducting Tailored Ship's Training Assessment in the Southern California operations area.

- COTF conducted the GCCS-M 4.1 operational test May – July 2010 onboard the USS *Tempest* (Patrol Coastal) while underway conducting simulated oil platform defense exercises in the Chesapeake Bay operations area and participating in the Commander, Second Fleet Common Operational Picture.

Assessment

- The Group Level variant of the GCCS-M 4.0.3 system is operationally effective and suitable. The GCCS-M v4.0.3 system met or exceeded all threshold requirements and satisfied all tested Critical Operational Issues (COIs). In comparison to legacy releases, the system demonstrated improved capabilities in processing, online documentation, and editing and exporting overlays, as well as more efficient loading of client workstations. A transition to blade-type servers and increased capacity storage hard drives reduces the space requirements for servers and workstations and provides the capability to accommodate future upgrades by expanding processing and storage capability.
- The Force Level variant of the GCCS-M v4.0.3.1 system is operationally effective and suitable. The GCCS-M v4.0.3.1 system met or exceeded all threshold requirements. The system included significant upgrades to the operating systems necessary to address security problems and obsolescence. The GCCS-M v4.0.3.1 system reduced client installation times and improved the information assurance posture compared to legacy releases. There were minor shortfalls associated with the Processing, Warfare Mission Planning, Reliability, and Documentation COIs, but these issues did not significantly detract from the overall mission capability.
- DOT&E expects results of the GCCS-M v4.1 operational tests to be available in early 2011.

Recommendations

- Status of Previous Recommendations. The Navy addressed all previous recommendations.
- FY10 Recommendations. None.

H-1 Upgrades – U.S. Marine Corps Upgrade to AH-1W Attack Helicopter and UH-1N Utility Helicopter

Executive Summary

- Commander, Operational Test and Evaluation Force (COTF) conducted the third and final phase of IOT&E of the AH-1Z in FY10.
- Testing was adequate to evaluate the operational effectiveness, suitability, and the survivability of the AH-1Z.
- The AH-1Z is operationally effective and operationally suitable.
- The AH-1Z (together with the UH-1Y) is survivable with the exception of the main rotor gearbox, which does not meet its required endurance after loss of lubrication following ballistic penetration. A redesign of the main rotor gearbox is in progress. Also, the fuel cells demonstrated inadequate self-sealing after ballistic events.

System

- This program upgrades two Marine Corps H-1 aircraft:
  - The AH-1W attack helicopter becomes the AH-1Z
  - The UH-1N utility helicopter becomes the UH-1Y
- The aircraft have identical twin engines, drive trains, four-bladed rotors, tail sections, digital cockpits, and helmet mounted sight displays. They are 84 percent common.
- In addition to improved range, payload capacity, and maneuverability, the AH-1Z has a new high-fidelity targeting sensor for delivery of air-to-ground and air-to-air missiles, rockets, and guns.
- The UH-1Y has twice the payload and range of legacy UH-1N aircraft and can deliver eight combat-ready Marines 118 nautical miles and return without refueling. The UH-1Y completed IOT&E in May 2008 and DOT&E reported on it in September 2008.

Mission

- Detachments equipped with the AH-1Z attack helicopter conduct rotary wing close air support, anti-armor, armed escort, armed and visual reconnaissance, and fire support coordination missions.
- Detachments equipped with the UH-1Y utility helicopter conduct command, control, assault support, escort, air reconnaissance, and aeromedical evacuation missions.
- Marine light/attack helicopter squadron detachments are currently deployed with a mixture of UH-1Y and AH-1W helicopters.

Major Contractor

Bell Helicopter – Amarillo, Texas

Activity

- In FY10, COTF conducted operational testing for the AH-1Z at White Sands Missile Range, New Mexico; Yuma Proving Grounds, Arizona; and at China Lake and Camp Pendleton, California. Testing also included shipboard operations onboard the USS *Cleveland*, LPD 7, off the coast of southern California. COTF conducted the AH-1Z IOT&E from March to June 2010 in accordance with a DOT&E-approved Test and Evaluation Master Plan and detailed test plan.
- IOT&E Phase 3 for the AH-1Z consisted of 271.7 flight hours spread out over 125 flight events, with 49 percent of the tactical missions flown at night. This was adequate to resolve critical operational issues as part of the aircraft's operational evaluation.
- Test operations consisted of day and night missions covering all AH-1Z mission areas, flown from shore-based and shipboard facilities. Test articles included four production representative AH-1Z aircraft, while additional resource support for IOT&E included AV-8B, UH-1Y, and AH-1W aircraft. The IOT&E included participation in the Weapons and Tactics Instructor (WTI) course at Marine Corps Station Yuma, Arizona, and a Supporting Arms Coordination Exercise (SACEX) at San Clemente Island, California, while operating from naval ships. Susceptibility testing was also conducted at the Center for Countermeasures at White Sands Missile Range, New Mexico.

- A second deployment of UH-1Y aircraft was completed during 2QFY10. The first deployment of AH-1Z aircraft is being planned for FY11.
- LFT&E of the AH-1Z was completed in FY10 in a combined UH-1Y/AH-Z LFT&E program.

Assessment

- The AH-1Z is operationally effective, operationally suitable, and survivable.
- When employed as a flight of two or more aircraft, the AH-1Z successfully completed 89 percent of its tactical missions. The AH-1Z demonstrated increased range and airspeed and more than doubled ordnance payload. The Optimized Top Owl Helmet Mounted Sight Display and the Target Sight System provide more accurate delivery of ordnance and increased situational awareness for the aircrew.
- Several deficiencies identified during Phase 1 and 2 testing still exist, to include a non-integrated mission planning system, shipboard compatibility problems with the H-1 Upgrades' blade fold equipment, lack of a "G" rate-of-change indication in the head-up-display, and the deficient structural integrity and service life of the H-1 cuff and yoke rotor assembly.
- Deficiencies unique to the AH-1Z and identified during IOT&E Phase 3 include: an unreliable auto-track function of the Target Sight System against moving targets, excessive time delays when transmitting using secure radio communications, reduced employment range of Hellfire missiles when using the color TV for targeting following an inflight bore sight, and software anomalies related to the Integrated Stores Management System.
- The AH-1Z is survivable with the exception of the main rotor gearbox, which does not meet its required endurance after loss of lubrication following ballistic penetration. The Navy is redesigning the main rotor gearbox. Fuel cells showed inadequate sealing after being shot.

Recommendations

- Status of Previous Recommendations. The program is addressing all previous recommendations.
- FY10 Recommendations. The Navy should:
  1. Continue efforts to redesign the cuff and yoke rotor assembly in order to increase its structural integrity and service life and eliminate maneuvering restrictions at high gross weights and high density altitudes. Conduct developmental and operational tests of the aircraft with the redesigned rotor system to verify performance.
  2. Improve G-limit warning systems to reduce pilot-intensive focus on the G meter during maneuvering flight.
  3. For the AH-1Z, increase color TV-to-laser boresight accuracy to allow for employment of precision-guided munitions, such as the Hellfire missile, at maximum ranges.
  4. For the UH-1Y, increase the load capacity of the Improved Defensive Armament System and address the gun depression angle limitation, which restricts defensive fields of fire.
  5. Fund and conduct LFT&E of the main rotor gearbox after redesign.
  6. Ensure fuel cells meet self-sealing specification requirements.
  7. Address water intrusion into the tail rotor for both AH-1Z and UH-1Y identified during IOT&E because of its negative impact on aircraft availability and increased maintenance burden.

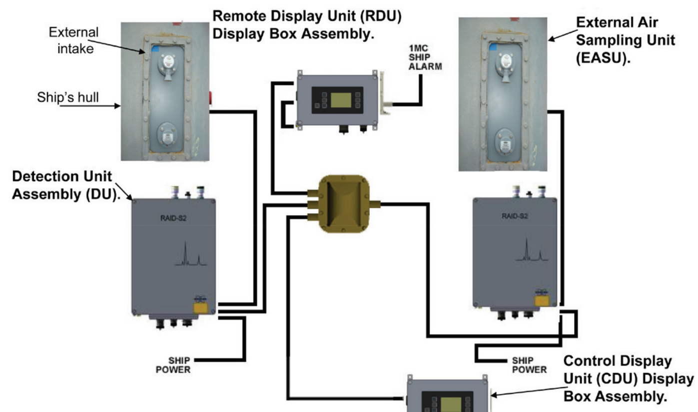
Improved (Chemical Agent) Point Detection System – Lifecycle Replacement (IPDS-LR)

Executive Summary

- The Navy completed FOT&E of the Improved (Chemical Agent) Point Detection System – Lifecycle Replacement (IPDS-LR) in September 2010.
- IPDS-LR was able to detect six of ten tested agents at concentrations associated with the onset of acute symptoms.
- The system meets key requirements for reliability, availability, and false alarms.
- DOT&E intends to publish a Beyond Low-Rate Initial Production (BLRIP) report in early FY11.

System

- The IPDS-LR is a ship-based Chemical Warfare Agent (CWA) detector that will serve as a form/fit/function replacement to the existing IPDS on all U.S. Naval ships. IPDS-LR is projected to be replaced by the Next Generation Chemical Point Detection System, still under development, in FY18.
- The commercially available detector unit is designed to automatically and simultaneously detect and identify CWA vapors by agent class (nerve, blister, and blood) within a specified concentration level and time period.
- The IPDS-LR CWA detection performance is measured against the requirements in the September 1994 IPDS Operational Requirements Document (ORD), the IPDS-LR Performance Specification, and the latest toxicological guidance provided by the U.S. Army Center for Health Promotion and Preventive Medicine (CHPPM).
- The IPDS-LR can be integrated into the Main Circuit (1MC) general shipboard announcing system in order to provide ship-wide alerts. The IPDS-LR shipboard system is composed of several components:
  - Two Detector Units (DUs). Located in the vicinity of each bridge wing, port and starboard side, the DU samples air for the presence of CWA vapors and provides an alert message to the display units.
  - Two External Air Sampling Units (EASU). Located near each DU, it draws in air from outside the ship, filters out particulates, and transfers that air to the DU for analysis. Exhaust from the DU exits the ship through the EASU.
  - One Control Display Unit (CDU). Located in Damage Control Central (DCC), it is the primary user interface that provides the control functions, selects the state of the system, reports the system status, and provides audible and visual alarms upon detection.
  - One Remote Display Unit (RDU). Located inside the bridge, it provides system status and alarm information to the ship's primary control station.



IPDS LR Functional Diagram

Mission

- The Navy intends to use the IPDS-LR to serve as a fixed-point detector to monitor external air for chemical weapon agents (CWA). The system is required to detect and alert ship personnel to the onset of CWA vapor hazards within one minute.
- Successful detection of a CWA at the required threshold concentration theoretically warns a ship of an imminent chemical attack and should provide sufficient time for the crew to seek shelter inside a collective protected zone or don personal protective equipment, including a filtered mask, before the concentration reaches a critical level.

Major Contractor

Bruker Detection Corporation – Billerica, Massachusetts

Activity

- The Navy completed the following Integrated Testing:
  - Chemical Weapons Agent (CWA) testing October 2009 to June 2010 at Edgewood Chemical and Biological Center, Edgewood, Maryland.
  - False alarm testing October 2009 to July 2010 aboard the USS *Dwight D. Eisenhower* (CVN-69), USS *Nassau* (LHA-4), USS *Laboon* (DDG-58) and

USS *Whidbey Island* (LSD-41) in Norfolk, Virginia, and the USS *Princeton* (CG-59) in San Diego, California.
  - Operational Service Life testing October 2009 to February 2010 in Key West, Florida.
- The Navy completed FOT&E in mid-September 2010 aboard USS *Oak Hill* (LSD-51) inport and underway from Norfolk against a simulant for Sulfur Mustard. FOT&E was conducted in accordance with the DOT&E approved test plan.
- DOT&E intends to publish a BLRIP report in early FY11.

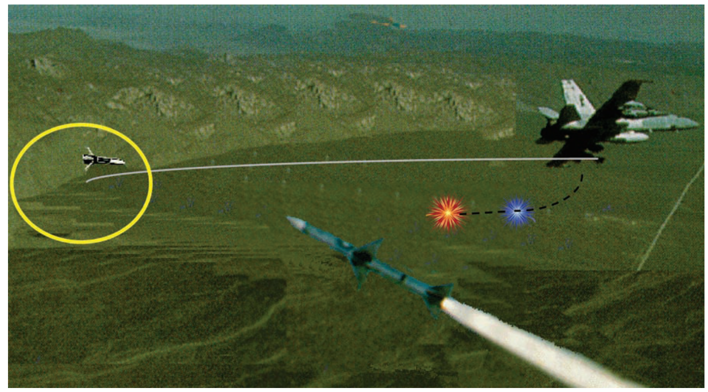
Assessment

- During FOT&E, IPDS-LR detected all port and starboard simulant challenges. The ship's crew was able to recognize and manage system alarms and was capable of taking appropriate action.
- The system detected one of two whole ship challenges, where the simulant was placed a distance from the system EASU ports.
- IPDS-LR was able to detect and alert personnel in time to take protective measures for six of ten agents tested, with a 95 percent or better Probability of Detection at concentrations associated with the onset of acute symptoms.
  - One of the six agents detected caused IPDS-LR to induce overload protection at concentrations associated with severe health effects when the temperature was in excess of 49 degrees Celsius. In overload, the system does not alarm.
- IPDS-LR demonstrated good detection probability for three of ten tested agents, with alarm times just above U.S. Army Center for Health Promotion and Preventative Medicine recommendations. The onset of critical health symptoms for these agents can be mitigated by reducing the amount of exposure time for topside personnel.
- The system Mean Time Between Operational Mission Failure was 3,055 hours, Mean Time Between False Alarms was 436 hours, and operational availability was 98 percent. These measures meet operational requirements.

Recommendations

- Status of Previous Recommendations. This is the first annual report for this program.
- FY10 Recommendations:
  1. Follow-on testing should include software updates that permit IPDS-LR to alarm when the system goes into overload protection.
  2. The currently fielded M88 Automatic Chemical Agent Detection Alarm should be considered by the Navy to supplement the IPDS-LR in the detection of the one agent that IPDS-LR has difficulty detecting.

Integrated Defensive Electronic Countermeasures (IDECM)



Executive Summary

- The Navy completed Integrated Defensive Electronic Countermeasures (IDECM) Block 3 developmental tests, to include laboratory and flight testing, to verify the correction of safety and suitability deficiencies noted during 2008 IOT&E. The Navy is scheduled to complete Verification of Correction of Deficiency (VCD) testing in FY11 to confirm the resolution of these problems.
- IDECM Block 4 successfully completed its critical design review in May 2010. The Navy will complete a revised Test and Evaluation Master Plan (TEMP) prior to the start of government testing in FY11.

System

- The IDECM system is a radio frequency, self-protection electronic countermeasure suite on F/A-18 aircraft. The system is comprised of onboard and off-board components. The onboard components receive and process radar signals and can employ onboard and/or off-board jamming components in response to identified threats.
- There are four IDECM variants: Block I (IB-1), Block II (IB-2), Block III (IB-3), and Block IV (IB-4). All four variants include an onboard radio frequency receiver and jammer. The F/A-18E/F installation includes off-board towed decoys. The F-18C/D installation includes only the onboard receiver/jammer components and not the towed decoy.
  - IB-1 combined the legacy onboard system (ALQ-165) with the legacy (ALE-50) off-board towed decoy (fielded FY02).
  - IB-2 combined the improved onboard system (ALQ-214) with the legacy (ALE-50) off-board towed decoy (fielded FY04).
  - IB-3 combines the improved onboard jammer (ALQ-214) with the new (ALE-55) off-board fiber optic towed decoy that is more integrated with the advanced onboard receiver/jammer (ALQ-214).
  - IB-4 replaces the onboard jammer (ALQ-214(V)3) with a lightweight repackaged onboard jammer for the F/A-18 aircraft variants.

Mission

- Combatant Commanders will use IDECM to improve the survivability of Navy F/A-18E/F strike aircraft against radio frequency guided threats while on air-to-air and air-to-ground missions.
- The Service members intend to use IB-3's and IB-4's complex jamming capability to increase survivability against modern radar guided threats.

Major Contractors

- ALE-55: BAE Systems – Nashua, New Hampshire
- ALQ-214: ITT Electronic Systems – Clifton, New Jersey
- ALE-50 and Improved Multi-purpose Launch Controller: Raytheon Electronic Warfare Systems – Goleta, California

Activity

IDECM Block 3 (IB-3)

- The Navy postponed the IB-3 Milestone III (full-rate production decision) to 1QFY11 to allow time to correct suitability and safety issues identified during IOT&E.
- The Navy continued laboratory testing to correct suitability and safety problems identified during IOT&E.
- In November 2009, at the request of the Navy program office, DOT&E performed a detailed review of the original and modified IB-3 software code at ITT Labs to verify corrections.
- The Navy conducted laboratory testing at the Advanced Weapons Lab to assess the performance of the corrected IB-3 software code.
- The Navy conducted risk reduction flight testing in October 2009 and July 2010 to assess system performance in preparation for VCD testing.
- The Navy began the developmental test flight portion of VCD in August 2010.

- The Navy conducted testing in accordance with the DOT&E approved TEMP and Test Plan.

IDECM Block 4 (IB-4)

- The Navy completed the IB-4 ALQ-214 preliminary design review in November 2009 and the overall critical design review in May 2010. Initial hardware deliveries to the government will begin 2QFY11.
- In accordance with the updated acquisition strategy, the Navy conducted the first two (of six total) in-process reviews in March and July 2010, respectively.
- The IB-4 TEMP update is scheduled to be completed prior to the start of government testing in FY11.

Assessment

IDECM Block 3 (IB-3)

- A detailed review of the software code and laboratory testing of the original and revised software increased confidence that the cause of uncommanded decoy deployments has been identified and corrected. This testing also suggests the built-in test (BIT) false alarm rate has improved. VCD flight testing should further confirm this assessment.
- DOT&E is awaiting the results of the VCD to complete the Beyond Low-rate Initial Production Operational Test Report in time to support Milestone III.

Recommendations

- Status of Previous Recommendations. The eight FY09 recommendations remain outstanding and require continued attention. The three recommendations related to resolving suitability issues are dependent upon post-VCD analysis and reporting. Status of those recommendations will be provided in the FY11 report.
- FY10 Recommendations. There are no new FY10 recommendations. The following are outstanding FY09 recommendations that remain to be resolved.

IDECM System

1. The Navy should complete adequate flight testing to confirm that decoy safety, maintenance, and reliability deficiencies have been resolved, and that the BIT false alarm rate has been reduced.
2. The Navy should develop hardware and/or software changes to provide the pilot with correct indications of whether a decoy was successfully severed.
3. The Navy should continue to improve maintenance procedures and training to reduce the incidence of incorrectly installed magazines and contaminated electrical contacts.
4. The Navy should investigate the susceptibility and effects of IDECM on threat missile fuses.
5. The Navy should continue to fund and develop new countermeasure techniques to improve IDECM effectiveness and keep pace with threat advancements.
6. The Navy should explore new tactics, techniques, and procedures to provide optimal aircraft and aircrew survivability when IDECM is employed.

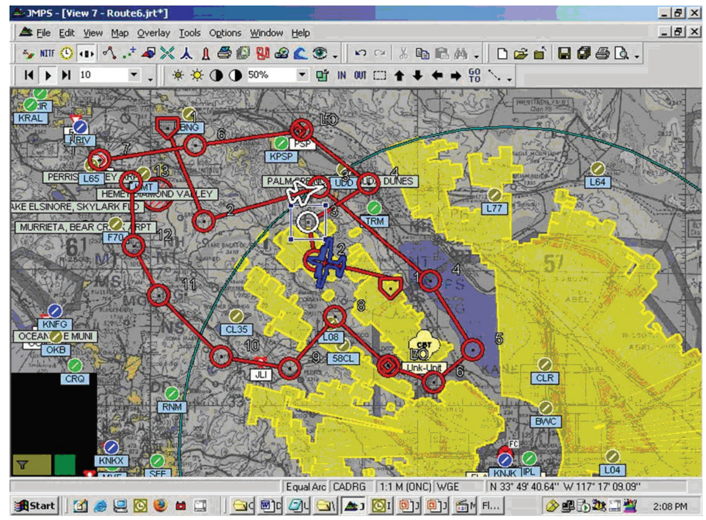
Electronic Warfare Warfighting Improvements

6. In coordination with DoD and other electronic warfare programs, the Navy should continue to develop an enterprise approach to updating and upgrading laboratory and open-air range modeling and simulation capabilities.
7. In coordination with the Defense Intelligence Agency, the Navy should update the threat lethal radii and/or the evaluation processes that are used to determine whether simulated shots are hits or misses.

Joint Mission Planning System – Maritime (JMPS-M)

Executive Summary

- The Navy Joint Mission Planning System – Maritime (JMPS-M) Program Manager is modifying Framework 1.2 to integrate new mission planning features. The Navy plans to re-host its existing Mission Planning Environments (MPEs) to the new Framework 1.4 once it becomes available.
- The Navy and Marine Corps JMPS-M MPEs for host platforms have demonstrated improved results during developmental and operational tests.
- The Program Manager is continuing to develop JMPS-Expeditionary (JMPS-E) as a force-level planning tool to support amphibious operations.



System

- JMPS-M is a Windows XP, PC-based common solution for aircraft mission planning. It is a system of common and host-platform-unique mission planning applications for Navy and Marine Corps aircraft.
- A JMPS-M Mission Planning Environment (MPE) is a set of developed applications built from a framework, common components, and Unique Planning Components (UPCs). The basis of an MPE is the Framework. The Navy currently uses Framework 1.2 for its MPEs. Software developers add other common components (e.g., GPS-guided weapons) and federated applications that support multiple users to the framework. Developers add a UPC for the specific aircraft type (e.g., F/A-18E/F) to the framework and common components to complete the MPE.
- Depending on the aircraft model, a JMPS-M MPE might operate on stand-alone, locally networked, or domain controlled Windows XP computers, or a mixture of all three operating environments.
- JMPS-M Framework 1.4, an enhancement of the currently-used Framework 1.2, is under development with the Air Force to enable JMPS-M users to collaborate on mission planning, even when they are operating from different locations. Framework 1.4 is not currently used by the Navy for any MPEs.
- Although portions of the JMPS-M software are being codeveloped among DoD components, JMPS-M is not a joint program.
- JMPS-E, a related but separate component from JMPS-M, is a force-level planning tool to support amphibious operations.

Mission

- Aircrew use JMPS-M MPEs to plan all phases of their missions. They then save required aircraft, navigation, threat, and weapons data on a data transfer device that they load into their aircraft before flight. They can also use the JMPS-M information to support post-flight mission analysis.
- Amphibious planners will use JMPS-E to plan the movement of personnel, equipment, and logistics support between the amphibious fleet and the shore.

Major Contractor

Framework: BAE Systems – San Diego, California

Activity

JMPS-M

Framework 1.2

- The Navy conducted the following developmental tests on JMPS-M platform MPEs in order to assess risks to successful operational test results:
  - Marine Helicopter MPE version 2.1 at Naval Air Station (NAS) Point Mugu, California
  - C-2A/E-2C MPE version 2.0 (used for cockpit mission planning) at NAS Point Mugu, California
  - E-2C MPE version 3.0 at NAS Point Mugu, California
  - CVIC (Carrier Intelligence Center) MPE version 1.0 at NAS Fallon, Nevada
  - VH-3/VH-60 MPE version 1.0 at NAS Point Mugu, California
  - FA-18/EA-18 MPE version 2.3.0 at NAS Point Mugu, California
  - MV-22 MPE version 1.2.0 at NAS Point Mugu, California

- AV-8B MPE version 3.0.0 at NAS Point Mugu, California
- EA-6B MPE version 6.0 at NAS Point Mugu, California
- DOT&E monitored these developmental tests in order to assess risks to successful operational testing.

- Commander, Operational Test and Evaluation Force (COTF) conducted the following operational tests on JMPS-M platform MPEs:
  - Marine Helicopter MPE version 2.0 at Marine Corps Air Station (MCAS) Miramar, California, and MCAS Camp Pendleton, California, in January and February 2010
  - VH-3/VH-60 version 1.0 at Marine Corps Base, Quantico, Virginia, in June through October 2010
  - EA-6B MPE version 5.0 at NAS Point Mugu, California, in June 2010
  - DOT&E monitored these operational tests to assess operational effectiveness and suitability.
- All operational testing was conducted in accordance with DOT&E-approved Test and Evaluation Master Plans (TEMPs) and test plans.

Framework 1.4

- The Navy JMPS-M Program Manager, PMA-281, is continuing development with the Air Force on a new JMPS Framework 1.4, which will replace Framework 1.2. The Navy successfully completed preliminary design review of Framework 1.4 software.

JMPS-E

- PMA-281 conducted (and COTF monitored) enhanced developmental testing of the JMPS-E version 1.0.2.3 at the Expeditionary Warfare Training Group Pacific, Coronado Island, California.
- DOT&E approved the COTF JMPS-E Test Concept for IOT&E.

Assessment

JMPS-M

Framework 1.2

- Marine Helicopter
  - Marine Helicopter MPE version 2.0 completed operational testing on UH-1N, CH-46E, and CH-53D/E aircraft. COTF deferred operational testing of the MPE for AH-1W aircraft due to lack of test resources. The MPE experienced three Operational Mission Failures (OMFs) during 214.3 hours of testing, generating a Mean Time Between Operational Mission Failure (MTBOMF) of 71.4 hours. This compares with an MTBOMF requirement of 30 hours.
  - Marine Helicopter JMPS MPE version 2.1 developmental testing indicated that the MPE has potential to mature as a true attack helicopter mission planning tool, but it is not ready for operational test or fleet release. Deficiencies identified included inaccurate and difficult fuel planning and difficulty in printing required forms for use by aircrew in the cockpit.
- C-2A/E-2C
  - C-2A/E-2C JMPS MPE version 2.0 operational testing showed the MPE does not provide C-2A and E-2C planners with intuitive procedures for printing take-off and landing data, and the MPE needs to better plan loitering time during missions. The MPE experienced no OMFs during 149 hours of testing, resulting in a MTBOMF of up to 149 hours. This compares with an MTBOMF requirement of 30 hours.
  - E-2C version 3.0 tactical support MPE initial test results showed that not all required flight data successfully transferred to the aircraft. The Navy issued a subsequent software upgrade that resolved this issue before the MPE was released to the fleet. The MPE experienced no OMFs during 293 hours of testing, which equates to a MTBOMF of up to 293 hours. This compares with an MTBOMF requirement of 30 hours.
- CVIC
  - CVIC MPE version 1.0 operational test results showed the MPE experienced no OMFs over 311 hours of operation, which equates to a MTBOMF of up to 311 hours, as compared with the requirement of 30 hours.
- VH-3/VH-60
  - DOT&E is still assessing VH-3/VH-60 MPE version 1.0. Developmental testing revealed few problems other than the MPE incorrectly calculated the fuel burn for hovering flight. Operational testing of the MPE commenced in June 2010 and concluded in October 2010 with analysis of test results ongoing.
- F-18/EA-18
  - The F-18/EA-18 MPE version 2.3.1 will enter operational testing in 1QFY11 without Joint Stand-Off Weapon – C1 (JSOW-C1). Developmental testing indicates that the JSOW-C1 planning component is poorly documented, unintuitive, inflexible, and difficult to use. The planners were unable to download their Global Positioning System (GPS) and JSOW-C1 mission planning information to removable media for transfer and uploading to the aircraft platform. JSOW C-1 testing will occur in 2QFY11 or later.
- MV-22
  - MV-22 JMPS MPE version 1.2 is undergoing developmental testing. During the February 2010 user event, the MPE provided basic functionality, but the developers need to improve system stability and reduce the number of workarounds needed to operate the MPE. The users had difficulty completing their mission planning within the one-hour requirement. In some cases, the users were unable to download their mission data to removable media for transfer to the aircraft. The MPE lacks aerial delivery planning functionality and

does not provide an ashore interface to the Navy Marine Corps Intranet.

- AV-8B
  - DOT&E is still assessing the AV-8B MPE version 3.0. This version provides sufficient functionality and improved stability compared with previous versions, but it is not intuitive and requires extensive user training. Users were not able to plan Military Training Route missions within the 60-minute threshold requirement and it is doubtful whether users will be capable of meeting the requirement without more automated help in creating planning map overlays. Planners were able to download their mission data to removable media for transfer to the aircraft, but the hardware adapter required to do this is not suitable for use in an operational environment.
- EA-6B
  - EA-6B MPE version 5.0 operational testing revealed that the MPE Platform and Configuration Editors allowed improper user input into the configuration and fuel calculations, resulting in erroneous flight planning. A correction to this error is forthcoming in software version 5.0.1 scheduled for 1QFY11 release. The planning process was not intuitive to the users and the embedded mission checklist is insufficient to guide users through the planning process.
  - DOT&E is still assessing EA-6B MPE version 6.0. Developmental testing indicates that the MPE will meet user needs but it will require extensive user training, especially for planners unfamiliar with previous versions of JMPS. The MPE experienced numerous software crashes during the first test event. During this event, transfer of mission plans to removable media for transfer to the aircraft was not attempted.

JMPS-E

- Due to a new test concept, the Navy must update and resubmit the JMPS-E TEMP annex to obtain approval for the start of operational test. A coherent JMPS-E Acquisition Strategy, approved by the Milestone Decision Authority, is required to properly develop follow-on increments of JMPS-E.
- DOT&E is still assessing JMPS-E. During developmental user testing, Amphibious Squadron users found JMPS-E useful in creating and adjusting plans quickly, but JMPS-E did not provide Tactical Air Control Squadron personnel with the information they needed to perform their planning tasks. Detailed aviation data were not available in JMPS-E and Tactical Air Control Squadron users had to use JMPS-M or other tools to create their plans. Developmental testing revealed significant information assurance issues that need correction.

Recommendations

- Status of Previous Recommendations. The Navy has satisfactorily improved the JMPS-M MPE software stability, as recommended in FY09. The Navy has made progress on the remaining five FY09 recommendations for JMPS-M and JMPS-E, valid for FY10. They are reiterated below.
- FY10 Recommendations. The Navy should complete all remaining FY09 recommendations for JMPS-M and JMPS-E.

JMPS-M

1. The Navy should continue to ensure that successful transfer of mission planning data to powered host platform computers occurs during developmental test prior to entrance into operational test.
2. The Navy should update the various host platform MPE Flight Performance Module applications to meet aircrew planning and accuracy expectations for fuel and endurance calculations.

JMPS-E

1. The Navy should conduct the necessary information assurance vulnerability certifications, obtain the necessary authorizations to directly connect, and then test JMPS-E interactions with external data network interfaces.
2. The Navy should produce an approved JMPS-E Acquisition Strategy for follow-on increments before development efforts continue.
3. The Navy must submit a TEMP Annex for JMPS-E prior to commencing operational testing.

KC-130J Aircraft

Executive Summary

- During FY10, the Marine Corps continued the development and fielding of Harvest HAWK, an armed variant of the KC-130J. This effort started in FY08 under an urgent universal need statement requesting rapid development and deployment of persistent direct fire and Intelligence, Surveillance, and Reconnaissance (ISR) in support of ground troops.
- Testing over the 48-week period indicates the Harvest HAWK system on the KC-130J can provide the Battlefield Commander with a limited, persistent surveillance capability with the onboard Production Target Sight Sensor (TSS). The TSS can also provide the ability to employ precision weapons using laser guidance. Because of TSS generated target coordinate and elevation errors, employment of those weapons with only GPS guidance will not be possible.

System

- The KC-130J is a medium-sized, four-engine turboprop tactical transport aircraft modified with air and ground refueling capabilities.
- The KC-130J incorporates many of the C-130J attributes, including a glass cockpit and digital avionics, advanced integrated diagnostics, defensive systems, and a cargo handling system.
- The KC-130J is outfitted with an air/ground refueling package consisting of an internally-carried 3,600-gallon fuselage tank and a hydraulically-powered/electronically-controlled air refueling pod on each wing.
- The current Marine Corps KC-130J (Block D) is flying with Operational Flight Program (OFP) software 6.5 that brings the software in line with Air Force Block 6.0 OFP.
- The Harvest HAWK system consists of a Target Sight Sensor (TSS – electro-optic/infrared targeting pod) and AGM-114P Hellfire missiles, integrated into a roll-on, roll-off Fire Control Console (FCC). An additional Standoff Precision Guided Munition (SOPGM), Griffin air-to-ground missile, uses a federated Battle Management System (BMS) for targeting and launch control.

Mission

- Combatant Commanders use the KC-130J within a theater of operations for fuel and combat delivery missions that include the following:
  - Aerial refueling of fixed wing, tilt-rotor, and rotary wing platforms equipped with refueling probes
  - Ground refueling of land-based systems such as trucks and storage tanks
  - Airdrop of paratroopers and cargo (palletized, containerized, bulk, and heavy equipment)
  - Airland delivery of passengers, troops, and cargo
  - Emergency aeromedical evacuations
- Combat Delivery units operate in all weather conditions, use night-vision lighting systems, and may be required to operate globally in civil-controlled airspace.

Major Contractor

Lockheed Martin – Marietta, Georgia

Activity

- In FY10, the Marine Corps continued the development, test, and evaluation of Harvest HAWK, the armed variant of the KC-130J. This effort started in FY08 under an urgent universal need statement requesting rapid development and deployment of persistent direct fire and ISR in support of ground troops.
- The Marine Corps provided one KC-130J for the Harvest HAWK system installation and integration, test and evaluation, and eventual deployment to theater in support of combat operations. Fleet aircrew participated to the maximum extent possible during all phases of ground and airborne operations.
- The Navy conducted developmental test and evaluation, consisting of limited scope characterization of the Harvest HAWK ISR capability, terminal laser designation capability, and safety of flight certification for use of both the Hellfire and Griffin precision air-to-ground missile systems.

- One Hellfire live missile shot experienced a warhead early burst event, resulting in minor aircraft damage. The investigation determined that the missile had an internal failure at the moment the fuze was armed by the Electronic Safe Arm Fuze timer and was not related to integration or installation on the KC-130J.
- Commander Operational Test Force conducted test and evaluation in accordance with a DOT&E-approved Quick Reaction Assessment test plan designed to evaluate the Harvest HAWK for the persistent ISR mission. Tactics, Techniques, and Procedures were also developed for fleet use.
- During operational testing and fleet training events, the Navy and Marine Corps fired 11 Hellfire AGM-114P and 7 Griffin missiles against representative targets on both instrumented and non-instrumented ranges.
- The roll-on, roll-off rapid reconfiguration of the aircraft was not demonstrated during test and evaluation.
- During FY10, Live Fire Hellfire ballistic tests consisted of two test series. The first fired threat munitions into rocket motor sections mounted on test stands. The second fired a threat into a Hellfire missile mounted on an under-wing pylon.
- LFT&E for Harvest HAWK continues in FY11.

Assessment

- Testing over the 48-week period indicates the Harvest HAWK system on the KC-130J can provide the Battlefield Commander with a limited, persistent surveillance capability with the onboard Production TSS. The TSS can also provide the ability to employ precision weapons using laser guidance. Because of TSS-generated target coordinates and elevation errors, employment of those weapons with only GPS guidance will not be possible. The location of the TSS laser mask (boundary of the airframe limits in regard to TSS azimuth and elevation limits) relative to the TSS line-of-sight was not integrated into the graphical user interface, resulting in the unplanned laser aim point break lock, terminating laser guidance for the weapon when the laser mask was encountered.
- Target coordinates and elevation generated by passive ranging (forward looking infrared only) were consistently inaccurate. The system was capable of generating non-weapons quality coordinates in completely flat terrain near sea level, but was unable to generate usable coordinates in terrain with appreciable elevation differences or mountainous terrain. Target elevation, a key component for weapons coordinate computation, was always incorrect.
- The Fire Control Operator must manually enter the target coordinates with elevation data acquired on the TSS FCC into the federated BMS laptop computer to engage targets with the Griffin missile system. Even if the coordinates had been accurate, the manual target data entry process caused data entry errors that could result in the Griffin attacking the wrong target during GPS mode of terminal guidance.
- For the Hellfire early burst event, the Navy determined that the speed of the aircraft at weapon release coupled with the short fuze arm time will result in the KC-130J entering the Hellfire safe escape fragmentation pattern every time the Hellfire fuze arms. The Navy accepted the risk associated with this hazard.
- Based on LFT&E, Harvest HAWK vulnerability to Hellfire ballistic impact is considered low. Testers placed two Hellfire missiles, one above the other, on an under wing pylon, then subjected the lower missile's rocket motor to a ballistic threat. Upon impact, the rocket motor exploded, releasing the missile's warhead section. Several minor fragment impacts occurred, but no significant damage occurred to the pylon or wing. The detonation did not affect the adjacent Hellfire missile.
- Reliability, maintainability, availability, logistics supportability, and documentation could not be fully assessed during this short test and evaluation period. However, publications, training instructions, and maintenance manuals were provided by the contractor.
- While this system is not intended to interfere with the KC-130J primary aerial refueling or secondary assault support missions, the TSS replaces the left aerial refueling pod, and the Hellfire missile launcher rail system replaces the left external fuel tank, leaving the KC-130J Harvest HAWK with half of the aerial refueling capability of the KC-130J.

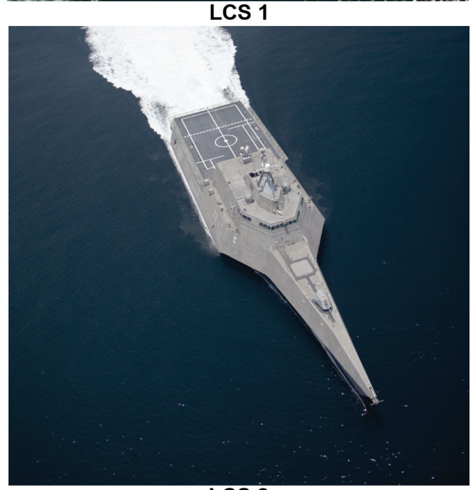
Recommendations

- Status of Previous Recommendations. The Navy did not satisfactorily complete LFT&E with the Harvest HAWK capability, as recommended in FY09.
- FY10 Recommendations. The Navy should:
  1. Improve the target coordinate and elevation generation capability to provide sufficient accuracy for GPS-guided munitions.
  2. Integrate the laser mask presentation in the Graphical User Interface for the accurate display of the laser sensor azimuth and elevation location.
  3. Integrate the Griffin SOPGM into the Fire Control Console to increase system capability and improve operator efficiency and prevent operator data entry errors.

Littoral Combat Ship (LCS)

Executive Summary
- The Navy has proposed ordering 20 Littoral Combat Ships (LCS) in a split buy between the two competing variants. If the proposal does not gain congressional approval, the Navy will continue with their plans to select one hull from the two competing ship designs of the LCS in FY11.
- Regardless of the final acquisition strategy, the Navy intends to employ the ships through their operational service life, so the current test and evaluation strategy reflecting comprehensive testing for both designs will remain applicable.
- LCS 1 critical ship control systems essential to support the crew have performed well in testing; however, several systems required for self-defense and mission package support have demonstrated early reliability problems.
- LCS 2 completed part one of Acceptance Trials and deferred several events to a second Acceptance Trial in early 2011. The ship was found to be incomplete; several systems and spaces have not been accepted by the government.
- The Navy designated LCS a Survivability Level 1 ship. Consequently, its design is not required to include survivability features necessary to conduct sustained operations in a combat environment. As such, LCS is not expected to maintain significant mission capability if hit by a weapon.


LCS 1


LCS 2

System
- The LCS is designed to operate in the shallow waters of the littorals where larger ships cannot maneuver as well. It can accommodate a variety of individual warfare systems (mission modules) assembled and integrated into interchangeable mission packages.
- There are two competing basic ship (seaframe) designs:
  - LCS 1 is a semi-planing monohull constructed of steel and aluminum.
  - LCS 2 is an aluminum trimaran design.
- Common characteristics:
  - Combined two diesel and two gas turbine engines with four waterjet propulsors
  - Sprint speed in excess of 40 knots, draft of less than 20 feet, and range in excess of 3,500 nautical miles at 14 knots
  - Accommodate up to 76 personnel (air detachment, mission module personnel, and core crew of no more than 50)
  - A Common Mission Package Computing Environment (MPCE) for mission module component transparency across Mission Packages.
  - Hangars sized to embark MH-60R/S with multiple Vertical Take-off Unmanned Aerial Vehicles (VTUAVs)
  - 57 mm BOFORS Mk 3 gun with dissimilar gun fire control systems.
- The designs have different combat systems for self-defense against anti-ship cruise missiles
  - LCS 1: COMBATSS-21, an Aegis-based integrated combat weapons system with a TRS-3D (German) Air/Surface search radar, Ship Self-Defense System Rolling Airframe Missile (RAM) interface (one 21-cell launcher), and a DORNA (Spanish) Electro-Optical/Infrared (EO/IR) for 57 mm gun fire control.
  - LCS 2: Integrated combat management system (derived from Dutch TACTICOS system) with a Swedish 3D Air/Surface search radar (Sea Giraffe), one RAM (11-cell) launcher integrated into Close-In Weapons System (Mk 15 CIWS) search and fire control radars (called SeaRAM), and Sea Star SAFIRE EO/IR for 57 mm gun fire control.
- More than a dozen individual programs of record involving sensor and weapon systems and other off-board vehicles make up the individual mission modules, including the following:
  - Remote Multi-Mission Vehicle, an unmanned semi-submersible that tows a special sonar to detect mines
  - Organic Airborne Mine Countermeasures, a family of systems employed from an MH-60S designed to detect, localize, and neutralize all types of sea mines

- Unmanned Surface Vehicles, used in both mine and anti-submarine warfare applications
- VTUAV, specifically the Fire Scout (MQ-8B)

- The Navy plans to acquire a total of 55 LCSs, the first four being a mix of the two competing designs, followed by a split buy of 10 vessels of each design.

Mission

- The Maritime Component Commander can employ LCS to conduct Mine Warfare, Anti-Submarine Warfare, or Surface Warfare, based on the mission package fitted into the seaframe. With the Maritime Security Module installed, the ship can conduct sustained Level II (Non-Compliant, free board less than 25 feet) Visit Board Search and Seizure (VBSS) Maritime Interception Operations. Mission packages are designed to be interchangeable, allowing the Maritime Component Commander flexibility to reassign missions.
- Commanders can employ LCS in a maritime presence role regardless of the installed mission package based on capabilities inherent to the seaframe.
- The Navy can deploy LCS alone or in conjunction with other ships.

Major Contractors

LCS 1

- Prime: Lockheed Martin Maritime Systems and Sensors – Washington, District of Columbia
- Shipbuilder: Marinette Marine – Marinette, Wisconsin

LCS 2

- Prime: General Dynamics Corporation Marine Systems, Bath Iron Works – Bath, Maine
- Shipbuilder: Austal USA – Mobile, Alabama

Mission Packages

- Future Mission Package Integration contract awarded to Northrop Grumman – Los Angeles, California

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Activity

- DOT&E published the LCS-1 Early Fielding Report in July 2010. DOT&E will submit an Operational and LFT&E report upon completion of IOT&E and prior to a full-rate production decision.
- DOT&E approved the LFT&E Management Plan in August 2010. This plan serves as the alternative LFT&E strategy that accompanies the Navy's request for waiver from full-up, system-level survivability testing.
- LCS 1:
  - USS *Freedom* (LCS 1) with initial increment of the Surface Warfare Mission Package, including two 30 mm gun mission modules, deployed nearly two years early to U.S. Southern Command and participated in Rim of the Pacific Exercise 2010.
- LCS 2:
  - Completed Acceptance Trials (part I) in November 2009 and deferred several events to a second Acceptance Trial tentatively scheduled for early 2011.
  - The Navy accepted delivery in December 2009.
  - The Navy commissioned LCS-2 on January 16, 2010.
  - The Navy completed OT&E of LCS 2 Electronic Chart Display and Information System – Navy (ECDIS-N).
- Mine Counter Measures (MCM) end-to-end Phase III testing scheduled onboard surrogate ship *Seafighter*. Testing was delayed by the Deepwater Horizon oil spill and subsequently moved to the south Florida range where testing was hindered by deteriorated sea conditions caused by several hurricanes passing the vicinity in September of 2010. Chase boats and unmanned vehicles were both limited by Sea States (SS) greater than three.
- The Navy has proposed ordering 20 LCSs in a split buy between the two competing variants. If the proposal does not gain congressional approval, the Navy will continue with their plans to select one hull from the two competing ship designs of the LCS in FY11.
- The Navy is conducting a study to determine if the Non-Line-of-Sight (NLOS) missile will be necessary to meet the LCS requirements. The Army cancelled the NLOS in FY10.
- The Navy is in the process of establishing a Service-wide 30 mm and 57 mm ammunition Live Fire Integrated Product Team. This team will address the lethality of each round with respect to each program's target set. The Navy will submit LFT&E Management Plans in FY11.
- Testing was conducted in accordance with DOT&E-approved test plans.

Assessment

- LCS 1:
  - Critical ship control systems essential to support the crew have performed well in testing; however, several systems required for self-defense and mission package support have demonstrated early reliability problems.
  - The crew appears to be operating at nearly full capacity during routine operations, and the Navy is still assessing whether the crew is "right-sized" to cope with the workload. The ship does not have sufficient installed berthing to accommodate the nominal crew complement,

nor is the installed refrigerated food storage capacity sufficient to meet the prescribed provision endurance.
- LCS 2:
  - Builder trials were initially delayed due to leaks at the gas turbine shaft seals. More testing identified additional deficiencies related to the main propulsion diesel engines, further delaying completion of the trials until October 2009.
  - During Acceptance Trials, the ship was found to be incomplete. Several spaces and critical systems were incomplete and had not been accepted by the government. Spaces and systems that were accepted had various levels of documented material deferrals necessitating a second Acceptance Trial, which is tentatively scheduled for early 2011.
- LCS is not expected to be survivable in terms of maintaining a mission capability in a hostile combat environment. This assessment is based primarily on a review of the LCS design requirements. The Navy designated LCS a Survivability Level 1 ship; the design of the ship just allows for crew evacuation. Consequently, its design is not required to include survivability features necessary to conduct sustained operations in a combat environment. The results of early live fire testing using modeling and simulation, while not conclusive, have raised concerns about the effects weapons will have on the crew and critical equipment. Additional live fire testing and analysis is needed to fully assess the survivability of the LCS class of ships. Additional information is available in the classified LCS 1 Early Fielding Report.
- The LFT&E Management Plan describes the major tests and analyses that will serve as the basis for DOT&E's survivability assessment. To address the vulnerability implications of building ships with aluminum structure to commercial standards, relevant to both ship designs, the LFT&E program will include the following surrogate tests: fire-induced structural collapse test of a multi-compartment aluminum structure, internal blast test of a multi-compartment aluminum structure, and an underwater explosion-induced inelastic whipping test of a surrogate ship.

Recommendations
- Status of Previous Recommendations. Two recommendations from FY05 and FY06 remain; recommendations concerning a risk assessment on the adequacy of Level I survivability, and detailed manning analyses to include mission package support. The Navy has partially addressed one FY09 recommendation to develop an LFT&E program with the approval of the LFT&E Management Plan; however, the recommendation will not be fully addressed until the details of the surrogate testing and the lethality testing are developed.
- FY10 Recommendations.
  1. LCS 1: The Navy should implement all recommendations from DOT&E's Combined Operational and Live Fire Early Fielding Report.
  2. LCS 2: The Navy should address all deficiencies noted in the Navy's Board of Inspection and Survey Acceptance Trials report.

Low Cost Conformal Array

Executive Summary

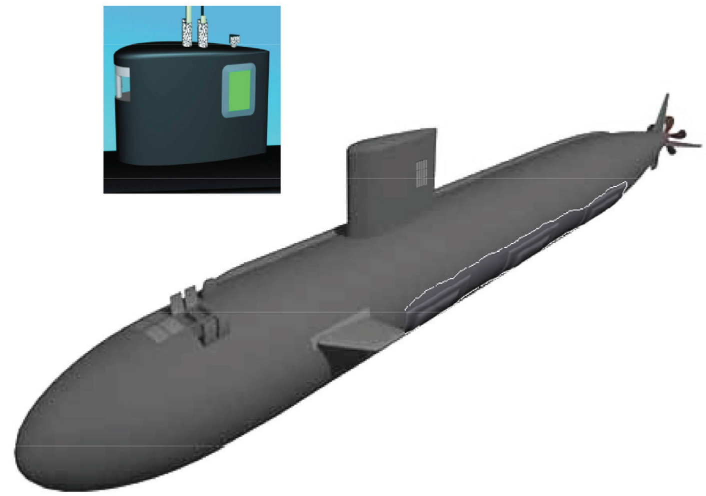
- The Navy completed operational testing of the Low Cost Conformal Array (LCCA) in 2010 in accordance with the DOT&E-approved test plan.
- Preliminary test results indicate that the LCCA meets its primary design goals.

System

- The LCCA is a planar sonar array mounted on both sides of the submarine sail. This configuration provides high frequency sonar coverage above and behind the ship. Combined with the legacy high frequency sail array mounted in the front of the sail, the system provides 360-degree detection capability with high frequency passive sonar.
- The LCCA program will be procured in three increments:
  - Increment 1 provides initial passive detection and ranging capability, and will be installed on Improved *Los Angeles* class submarines.
  - Increment 2 will add an active detection and ranging capability to Increment 1 systems.
  - Increment 3 will implement lower cost and weight technologies, and be installed on additional submarine classes (*Seawolf*, *Virginia*, and *Ohio* class SSGNs), as well as the remaining *Los Angeles* class submarines.
- The Navy intends the LCCA to improve the situational awareness of submarines operating in high-density littoral environments.
- The signals detected by the LCCA will be processed by the Acoustic Rapid Commercial Off-the-Shelf Insertion sonar system, starting with the hardware upgrade installed in the Technology Insertion 2008 version.

Mission

Submarine commanders will use the LCCA to increase tactical control when operating in littoral and open-ocean environments



in the presence of conventional and nuclear submarines and surface warships, often in areas that are heavily populated with non-combatant surface vessels. The LCCA is designed to increase situational awareness of short range contacts and should aid in:

- Providing Intelligence, Surveillance, and Reconnaissance
- Providing Indications and Warning
- Conducting Anti-Submarine Warfare
- Conducting Surface Warfare
- Conducting Naval Special Warfare

Major Contractor

Lockheed Martin Maritime Systems and Sensors – Washington, District of Columbia

Activity

- DOT&E placed the LCCA program on oversight after the Navy approved the Test and Evaluation Master Plan. DOT&E approved the LCCA Operational Test Plan in April 2010.
- The Navy completed operational testing of the LCCA system during two events in 2010. The first event was conducted in May and tested the system in both open-ocean and littoral environments in the vicinity of numerous surface contacts. A second test event was conducted in August in conjunction with a Fleet Exercise, during which the system tracked a submerged target.
- DOT&E plans to issue a Beyond Low-Rate Initial Production Report for the LCCA in FY11.

Assessment

Although analysis of the operational tests is ongoing, developmental testing and preliminary analysis of the operational testing results suggest the following:

- LCCA meets its requirements for frequency coverage, angular coverage, and angular resolution, achieving the primary goal of providing 360-degree high frequency sonar coverage to the submarine.
- LCCA appears to be operationally suitable, demonstrating above-threshold availability and acceptable software reliability.

Recommendations

- Status of Previous Recommendations. This is the first annual report for this program.
- FY10 Recommendations. None.

LPD-17 *San Antonio* Class Amphibious Transport Dock

Executive Summary

- LPD-17 is capable of conducting amphibious operations in a benign environment but is not operationally effective, suitable, or survivable in a hostile environment.
- Chronic reliability problems associated with critical ship systems across the spectrum of mission areas reduce overall ship suitability and jeopardize mission accomplishment. The Navy's Board of Inspection and Survey identified similar problems in all of the first four ships of the class.
- There was no Live Fire Testing conducted in FY10. However, the Navy continued their overall survivability analysis; the Navy's final survivability report is expected in FY11.
- DOT&E's Beyond Low-Rate Initial Production (BLRIP) report recommended FOT&E to complete outstanding test events and address an extensive list of deficiencies.

System

LPD-17 is a diesel engine-powered ship designed to embark, transport, and deploy ground troops and equipment. Ship-to-shore movement is provided by Landing Craft Air Cushion (LCAC), Landing Craft Utility (LCU), Amphibious Assault Vehicles (AAVs), MV-22 tiltrotor aircraft, and/or helicopters. Key ship features and systems include the following:

- A floodable well deck for LCAC, LCU, and AAV operations
- A flight deck and hangar to support various Navy and Marine Corps aircraft
- Command, Control, Communications, Computers, and Intelligence facilities and equipment to support Marine Corps Landing Force operations
- A Ship Self-Defense System Mark 2 Mod 2 with Cooperative Engagement Capability equipped with Rolling Airframe Missiles (RAM), the SLQ-32B (V)2 (with Mk 53 Nulka electronic decoys) passive electronic warfare system, and radars (SPQ-9B horizon search radar and SPS 48E long-range air search radar) to provide air warfare ship self-defense
- Two Mk 46 30 mm gun systems and smaller caliber weapons to provide defense against small surface threats
- A Shipboard Wide Area Network (SWAN) that serves as the data backbone for all electronic systems. (LPD-17 is one of the first ships built with a fully integrated data network system.)

Mission

A Fleet Commander will employ LPD-17 class ships to conduct Amphibious Warfare. The ship will normally deploy with a notional three-ship Amphibious Ready Group (ARG) but can operate independently. In these roles, the ship will:

- Transport combat and support elements of a Marine Expeditionary Unit or Brigade
- Embark, launch, and recover LCACs, LCUs, and AAVs for amphibious assault missions
- Support aerial assaults by embarking, launching, and recovering Marine Corps aircraft
- Carry and discharge cargo to sustain the landing force
- Conduct non-combatant evacuation operations and other crisis response missions

Major Contractor

Northrop Grumman Ship Systems – Pascagoula, Mississippi

Activity

- The Navy completed two IOT&E events in FY10: a Rolling Airframe Missile engagement on the Self-Defense Test Ship in December 2009 and Probability of Raid Annihilation (PRA) modeling and simulation in November 2009. The IOT&E test events were conducted in accordance with DOT&E-approved test plans.
- There was no Live Fire Testing conducted in FY10, however the Navy continued their overall survivability analysis. The Navy's final survivability report is expected in FY11.
- DOT&E's BLRIP report published in June 2010 recommended FOT&E to complete outstanding test events and address an extensive list of deficiencies.

Assessment

- LPD-17 is capable of conducting amphibious operations in a benign environment, but is not operationally effective, suitable, or survivable in a hostile environment.
- LPD-17 is able to meet its amphibious lift requirements for landing force vehicles, cargo, personnel, fuel, hangar space, well-deck capacity, and flight-deck landing areas.
- LPD-17 has not yet demonstrated adequate reliability and availability of critical ship systems, including:
  - Control systems – SWAN, Interior Voice Communications System (IVCS), and Engineering Control System (ECS).
  - Support equipment – Cargo Ammunition Magazine elevators, vehicular ramps, main propulsion diesel engines, electrical distribution system, and steering system.
  - Combat systems – SPQ-9B horizon search radar, the Mk 46 Gun Weapons System (GWS), and the Magnetic Signature Control System.
- The following LPD-17 self-defense systems did not demonstrate adequate capability: Mk 46 GWS, SSDS Mk 2, SPQ-9B, and SPS-48/CEC.
- The Navy's Board of Inspection and Survey identified similar deficiencies in identical areas during both acceptance and final contract trials across all four of the first ships of the class. Severe casualties recorded prior to the Full Ship Shock Trial in LPD-19 and during LPD-17's deployment revealed serious fabrication and production deficiencies.
- The ship has not yet demonstrated an adequate Command, Control, Communications, Computers, and Intelligence capability.
- The Navy still needs to validate critical Information Exchange Requirements and pursue a formal Information Support Plan to support a Joint Interoperability Certification.
- The design of San Antonio class ships have numerous survivability improvements compared to the LPD class ships they will replace. However, problems encountered with critical systems during testing, as well as difficulties in recovering mission capability, have offset some of the survivability design improvements and have highlighted the impact of serious reliability shortcomings.
- PRA test bed events and the Self-Defense Test Ship events revealed several combat systems deficiencies and underscored several previously known deficiencies.

Recommendations

- Status of Previous Recommendations. The Navy has satisfactorily addressed the ship's interoperability with AV-8 aircraft and completed PRA modeling and simulation efforts. All additional recommendations made in FY07, FY08, and FY09 remain valid and the Navy must continue to address them in FOT&E.
- FY10 Recommendations. The Navy should:
  1. Improve the reliability of critical control systems to include the SWAN, IVCS, and ECS.
  2. Improve reliability of critical support equipment to include the Cargo Ammunition Magazine elevators, vehicular ramps, main propulsion diesel engines, electrical distribution system, and steering system.
  3. Improve reliability of key components of the combat systems to include the SPQ-9B horizon search radar, the Mk 46 GWS, and the Magnetic Signature Control System.
  4. Improve the effectiveness of the Mk 46 GWS.
  5. Improve the effectiveness of the SSDS Mk 2-based combat system (detailed SSDS performance is reported separately in this annual report).
  6. Complete deferred test events to include Chemical/Biological/Radiological Defense, Information Assurance, and vulnerability against enemy mines using the Advanced Mine Simulation System.
  7. Correct deficiencies identified in the Naval Sea Systems Command Total Ship Survivability Trial and Full Ship Shock Trial reports.
  8. Improve Total Ship Operational Availability. Measure over an extended period, preferably during a deployment, after making reliability improvements.
  9. Incorporate FOT&E into the updated LPD-17 Test and Evaluation Master Plan to evaluate the efficacy of the corrective actions taken by the Navy to address DOT&E's recommendations.

MH-60R Multi-Mission Helicopter

Executive Summary
- Combined MH-60R/S FOT&E on Pre-Planned Product Improvement (P3I) components commenced in FY08 and is expected to continue into the latter half of FY11. The first phase of P3I components completed operational testing in September 2009.
- The MH-60R, with tested P3I components, is operationally effective for all missions with the exception of Surface Warfare (SUW).
- The MH-60R, with tested P3I components, is operationally suitable for all missions.
- The MH-60R is survivable for all missions. No dedicated LFT&E events were conducted in support of the MH-60R P3I testing. The incorporation of P3I components in MH-60R aircraft did not alter the survivability of the aircraft.

System
The MH-60R is a ship-based helicopter designed to operate from Cruisers, Destroyers, Frigates, Littoral Combat Ships, and Aircraft Carriers. It is intended to replace the SH-60B and SH-60F.
- It incorporates dipping sonar and sonobuoy acoustic sensors, multi-mode radar, electronic warfare sensors, a forward-looking infrared sensor with laser designator, and an advanced mission data processing system.
- It employs torpedoes, Hellfire air-to-surface missiles, and crew-served mounted machine guns.
- It has a three-man crew: two pilots and one sensor operator.

Mission
The Maritime Component Commander employs the MH-60R from ships or shore stations to accomplish the following:
- SUW, Under Sea Warfare (USW), Area Surveillance, Combat Identification, and Naval Surface Fire Support missions previously provided by two different (SH-60B and SH-60F) helicopters
- Support missions such as Search and Rescue at sea and, when outfitted with necessary armament, maritime force protection duties

Major Contractors
- Sikorsky Aircraft Corporation – Stratford, Connecticut
- Lockheed Martin Mission System and Sensors – Owego, New York

Activity
- FOT&E on the first phase of P3I components completed in September 2009. Commander, Operational Test and Evaluation Force (COTF) conducted testing in accordance with the DOT&E-approved Test and Evaluation Master Plan and test plan. COTF tested 9 of the 16 components scheduled to be integrated into the MH-60R during this first increment. The following nine MH-60R P3I systems were of sufficient maturity for test during FOT&E:
  - Link 16
  - Multi-spectral Targeting System (MTS)
  - Mk 54 Torpedo Digital Interface
  - Selective Availability Anti-spoof Module Embedded GPS/Inertial
  - GPS Antenna System
  - Modifications to the Avionics Operational Program to control Single Channel Ground and Airborne Radio System operation through the Operator System Interface
  - Modifications to the Avionics Operational Program to control satellite communications with Demand Assigned Multiple Access operation through the Operator System Interface
  - APX-118 Transponder system that adds a new mode, Mode-S surveillance capability (providing an aircraft-unique 24-bit address identifier), to the existing modes 1, 2, 3/A, C, and 4 of the legacy APX-100. This is not a tactical system and is currently used solely for communication with civilian air traffic control authorities.
  - Active Vibration Control (AVC) designed to replace the current passive vibration absorbers on the MH-60R and MH-60S aircraft. The function of the AVC is to attenuate the vibrations induced into the helicopter by the operation of the rotor system.
- FOT&E for the remaining seven components is expected to complete in FY11.

- All LFT&E activities have been completed and reported in the Live Fire Test and Evaluation Report to Congress in 2008.

Assessment

- The addition of Link 16 allows the MH-60R to share sensor data directly with other battle group participants and provides increased situational awareness for all units participating in the network while conducting SUW and USW missions. However, during the conduct of SUW missions, the enormous amount of track information and sensor data presented to the three-man crew over-saturated the sensory and cognitive skills of the operators, decreasing their ability to discern critical information from within all the information presented. This required the use of numerous workarounds that ultimately led to frequent loss of situational awareness as crews were forced to filter out critical sensor data to maintain a sustainable task load.
- The MH-60R with the installed AN/AAS-44C(V) Multi-spectral Targeting System upgrades is not operationally effective for SUW.
- The Mk 54 Torpedo Digital Interface P3I allows for successful integration of the Mk 54 torpedo with the MH-60R.
- APX-118 Mode-S surveillance information fails to meet the Federal Aviation Administration (FAA) threshold for certification by not transmitting accurate track angle information to civilian air traffic controller authorities. As a result, the FAA would not certify the APX-118 Mode-S surveillance capability for communication with traffic controllers.

Recommendations

- Status of Previous Recommendations. The Navy satisfactorily addressed three of the four previous recommendations. The Navy should identify the cause and corrective action to resolve the frequent failures of the Airborne Low Frequency Sonar reel and cable assembly.
- FY10 Recommendations. The Navy should:
  1. Investigate and apply corrections to Link 16 deficiencies to include possible changes to employment tactics, techniques, and procedures. The Navy should verify corrections in FOT&E.
  2. Correct and test deficiencies revealed in conducting SUW during testing.
  3. Investigate and apply corrections to APX-118 Transponder aircraft track angle information disparity deficiency and verify corrections in FOT&E.

MH-60S Multi-Mission Combat Support Helicopter

Executive Summary

- Combined MH-60R/S FOT&E on Pre-Planned Product Improvement (P3I) components commenced in FY08 and is expected to continue into the latter half of FY11. The first phase of P3I components completed operational testing in September 2009.
- The MH-60S with tested P3I components is operationally effective for all missions with the following exception: the Block 3A Armed Helicopter with the installed AN/AAS-44C(V) Multi-spectral Targeting System (MTS) upgrades is not operationally effective for Surface Warfare (SUW).
- The MH-60S, with tested P3I components, is operationally suitable for all missions.
- The MH-60S is survivable for all missions. No dedicated LFT&E events were conducted in support of the MH-60S P3I testing. The incorporation of P3I systems in MH-60S aircraft did not alter the survivability of the aircraft.

System

- The MH-60S is a helicopter modified into three variants (Blocks) from the Army UH-60L Blackhawk. It is optimized for operation in the shipboard/marine environment.
- The Blocks share common cockpit avionics and flight instrumentation with the MH-60R.
- Installed systems differ by Block based on mission:
  - Block 1 – Fleet Logistics. Precision navigation and communications, maximum cargo or passenger capacity
  - Block 2A/B –Airborne Mine Countermeasures (AMCM). AMCM systems operator workstation, tether/towing system, any one of five mine countermeasure systems currently under development
  - Block 3A – Armed Helicopter. Tactical moving map display, forward-looking infrared with laser designator, crew-served side machine guns, dual-sided Hellfire air-to-surface missiles, and defensive electronic countermeasures
  - Block 3B – Armed Helicopter. Block 3A with addition of tactical data link (Link 16)
- P3I components add Link 16 and various communication, navigation, and command and control upgrades.

Mission

The Maritime Component Commander can employ variants of MH-60S from ships or shore stations to accomplish the following missions:

- Block 1 – Vertical replenishment, internal cargo and personnel transport, medical evacuation, Search and Rescue, and Aircraft Carrier Plane Guard
- Block 2 – Detection, classification, and/or neutralization of sea mines depending on which AMCM systems are employed on the aircraft
- Block 3 – Combat Search and Rescue (CSAR), SUW, Aircraft Carrier Plane Guard, Maritime Interdiction Operations, and Special Warfare Support

Major Contractors

- Sikorsky Aircraft Corporation – Stratford, Connecticut
- Lockheed Martin Mission System and Sensors – Owego, New York

Activity

- FOT&E on the first phase of P3I components completed in September 2009. Commander, Operational Test and Evaluation Force (COTF) conducted testing in accordance with the DOT&E-approved Test and Evaluation Master Plan and test plan. COTF tested 8 of the 13 components scheduled to be integrated into the MH-60S during this first increment. The following eight MH-60S P3I systems were of sufficient maturity for test during FOT&E:
  - Link 16
  - MTS
  - Downed Aircrew Locator System (DALS)
  - Selective Availability Anti-spoof Module Embedded GPS/Inertial
  - GPS Antenna System

- Modifications to the Avionics Operational Program to control Single Channel Ground and Airborne Radio System operation through the Operator System Interface
- Modifications to the Avionics Operational Program to control satellite communications with Demand Assigned Multiple Access operation through the Operator System Interface
- APX-118 Transponder system that adds a new mode, Mode-S surveillance capability (providing an aircraft-unique 24-bit address identifier), to the existing modes 1, 2, 3/A, C, and 4 of the legacy APX-100. This is not a tactical system and is currently used solely for communication with civilian air traffic control authorities.

• FOT&E for the remaining five components is expected to complete in FY11
• Correction of deficiencies is ongoing, to include some redesign of critical components in the Block 2 AMCM variant, designed primarily to support systems that are part of the new Littoral Combat Ship Mine Countermeasures Mission Package. Developmental testing on Block 2A with the AN/AQS-20A sonar recommenced in 4QFY09. IOT&E is scheduled to commence in February 2011.

Assessment

• The addition of Link 16 allows the MH-60S to share sensor data directly with other battle group participants and provides increased situational awareness for all units participating in the network while conducting SUW and CSAR missions. However, Link 16 employment tactics, techniques, and procedures require further development and refinement to facilitate optimal employment of Link 16 functionality into MH-60S missions.
• The MH-60S with tested P3I components, is operationally effective for all missions, with the following exception: the Block 3A Armed Helicopter with the installed AN/AAS-44C(V) MTS is not operationally effective for SUW.
• The MH-60S helicopter with the upgraded DALS is effective for the CSAR mission. The following DALS deficiencies were observed:
  - An interoperability deficiency between the DALS and the Combat Survival Evader Locator (CSEL) AN/PRQ-7 handheld radio, the current aviation survival radio fielded by deploying battle groups
  - The failure to simultaneously receive Quickdraw situation reports (e.g. GPS location and text messages) and DALS locating information (e.g. precise directional guidance to the survivor), prevented the MH-60S aircrew from receiving time-critical survivor information during the terminal phase of the rescue
  - Electromagnetic interference from the DALS infrared searchlight that induced navigational bearing errors.
  - APX-118 Mode-S surveillance information fails to meet the Federal Aviation Administration (FAA) threshold for certification by not transmitting accurate track angle information to civilian air traffic controller authorities. As a result, the FAA would not certify the APX-118 Mode-S surveillance capability for communication with traffic controllers.

Recommendations

• Status of Previous Recommendations. The Navy has satisfactorily addressed four of the eight previous recommendations. With regard to the four remaining recommendations, the Navy should:
  1. Demonstrate Block 3A Armed Helicopter Weapons System (AHWS) operational effectiveness in the SUW mission to include sufficient day and night overwater Hellfire missile firings, which would exhibit the aircraft's ability to conduct attacks against threat-representative, evasively maneuvering, seaborne targets from all weapon stations at tactical ranges.
  2. Develop a plan to allow safe shipboard storage of Block 3A AHWS kit components when not installed and in use on the aircraft.
  3. Determine aircraft carrier (CV(N)) shipboard compatibility of the MH-60S Armed Helicopter under operationally realistic conditions.
  4. Improve the APR-39A(V)2 Radar Warning Receiver effectiveness and consider increasing the number of ALE-47 Chaff/Flare dispensers.
• FY10 Recommendations. The Navy should:
  1. Develop and refine Link 16 employment tactics, techniques, and procedures to facilitate optimal employment of Link 16 functionality into MH-60S missions and verify results in future OT&E.
  2. Correct SUW deficiencies and verify correction through subsequent testing.
  3. Investigate and apply corrections to DALS deficiencies and verify corrections in future OT&E. Deficiencies include the inability to simultaneously receive Quickdraw situation reports and DALS location reports; the incompatibility of the CSEL AN/PRQ-7 hand-held radio with DALS; and electromagnetic interference from the DALS infrared searchlight that induces navigational bearing errors.
  4. Investigate and apply corrections to APX-118 Transponder aircraft track angle information disparity deficiency and verify corrections in future OT&E.

Mobile User Objective System (MUOS)

Executive Summary

- The Mobile User Objective System (MUOS) is making progress, but continues to experience schedule delays due to the technical complexity of the spacecraft, ground segment and user segment software, and programmatic interdependencies with the Joint Tactical Radio System (JTRS).
- MUOS is designed to support its primary mission to provide mobile users with beyond line-of-sight connectivity to the Global Information Grid (GIG). However, the design provides no capability for non-secure voice communications using the JTRS. The DoD Teleport program is being funded to provide the non-secure voice with JTRS capability.

System

- MUOS is a satellite-based communications network designed to provide worldwide, narrowband, beyond line-of-sight, point-to-point, and netted communication services to multi-Service organizations of fixed and mobile terminal users. MUOS is designed to provide 10 times the throughput capacity of the current narrowband satellite communications (SATCOM) system. MUOS is intended to provide increased levels of system availability over the current constellation of Ultra High Frequency (UHF) follow-on satellites, as well as improved availability for small, disadvantaged terminals.
- MUOS consists of six segments:
  - The space transport segment consists of four operational satellites and one on-orbit spare. Each satellite hosts two payloads: a legacy communications payload that mimics the capabilities of a single UHF follow-on satellite and a MUOS communications payload.
  - The ground transport segment is designed to manage MUOS communication services and allocation of radio resources.
  - The network management segment is designed to manage MUOS ground resources and allow for government controlled, precedence-based communication planning.
  - The ground infrastructure segment is designed to provide transport of both communications and command and control traffic between MUOS facilities and other communication facilities.
  - The satellite control segment consists of MUOS Telemetry, Tracking, and Commanding facilities at Naval Satellite Operations Center (NAVSOC) Headquarters, Point Mugu, California, and NAVSOC Detachment Delta, Shriever AFB, Colorado.
  - The user entry segment is intended to provide a software waveform application that can be ported to JTRS to communicate with the MUOS satellites. The JTRS program is responsible for developing and fielding MUOS-compatible terminals.

Mission

Combatant Commanders and U.S. military forces deployed worldwide will use the integrated MUOS SATCOM system to accomplish globally assigned operational and joint force component missions with increased operational space-based narrowband, beyond line-of-sight throughput, point-to-point, and netted communications services.

Major Contractor

Lockheed Martin Space Systems – Sunnyvale, California

Activity

- The MUOS program is making progress toward an FY11 launch; however, there are schedule delays due to spacecraft integration and Common Air Interface (CAI) waveform software complexity and integration challenges.
- The program manager conducted a Critical Design Review for the CAI waveform application software necessary for interfacing with the JTRS mobile terminal in February 2010.

- The program manager is installing the space control and ground infrastructure hardware in Hawaii, Virginia, Italy, and Australia.
- The Commander, Operational Test and Evaluation Force (COTF) participated in integrated testing in accordance with the DOT&E-approved operational assessment plan. The integrated test team executed an integrated developmental/operational test in November 2009. A second integrated test is scheduled for January 2011 that will lead to an Operational Assessment in early FY11.

Assessment

- Based upon COTF testing in FY10, MUOS is likely capable of completing its primary mission to provide mobile user beyond line-of-sight GIG connectivity, with the exception of non-secure voice communications with JTRS. The DoD Teleport program is being funded to provide the non-secure voice with JTRS capability.
- The delay of the launch of MUOS spacecraft beyond FY10 increases the risk of an UHF satellite communications gap as the earlier generation of operational UHF follow-on system satellites become unavailable for service.
- COTF cannot adequately test the MUOS capacity requirements in the MOT&E due to an insufficient number of JTRS-equipped mobile users. COTF will need to supplement MOT&E data with accredited modeling and simulation or other data to evaluate the system's ability to operate at its planned capacity and link availability levels.

Recommendations

- Status of Previous Recommendations. The Navy has made progress on one of two recommendations for FY09. The Navy does not have plans in place to operationally load the system to evaluate capacity during the MOT&E. Without a means to load the MUOS system, the evaluation of MUOS capacity will rely solely on modeling and simulation results.
- FY10 Recommendations. None.

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-IIIE integrated phase was accomplished from March 15, 2007 to July 10, 2009. The dedicated OT-IIIE 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

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 proprotor 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.

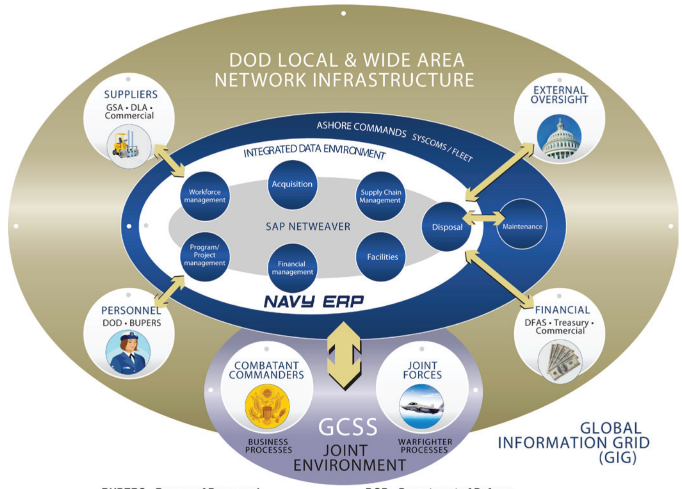
Navy Enterprise Resource Planning (ERP) Program

Executive Summary

- During FY10, Commander, Operational Test and Evaluation Force (COTF) participated in integrated developmental/operational testing of Navy Enterprise Resource Planning (ERP) Single Supply Solution Release 1.1. The testing was conducted with subject matter experts and users in a production-representative laboratory environment from November 2009 - January 2010. COTF conducted an independent operational assessment during the final week of testing in January 2010. A Naval Information Operations Command (NIOC) Blue Team concurrently conducted security and vulnerability testing.
- The areas of greatest concern during the integrated testing were interface performance and lack of accuracy and completeness of required system data. Identified system deficiencies could impact mission accomplishment in the areas of advanced planning, funds tracking, and supply support.
- COTF did not test reliability, availability, and maintainability (RAM), the Initial Source Processing Time Key Performance Parameter (KPP), and other capabilities during the operational assessment, but began testing of these capabilities in IOT&E from late September through early November 2010.

System

- Navy ERP is an integrated mission support hardware and software system providing financial transparency and total asset visibility across the Naval enterprise. Navy ERP uses a commercial off-the-shelf product, configured to integrate with Navy and DoD requirements, that unifies and streamlines mission support activities using a common data set, available in near real-time.
- The Navy ERP system is being incrementally implemented in two releases: (1) Financial and Acquisition Management and (2) the Single Supply Solution. The system will serve more than 66,000 users at more than 120 locations around the world. The Program Office has been tasked to investigate the requirements for implementing the system in an additional 14 Navy commands in future years.
- The Assistant Secretary of the Navy (Financial Management and Comptroller) approved Navy ERP on October 1, 2008 as the Financial System of Record for current users and "all future users of this system." The system will be used to manage more than one-half of the Navy's Total Obligation Authority.



BUPERS - Bureau of Personnel
DFAS - Defense Finance and Accounting Agency
DLA - Defense Logisitics Agency
DOD - Department of Defense
GCSS - Global Combat Support System
GSA - Government Services Administration

- The system supports the Navy's ability to produce auditable financial statements, enabling compliance with federal financial and security standards, the Chief Financial Officers Act of 1990, and the DoD Information Assurance Certification and Accreditation Process.

Mission

The Navy will utilize Navy ERP to:

- Implement an ERP business management system for the Navy to modernize and standardize financial, workforce, and supply chain management across the Naval Enterprise.
- Improve decision-making by the Navy's leadership, enabling more effective and efficient support of naval forces.

Major Contractors

- International Business Machines (IBM) – Bethesda, Maryland
- Deloitte – New York, New York

Activity

- COTF participated in integrated developmental/operational testing of Navy ERP Release 1.1 with selected users in a production-representative laboratory environment from November 2009 through January 2010.
- COTF also conducted an independent operational assessment, in accordance with the DOT&E-approved test plan, from January 25-28, 2010.
- A NIOC Blue Team concurrently conducted security and vulnerability testing from January 25-28, 2010.
- IOT&E began in late September 2010.

Assessment

- Users noted deficiencies in interface performance following the completion of 88 percent of approximately 2,800 attempted transactions.
- Seven of 44 required interfaces were not available or did not work. Navy ERP relies heavily on its interfaces with DoD and other Navy systems.
- The operational assessment revealed problems with data compatibility as well as inaccurate, incomplete, and missing data (including converted legacy data) across the planning, allowancing, repairables, procurement, and order fulfillment business areas. Navy ERP deficiencies that posed the most significant risk included:
  - The system did not capture appropriate changes for outbound delta files, causing outdated material master files and inaccurate interfaced data, impacting user's advanced planning activities.
  - The system experienced errors with the interfacing and processing of financial transactions, diminishing the user's ability to track funds and financial documents.
  - The system failed to consistently convert and process change notices for Navy and non-Navy items of supply, hindering user supply support activities.
- The Initial Source Processing Time KPP, RAM, expanded help desk operations, user training, and portions of change management require an operational environment for testing. Full functionality of Maritime Outfitting and Allowancing Processes was not available for the operational assessment. These capabilities began testing during IOT&E from late September through early November 2010.
- Testers did not note any major information assurance deficiencies. The system effectively integrates with the Navy-Marine Corps Intranet. ERP's technical infrastructure provides a sound platform for both current operations and further expansion.
- Continuity of operations capabilities met expectations with only minor difficulties.
- Based on the results of integrated developmental/operational testing and the operational assessment, the Milestone Decision Authority decided to "go live" with Release 1.1 at Naval Supply Systems Command (NAVSUP) in order to provide a venue for correcting known deficiencies, while identifying and correcting any other inadequacies prior to IOT&E and the Full Deployment Decision. IOT&E sites include NAVSUP Headquarters in Mechanicsburg, Pennsylvania; Naval Inventory Control Point, located in Mechanicsburg and Philadelphia, Pennsylvania; and Naval Air Weapons Station, China Lake, California.

Recommendations

- Status of Previous Recommendations. There were no recommendations for FY09.
- FY10 Recommendation.
  1. The Navy should correct identified deficiencies during the limited deployment at NAVSUP, and provide documentation of the corrections prior to entering IOT&E of Release 1.1.

Navy Multiband Terminal (NMT)

Executive Summary

- The Commander, Operational Test and Evaluation Force (COTF) conducted an operational assessment of the Navy Multiband Terminal (NMT from March 8 to April 6, 2010 in support of a Milestone C decision in July 2010. The operational assessment used NMT Engineering Development Models (EDMs) installed on USS *Roosevelt* (DDG 80), the Naval Computer and Telecommunications Area Master Station Atlantic (NCTAMS LANT), Norfolk, Virginia, and shore-based test facilities.
- The NMT Milestone C decision authorized the procurement of NMT systems necessary to: (1) establish the initial NMT production base for the system and (2) permit an orderly increase in the production rate for the system sufficient to lead to full-rate production upon the successful completion of IOT&E scheduled for July 2011.

System

- The NMT system is the next generation maritime military satellite communications terminal for the Navy and coalition partners for enhancing protected and survivable satellite communications (SATCOM).
- The NMT, a system-of-systems program, is an integral part of the Navy's joint SATCOM terminal suite. The NMT is interoperable with the legacy service SATCOM terminals, including the Follow-on Terminal (FoT) and Navy Extremely High Frequency Satellite Program (NESP).
- The NMT has variants for surface ships, submarines, and shore sites. The NMT system variants have two major component groups: the Communications Group and the Antenna Group.
- The Communications Group includes the following:
  - Operator User Interface
  - Power Distribution Unit
  - Keyboard
  - Extremely High Frequency (EHF) and Wideband drawers
  - Prime Power Interface
- The Antenna Group varies across different platforms and includes new, reused, and modified antennas to support the required Q-, Ka-, and X-band with Global Broadcasting System (GBS) receive operations.
- The key features of the NMT system are:
  - Open system architecture
  - Full compatibility with legacy terminal components
  - High commonality, reliability, and effective fault isolation
  - Mission Planning capability

Mission

The Navy uses the NMT to provide secure, protected, and survivable connectivity across the spectrum of mission areas, including land, air, and naval warfare; special operations; strategic nuclear operations; strategic defense; theater missile defense; and space operations and intelligence.

Major Contractor

Raytheon Net-Centric Systems – Marlboro, Massachusetts

Activity

- DOT&E approved Revision A to the NMT Test and Evaluation Master Plan (TEMP) on March 4, 2010.
- COTF conducted an operational assessment on the NMT from March 8 to April 6, 2010. All testing was conducted in accordance with a DOT&E-approved TEMP and test plan. The operational assessment used NMT Engineering Development Models (EDMs) installed on USS *Roosevelt* (DDG 80), the Naval Computer and Telecommunications Area Master Station Atlantic (NCTAMS LANT), Norfolk, Virginia, and shore-based test facilities.

- The operational assessment was conducted to inform a Milestone C and Low-Rate Initial Production (LRIP) decision in July 2010, which authorized the procurement of NMT systems necessary to: (1) establish the initial NMT production base for the system and (2) permit an orderly increase in the production rate for the system sufficient to lead to full-rate production upon the successful completion of IOT&E scheduled for July 2011. The Navy is updating the TEMP to provide greater detail on future test events in preparation for IOT&E to inform the full-rate production decision scheduled for FY12. The TEMP update will include a phase of integrated testing prior to IOT&E.
- Reliability growth testing is scheduled to begin in 2QFY11 at the contractor test lab. The program manager will use environmental chambers to replicate the stresses the terminal will experience in an operational environment.

Assessment

- The measured NMT reliability was significantly below threshold due to numerous software deficiencies and faults. However, the demonstrated operational availability exceeded the threshold requirement due to the short duration of many of the reliability failures. Raytheon Company has defined a reliability growth program, which is scheduled to be completed prior to the IOT&E.
- During the operational assessment, COTF reported an anomaly when NMT lost EHF communication on the DDG 80. The loss of communication occurred during ship maneuvers and resulted from a combination of antenna tracking issues, antenna hand-over problems, and improper antenna configuration settings. The root cause of this anomaly was an incorrectly installed software update to the NMT on the DDG 80.
- The NMT uses an interim process for communications planning that will later transition to the Advanced EHF (AEHF) Mission Planning Element (MPE) Increment 7. During the operational assessment, the NMT experienced one outage that lasted over 16 hours while the units waited for a new communications plan to be delivered. The timeliness of delivery of communication plans is an area of concern.
- The operational assessment did not include a submarine platform due to the lack availability to install a NMT EDM for the scheduled test period. Similarly, a NMT EDM was not installed on a large deck surface ship, which reduced the ability to assess risk factors related to surface ships leading into IOT&E.
- Additional risks, other than those observed during this operational assessment, may not become apparent until IOT&E and FOT&E when new terminal modes of operation, including Q-band XDR, Wideband Global SATCOM (WGS) (Ka-band and GBS receive), and Defense Satellite Communications System (DSCS) X-band will be tested. These modes of operation were not assessed during this operational assessment because they depend on new capabilities being delivered by the NMT, AEHF, and WGS programs on different timelines.
- The operational assessment testing on the USS *Roosevelt* (DDG 80) did not include a production-representative unit. The permanent installation of the NMT EDM on DDG 80 increases operational risk during deployment due to the many significant capabilities that have yet to be demonstrated during operational testing.

Recommendations

- Status of Previous Recommendations. This is the first annual report for this program.
- FY10 Recommendations. The Navy should:
  1. Update the software installation procedures and test the antenna handover function prior to deployment of the DDG 80.
  2. Update the interim communications planning process to reduce avoidable downtime prior to operational deployment of the NMT.

P-8A Poseidon

Executive Summary

- The Operational Assessment conducted to support the Milestone C decision in August 2010 identified 75 system shortfalls. The shortfalls identified during the Operational Assessment, if not addressed, pose a risk to the successful completion of the IOT&E scheduled to start in 2012.
- Flight testing, using the three test aircraft, began in 2010.

System

- The P-8A Poseidon is the Navy's next generation maritime patrol aircraft that will replace the P-3C.
- The P-8A is based on the Boeing 737-800 aircraft, but uses the 737-900 extended-range wing.
- It is intended to carry and employ anti-ship missiles, air-to-surface weapons, torpedoes, sonobuoys, and other expendables.
- The P-8A onboard sensors include acoustics, radar, missile warning system (MWS), and electro-optic sensors.
- Survivability enhancement and vulnerability reduction features are incorporated into the P-8A design.
  - Susceptibility is reduced with an integrated Aircraft Survivability Equipment suite that consists of a radar warning receiver, chaff/flare dispenser, MWS, directed infrared countermeasures, and an Electronic Warfare Management Unit to control the system. Radio frequency countermeasures are planned for spiral development with installation provisions (including wiring and mounting pylons) incorporated into all production aircraft.
  - Vulnerability is reduced through the addition of fuel tank inerting systems and fire protection systems for the vulnerable dry bays that surround aircraft fuel tanks.

Mission

Units equipped with the P-8 will perform a wide range of patrol missions, including:

- Armed anti-submarine warfare
- Armed anti-surface warfare
- Intelligence collection, processing, evaluation, and dissemination to Naval and Joint forces
- Maritime and littoral reconnaissance

Major Contractor

Boeing Defense, Space, and Security – St. Louis, Missouri

Activity

- The Navy conducted an Operational Assessment between September 25 and October 9, 2009 in the P-8A Weapons System Integration Lab (WSIL), located at the Boeing facilities in Kent, Washington. The objective of the Operational Assessment was to test the sensors, computer workstations, computer processing algorithms, and other mission equipment that are being integrated into the P-8A aircraft in a laboratory environment. The Navy conducted a total of 67.5 test hours during 26 simulated missions.
- There are two non-flying developmental test aircraft: S-1 and S-2.
  - The prime contractor conducted structural testing on the S-1 (static test) aircraft throughout 2010 to support airworthiness flight testing. As of the Milestone C decision in August 2010, 74 percent of the planned structural testing was completed. The static testing is expected to be completed in March 2011. The S-1 aircraft will be used for Live Fire testing upon completion of OT structural testing.
  - The Navy placed fatigue testing on the S-2 aircraft on hold in October 2009 due to funding shortfalls. This testing is expected to begin in July 2011.
- There are three flight test aircraft: T-1, T-2, and T-3.
  - The T-1 test aircraft is used for airworthiness testing; it is heavily instrumented, but does not have the mission systems (e.g. sensors) integrated onboard the aircraft. Flight testing of T-1 began in October 2009 and continued in 2010. As of September 20, 2010, the integrated test team conducted 31 test flights (104 flight test hours).
  - The T-2 test aircraft has the full mission equipment (e.g., sensors, onboard computers, aircrew workstations)

integrated onboard. Flight testing of T-2 began in June 2010. As of September 20, 2010, the integrated test team conducted 14 test flights (50.6 flight test hours) on T-2.
  - The T-3 test aircraft has the full mission equipment onboard. The instrumentation onboard the test aircraft includes a number of cameras to monitor the separation of weapons and sonobuoys launched from the aircraft. Flight testing of T-3 began in July 2010. As of September 20, 2010, the integrated test team conducted five test flights (16.2 flight test hours) on T-3.
- DOT&E approved the Test and Evaluation Master Plan (TEMP) to support the Milestone C decision in August 2010. The TEMP includes a plan under which the Navy will collect data during fleet and naval exercises on the legacy P-3 aircraft to compare its performance to the P-8A.
- The Navy's operational test force started collecting operational data from the currently fielded P-3 fleet to support comparison testing with the P-8A. The test force collected operational data on the P-3s flying during the Rim of the Pacific naval exercise in July 2010.
- The Navy is tracking system deficiencies and problems discovered during the Operational Assessment, as well as flight, ground, and laboratory testing. The P-8A Combined Reliability Board regularly reviews reliability data.
- There is potential for buffet loads on the P-8A's horizontal tail section to exceed the designed load limits during heavy weight, high angle-of-bank flight profiles. The Navy conducted simulated operational scenarios in the WSIL in August 2010 to determine the operational impacts of flying at reduced angles-of-bank to mitigate the loads on the tail section. The prime contractor is exploring design modifications to strengthen the horizontal tail section.
- Live Fire ballistic testing showed the horizontal tail's pitch control vulnerability.

Assessment

- The Operational Assessment identified 75 system shortfalls in a laboratory environment before test aircraft were available for flight testing. The shortfalls included aspect areas of track management, acoustics, sonobuoy and weapons deployment, flight planning, and interoperability with onboard sensors. Thirty of the 75 deficiencies degraded mission performance, had no operator workaround, and had no corrective program in place to fix deficiencies. The shortfalls identified during the Operational Assessment, if not addressed, pose a risk to a successful IOT&E.
- Initial flight testing on the T-2 test aircraft suggests that the systems integration evaluated in the laboratory environment during the Operational Assessment provided an accurate representation of actual aircraft mission system functionality. System performance, including system deficiencies and system improvements, observed during flight test closely matched what was observed during the Operational Assessment conducted in the laboratory.
- The plan was to complete 77 test flights prior to Milestone C per the March 2007 DOT&E-approved TEMP. Approximately 35 test flights were completed prior to Milestone C. Delays in the flight test program can be attributed to delays in the delivery of architectural design drawings, the building of the test aircraft, structural testing on the S-1 static test aircraft, and instrumentation problems.
- Although reliability is being tracked, the sample size (i.e., number of test hours) is still too small to fully assess whether the P-8A will meet its reliability, maintainability, and sustainment requirements.
- The horizontal tail pitch control is vulnerable to the armor piercing incendiary (API) threats tested. The larger API threat severed the horizontal tail pitch control, resulting in loss of aircraft flight control. However, the jackscrew's cross-sectional area is small and it is surrounded by internal components that provide shielding against threats, thus its susceptibility to threats is small.

Recommendations

- Status of Previous Recommendations. The Navy is satisfactorily addressing previous recommendations.
- FY10 Recommendation.
  1. The Navy should fix the system shortfalls discovered during the Operational Assessment, specifically those that degrade the mission, have no operator workaround, and have no current corrective plan in place, in order to reduce the risk of an unsuccessful IOT&E.

Ship Self-Defense

Executive Summary

- The ship self-defense mission for aircraft carriers and amphibious warfare ships coordinates several legacy shipboard systems, as well as four major acquisition programs: Ship Self-Defense System (SSDS), Rolling Airframe Missile (RAM), Evolved SeaSparrow Missile (ESSM), and Cooperative Engagement Capability (CEC). These comprise a self-defense capability for in-service ships as well as the LPD 17, LHA 6, and CVN 78 ship classes still in acquisition.
- While the integration of sensor and weapon systems with the command and decision system enhances the ships' self-defense capability over non-integrated combat systems, the ability to effectively complete the self-defense mission against the types of threats for which the overall system was designed has not been successfully demonstrated. In addition, reliability problems further degrade the ships' ability to complete this mission.
- The Navy must complete the currently planned operational test program and conduct additional operational testing to demonstrate the correction of significant deficiencies with SSDS Mark 2, RAM, ESSM, CEC, and legacy ship self-defense combat system elements.

System

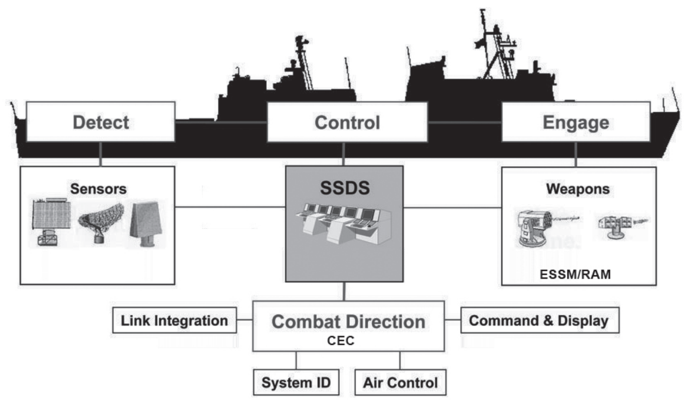
- The ship self-defense mission area is addressed by several legacy combat system elements (ship class-dependent) and four major acquisition programs: SSDS, RAM, ESSM, and CEC.

SSDS

- SSDS is a local area network that uses open computer architecture and standard Navy displays to integrate a surface ship's sensors and weapon systems to provide an automated detect track-engage sequence for ship self defense. SSDS Mark 1 is the command and control system for LSD 41/49 class ships.
- SSDS Mark 2 has six variants:
  - Mod 1, used in CVN 68 class aircraft carriers
  - Mod 2, used in LPD 17 class amphibious ships
  - Mod 3, used in LHD 1 class amphibious ships
  - Mod 4, in development for LHA 6 class amphibious ships
  - Mod 5, in development for LSD 41/49 class amphibious ships
  - Mod 6, in development for CVN 78 class aircraft carriers

RAM

- The RAM, jointly developed by the United States and the Federal Republic of Germany, provides a short-range, lightweight, self-defense system to defeat anti-ship cruise missiles (ASCMs). RAM is currently installed in all aircraft carriers and amphibious ships (except LPD 4 class).



CEC - Cooperative Engagement Capability
ESSM - Evolved Sea Sparrow Missile
ID - Identification
RAM - Rolling Airframe Missile

- There are four RAM variants:
  - RAM Block 0 uses dual mode, passive radio frequency/infrared guidance.
  - RAM Block 1 adds infrared guidance improvements to extend defense against non-radio frequency radiating ASCMs.
  - RAM Block 1A extends the capability of RAM Block 1 against non-ASCM targets, including helicopters, slow aircraft, and surface (HAS) threats.
  - RAM Block 2 is in development and will extend the capability of RAM Block 1A against newer classes of ASCM threats.

ESSM

- The ESSM, cooperatively developed among 13 nations, is a medium-range, ship-launched self-defense guided missile designed to defeat ASCMs. The ESSM is currently installed on DDG 51 Flight IIA Destroyers and on CVN 68 class aircraft carriers equipped with the SSDS Mark 2 Mod 1 Combat System. The Navy is planning for future ESSM installations in CG 47 Class Cruisers, LHA 6 Class Amphibious Assault Ships, and the DDG 1000 Class Destroyers.

CEC

- CEC is a sensor network with integrated fire control capability that is intended to significantly improve battle force air and missile defense capabilities by combining data from multiple battle force air search sensors on CEC-equipped units into a single, real-time, composite track picture. The two major hardware pieces are the Cooperative Engagement Processor (CEP), which collects and fuses radar data and the Data Distribution System, which exchanges the CEP data. CEC is an integrated component of, and serves as the primary air tracker for SSDS Mark 2-equipped ships.

- There are four major variants of CEC:
  - The CEC USG-2 is used in selected Aegis cruisers and destroyers, LPD 17/LHD amphibious ships, and CVN 68 class aircraft carriers.
  - The CEC USG-2A, an improved version of the USG-2, is used in selected Aegis cruisers and destroyers.
  - The CEC USG-3 is used in the E-2C Hawkeye 2000 aircraft.
  - The CEC USG-3B is in development for use in the E-2D Advanced Hawkeye aircraft.

Mission

Naval surface forces use SSDS, RAM, ESSM, and CEC as well as many legacy systems to provide faster, more effective accomplishment of ship self-defense missions.

- Naval surface forces use SSDS to provide automated and integrated detect-to-engage ship self-defense capability against ASCM, air, and surface threats.
- Naval surface forces use RAM to provide a short-range hard kill engagement capability against ASCM threats.
- Naval surface forces use ESSM to provide a medium-range hard kill engagement capability against ASCM, surface, and low velocity air threats.
- Naval surface forces use CEC to provide accurate air and surface threat tracking data to SSDS.

Major Contractors

- SSDS: Raytheon – San Diego, California
- RAM: Raytheon – Tucson, Arizona
- ESSM: Raytheon – Tucson, Arizona
- CEC: Raytheon – St. Petersburg, Florida

Activity

- The Commander, Operational Test and Evaluation Force (COTF) conducted operational testing of the ship self-defense mission during FOT&E of the SSDS Mark 2 Mod 2 on the Self-Defense Test Ship (SDTS) in conjunction with the IOT&E of the LPD 17 class ship in December 2009.
- COTF completed an operational test of the ship self-defense mission during FOT&E of the SSDS Mark 2 Mod 3 on USS *Makin Island* (LHD 8) in February 2010.
- COTF continued to operationally test the ship self-defense mission during FOT&E of the SSDS Mark 2 Mod 1 and ESSM on USS *Carl Vinson* (CVN 70) in July 2010. Testing is scheduled to continue in July 2011.
- COTF conducted all testing in accordance with DOT&E-approved test plans.

Assessment

- Ship self-defense mission area assessments are:
  - The completed operational testing on the SDTS indicates that the LPD-17 class combat system continues to have difficulty defeating certain ASCM raid types. Specifically, one of the legacy combat system elements, the AN/SPQ-9B Radar, had limited capability against the threat surrogates used in those raid types.
  - The completed operational testing on LHD 8 indicates that some elements of the ship class combat system continue to have reliability problems. In addition, the LHD 8 combat system had difficulty engaging certain classes of asymmetric threats.
  - The completed operational testing on CVN 70 revealed several problems with the ship's combat system's ability to successfully complete the ship self-defense mission. Specific problems included deficiencies in weapon employment timelines, sensor coverage, and system track management. COTF also discovered deficiencies with North Atlantic Treaty Organization (NATO) SeaSparrow Missile System performance and with the recommended engagement tactics provided for use against multiple ASCM threat classes.
  - Due to the similarities between the CVN 70 and LHD 8 ship self-defense combat system elements and software commonality, most of the problems observed during FY10 and prior operational tests are applicable to all CVN 68, LHD 1, and LPD-17 ship class combat systems.
- Program specific assessments are:
  - SSDS Mark 2 performance has improved; however, significant deficiencies remain with weapon employment timelines, training, and software reliability. While the FY09 Annual Report stated that SSDS Mark 2 software reliability was improved, new data collection systems/techniques uncovered new software reliability failures that were previously undocumented.
  - RAM performance against stream raids of supersonic sea-skimming ASCMs remains undetermined.
  - ESSM in-flight reliability as well as performance against supersonic high-diving ASCMs, stream raids of supersonic, sea-skimming maneuvering ASCMs, raids of several simultaneous subsonic ASCMs, low velocity air threats, and maneuvering surface craft remains undetermined. Additionally, ESSM performance in the presence of electronic jamming remains undetermined.
  - CEC performance shows continued deficiencies in tracking certain ASCM threats in support of the ship self-defense mission.

Recommendations

- Status of Previous Recommendations. The Navy has not resolved the following previous recommendations:
  1. Optimize SSDS Mark 2 weapon employment timelines to maximize weapon probability of kill.
  2. Ensure development and procurement of a threat representative anti-ship ballistic missile target to support demonstration of CVN 78 ship self-defense capability against this threat during operational testing.
  3. Update the CEC Test and Evaluation Master Plan (TEMP) to include details of FOT&E testing with the Joint Lightweight Elevated Sensor System and the Navy Integrated Fire Control-Counter Air capability.
  4. Acquire range-safe supersonic sea-skimming ASCM surrogate targets for ESSM FOT&E with the Aegis Combat System.
  5. Ensure availability of a credible open-loop seeker subsonic ASCM surrogate target for ship self-defense combat system operational tests.
  6. Correct the identified SSDS Mark 2 software reliability deficiencies.
  7. Correct the identified SSDS Mark 2 training deficiencies.
  8. Develop and field deferred SSDS Mark 2 interfaces to the Global Command and Control System-Maritime and the TPX-42A(V) command and control systems.
- FY10 Recommendations. The Navy should:
  1. Demonstrate through operational testing the correction of identified problems with CVN, LHD 1, and LPD-17 ship class self-defense combat systems, supporting the deployment schedule of those ships.
  2. Ensure adequate funding is available to complete all Navy-approved plans for FY11 ship self-defense operational testing.
  3. Ensure required ESSM and RAM missile assets are available for all planned FY11 ship self-defense operational testing.
  4. Continue to implement the Program Executive Office for Integrated Warfare Systems' plan for more robust, end-to-end systems engineering and associated developmental/operational testing of ship self-defense combat systems.
  5. Update the SSDS TEMP to show FOT&E test details of the SSDS Mark 2 Mod 4, Mod 5, and Mod 6 variants.
  6. Update the RAM Block 2 TEMP to show details of the RAM Block 2 IOT&E in addition to details of testing against stream raids of supersonic sea-skimming ASCMs.
  7. Update the ESSM TEMP to show details of the ESSM/Aegis modernization testing and information assurance testing. In addition, the TEMP update should include details of tests against supersonic high-diving ASCMs, stream raids of supersonic, sea-skimming maneuvering ASCMs, raids of several simultaneous subsonic ASCMs, low velocity air threats, and maneuvering surface craft.
  8. Provide a capability to launch a raid of four supersonic sea-skimming targets at the Naval Air Warfare Center/Weapons Division, Point Mugu, California, test range to support TEMP-approved Air Warfare/Ship Self-Defense Enterprise testing planned for FY14.

SSN 774 *Virginia* Class Submarine

Executive Summary

- The Milestone III Defense Acquisition Board met and awarded the program a Full-Rate Production Decision in September 2010.
- *Virginia* is an effective, suitable, and survivable replacement for the *Los Angeles* submarine, with improvements in acoustic and electromagnetic covertness.
- With the completion of IOT&E, assessment of the *Virginia* class has shifted to the following areas: modernization of the *Virginia* class submarine's Non-Propulsion Electronics Systems (NPES), verification of the correction of deficiencies discovered during IOT&E, and completion of operational testing not conducted in IOT&E. The Navy began revising the Test and Evaluation Master Plan (TEMP) to address the outstanding test requirements as well as future testing of the Block III redesign of the *Virginia* class.
- Operational and Live Fire testing demonstrated that the *Virginia* class submarine is survivable in most expected threat environments.

System

- The *Virginia* class submarine is the replacement for the aging fleet of *Los Angeles* class submarines. The *Virginia* class:
  - Is designed to be capable of targeting, controlling, and launching Mk 48 Advanced Capability torpedoes, Tomahawk cruise missiles, and future mines.
  - Is designed to have sonar capability similar to the *Seawolf* submarine class with improvements to the electronic support suite and combat control systems.
  - Has a new-design propulsion plant incorporating components from previous submarine classes.
  - Uses a modular design and significant commercial off-the-shelf computer technologies and hardware intended to allow for rapid and cost-effective technology refresh cycles.
- The *Virginia* class submarines are being procured and incrementally upgraded in a series of blocks. Each block is procured with a multi-year contract; however, not each block will incorporate a major design change.
  - Block I (hulls 1-4) and Block II (hulls 5-10) ships incorporated the initial design of the *Virginia* class
  - Block III (hulls 11-18) ships will include the following affordability enhancements:
    - A Large Aperture Bow array will replace the spherical array in the front of the ship.
    - Two *Virginia* Payload Tubes will replace the 12 vertical launch tubes. Each *Virginia* Payload Tube is capable of storing and launching six Tomahawk Land Attack Missiles used in strike warfare.
  - The design for Block IV and beyond ships has not been finalized.

Mission

The Operational Commander will employ the *Virginia* class submarine to conduct open-ocean and littoral covert operations in support of the following submarine mission areas:

- Strike warfare (STW)
- Anti-Submarine Warfare (ASW)
- Intelligence, Surveillance, and Reconnaissance (ISR); Indications and Warnings (I&W); and Electronic Warfare (EW)
- Anti-Surface Ship Warfare (ASUW)
- Naval Special Warfare (NSW)
- Mine warfare (MIW)
- Battle Group Operations (BGO)

Major Contractors

- General Dynamics Electric Boat – Groton, Connecticut
- Northrop Grumman Shipbuilding Newport News – Newport News, Virginia

Activity

- DOT&E issued a Beyond Low-Rate Initial Production (BLRIP) report in November 2009. This report was classified and included a limited distribution version to comply with the Navy's special security rules for submarine data.
- DOT&E approved the *Virginia* TEMP Revision F in November 2009 to include FOT&E. The first FOT&E event of the *Virginia* class occurred in September 2010 and examined the submarine's susceptibility to low-frequency active sonar. Analysis of this event is expected to begin in November 2010.
- The Under Secretary of Defense for Acquisition, Technology and Logistics (USD (AT&L)) approved full-rate production in September 2010. Per the Acquisition Decision Memorandum, the Navy must submit a revised TEMP by March 2011 that includes plans to test deferred capabilities, verify correction of major deficiencies found during IOT&E, and planned upgrades.
- The Navy began planning the comprehensive testing to occur in FY11 required for modernization of *Virginia*'s NPES. This testing will be combined with the operational testing of the Acoustic Rapid Commercial Off-the-Shelf (COTS) Insertion (A-RCI) Sonar System, the AN/BYG-1 fire control system, and the Mk 48 Advanced Capability Torpedo. Developmental testing of these systems began in 4QFY10.
- Because Navy security rules prohibit *Virginia* conducting exercises with foreign diesel-electric submarines (SSKs), the Navy finished IOT&E without testing the *Virginia* class submarine against this primary threat of record. The Navy began investigating alternative testing strategies against the SSK threat of record.
- The Navy completed shock qualification of over 99 percent of the baseline *Virginia* class components. The Block III design will require a shock test series for the *Virginia* class Payload Tube hatch. The test series is scheduled for spring 2012 in support of the first Block III delivery in August 2014.

Assessment

- DOT&E's classified BLRIP report on *Virginia*'s performance concluded the following:
  - *Virginia* is an effective, suitable, and survivable replacement for the *Los Angeles* submarine, with improvements in acoustic and electromagnetic covertness.
  - *Virginia*'s operational effectiveness is dependent on the mission conducted. *Virginia* is effective for conducting Strike Operations, minefield avoidance operations, Battle Group Support, and Anti-Surface Ship Warfare attack (in most scenarios).
  - *Virginia* is effective for conducting ASW against some submarines, but is not effective in some environments or against most quiet threats of record. It is not clear that any passive sonar system using existing or planned technology could be effective in all environments or against quiet threats.
  - *Virginia* is effective for conducting some limited ISR missions depending on the intelligence collection requirements; however, additional testing is required.
  - *Virginia* was not fully evaluated for the Naval Special Warfare mission, but has the potential to use the installed Lock-Out Trunk for Special Operations Force operations once the Navy certifies *Virginia* for diver oxygen recompression and storage of Special Warfare equipment and ordinance. Further testing is required to evaluate *Virginia*'s capability with a Dry-Deck Shelter.
  - *Virginia* is operationally suitable. However, the reliability of several key engineering plant components, NPES equipment, Government Furnished Equipment, and the Photonics Mast need improvement.
  - Operational and Live Fire testing demonstrated that the *Virginia* class submarine is survivable in most expected threat environments. Details of the survivability assessment are classified and contained in the BLRIP report.
- The Navy has achieved some testing efficiencies by combining operational testing of several programs into consolidated test events.
- With the completion of IOT&E, assessment of the *Virginia* class has shifted to the following areas:
  - Modernization of the *Virginia* class submarine's NPES. These changes to the class require testing to assess the effects of the combat system upgrades on ASW, ASUW, STW, Mine Avoidance, and Information Assurance capabilities.
  - Verification of the correction of deficiencies discovered in IOT&E. The Navy expects to correct and retest many of the deficient areas in the upcoming modernization FOT&E period. Other efforts to retest deficient performance are under discussion and the Navy is tracking each issue identified by the Commander, Operational Test and Evaluation Force (COTF) and DOT&E from their respective IOT&E reports.
  - Operational testing not completed during IOT&E. *Virginia*'s IOT&E did not include testing of ASW capabilities in the Arctic environment (planned for 2QFY11), susceptibility to Low-Frequency Active sonar systems (completed in 4QFY10), special operations forces deployment from a Dry-Deck Shelter (planned for FY13), and ASW capabilities against diesel-electric submarines (unknown completion date).
- *Virginia*'s mission performance is significantly dependent on supporting acquisition programs that make up the *Virginia* combat and weapons systems. The performance requirements or demonstrated performance of some NPES components do not support meeting *Virginia*'s requirements. The A-RCI Sonar AN/BQQ-10, the TB-29 series towed array, the AN/BLQ-10 Electronics Support Measures and the Mk 48 Advanced Capability torpedo are examples of systems with known performance limitations or reliability problems that affected *Virginia*'s performance during IOT&E.

Recommendations

- Status of Previous Recommendations. The Navy has made progress in addressing 12 of the 33 recommendations contained in the November 2009 classified BLRIP report. Nine of the outstanding recommendations are classified. Of the remaining 12 unclassified comments, the key recommendations are:
  1. Complete the component shock qualification program.
  2. Test against an SSK threat surrogate in order to evaluate *Virginia*'s capability, detectability, and survivability against modern diesel-electric submarines.
  3. Conduct ASW-search testing to assess *Virginia*'s capability with other towed arrays (i.e., TB-16 and TB-23).
  4. Complete ASUW testing and investigate alternatives to the Atlantic Undersea Test Evaluation Center (AUTEC) for ASW and ASUW testing.
  5. Conduct follow-on mine avoidance training and testing in areas of mixed mine types (bottom and volume mine surrogates) using realistic tactics and realistic mine employment (near-surface).
  6. Measure the ISR-intercept metrics with a deployment-outfitted *Virginia* class submarine and with realistic threat signals.
- FY10 Recommendation. The Navy should:
  1. Begin developing the shock test series for the *Virginia* class Payload Tube hatch.

STANDARD Missile 6 (SM-6)

Executive Summary

- The STANDARD Missile 6 (SM-6) program is in low-rate initial production.
- The SM-6 OT&E commenced in May 2010, but was suspended to investigate two failures. During five attempted missions, initial analysis indicates one mission was successful, one was not completed due to a target failure, one was a missile software-to-ship integration failure, and two were missile fuze software failures. Two postponed missions, as well as re-attempts for the failed missions, remain to be executed prior to IOT&E.
- The Navy completed failure analysis and determined the corrective action needed to address the failures. Re-testing to verify the corrective actions is planned for January 2011.
- The failures and resulting delays have exhausted the margins that existed in the SM-6 schedule.

System

- SM-6 is the latest evolution of the STANDARD Missile family of fleet air defense missiles that incorporates components from two existing Raytheon product lines: the SM-2 Block IV and the Advanced Medium-Range Air-to-Air Missile (AMRAAM).
- SM-6 is employed from cruisers and destroyers equipped with Aegis combat systems.
- The SM-6 seeker and terminal guidance electronics derive from technology developed in the AMRAAM. SM-6 retains the legacy STANDARD Missile semi-active radar homing capability.
- SM-6 receives midcourse flight control from the Aegis combat system; terminal flight control is autonomous via the missile's active seeker or supported by the ship's radar.

Mission

- The Joint Force Commander/Strike Group Commander will use SM-6 for fleet air defense against fixed/rotary winged targets and anti-ship missiles operating at altitudes ranging from very high to sea-skimming.
- The Joint Force Commander will use SM-6 as part of the Naval Integrated Fire Control – Counter Air (NIFC-CA) concept to provide extended range, over-the-horizon capability against at-sea and overland threats.

Major Contractor

Raytheon Missile Systems – Tucson, Arizona

Activity

- In FY10, the Navy completed land-based developmental testing at White Sands Missile Range, New Mexico. The final mission, Guidance Test Vehicle-3 was an SM-6 engaging a BQM-74E target with electronic countermeasures. Guidance Test Vehicle-1 and Guidance Test Vehicle-2 were successfully flown in FY08; the Advanced Area Defense Interceptor mission was successfully flown in FY09. Guidance Test Vehicle-3 was successfully flown on January 11, 2010, meeting its test objectives after target countermeasure equipment failures prevented the first firing attempt on December 2, 2009.
- DOT&E approved the developmental/operational test plan in April 2010.
- In May 2010, the Navy began at-sea Developmental Testing/Operational Testing (DT/OT) and live fire testing at the Pacific Missile Range Facility, Kauai, Hawaii. Subsequent failures during DT/OT led to suspension of the test series. During five attempted missions, one mission was successful, one was not completed due to a target failure, one was a missile software-to-ship integration failure, and two were missile fuze failures. Two missions remain to be executed. Details of each test in the order they were executed is as follows:
  - DT-5/OT-3. SM-6 successfully engaged a QUH-1 helicopter target at low altitude.
  - DT-3. On the first attempt for this mission, the target presentation, a BQM-74E target with electronic countermeasures, was unsuccessful. This target failure was unrelated to the December 2009 target failure. This mission is being rescheduled.

- Alternate-1. During the mission, the SM-6 failed to guide to the BQM-74E target.
- DT-3 (second attempt). SM-6 engaged and directly impacted an electronic countermeasures equipped BQM-74E target; however, the missile fuze failed to function properly.
- DT-1/OT-1. SM-6 engaged a supersonic, high altitude AQM-37 target. Although the SM-6 successfully guided to the target, the missile fuze again failed to function properly. Remaining flight testing was suspended following this mission. As an additional test objective, the DT-1/OT-1 mission successfully demonstrated the compatibility of SM-6 and SM-2 (three SM-2s and one SM-6 fired from two ships) in a mass raid environment.

• Upon suspension of flight testing, two failure review boards were formed to determine the cause of the failures and to identify corrective actions. These boards have completed their investigations. The Alternate-1 mission failure was attributed to errors in missile software-to-ship integration, which have been corrected via changes to SM-6 software. The DT-1/OT-1 and DT-3 missile fuze failures were caused by a fuze software design error that has been corrected in a subsequent fuze software build. This fuze software build will be installed in the remaining SM-6 flight test rounds and tested in the January 2011 DT/OT test period and the July 2011 IOT&E.
• The two postponed developmental/operational test missions and the re-fly of the failed missions are planned for January 2011.
• IOT&E is planned for July 2011 at the Pacific Missile Range Facility, Kauai, Hawaii.

Assessment

• The suspension of developmental/operational testing exhausted the schedule margins that existed in the SM-6 schedule. The planned full-rate production decision in 4QFY11 will not be met if further deficiencies are uncovered during the remaining test program. Additional discoveries are possible given the number of significant areas still requiring further testing and evaluation (i.e. electronic countermeasures; long-range engagements; warhead lethality; and testing against a threat-representative set of anti-ship cruise missiles, unmanned air vehicles, and full-scale aircraft).
• The lack of a reliability growth program makes rigorous estimation of missile reliability difficult. SM-6 has functioned successfully in five of eight completed intercept attempts to date. The developmental/operational test failures were previously unknown failure modes. SM-6 reliability will be assessed upon completion of IOT&E.
• The Navy does not have a clear test strategy for SM-6 in the NIFC-CA role. Testing of the SM-6/NIFC-CA capability will not occur until after the SM-6 full-rate production decision. Also required for the NIFC-CA capability is the Aegis Advanced Capability Build-12 and E-2D program; neither will be delivered until after 2012.
• Testing of SM-6 against one specific, fielded anti-ship cruise missile threat will not occur until after the full-rate production decision because the Navy will not complete development of the threat surrogate in time to support the SM-6 IOT&E.

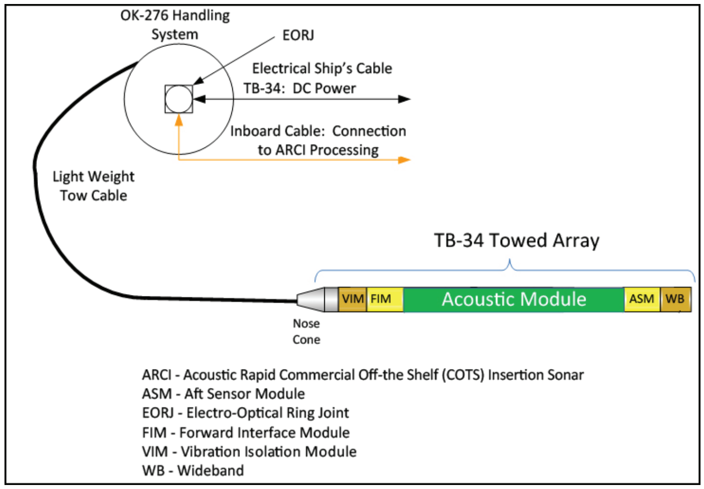
Recommendations

• Status of FY09 Recommendations. The Navy successfully addressed the FY09 recommendations.
• FY10 Recommendations.
  1. The Navy should develop a test strategy for the SM-6 in the NIFC-CA role to determine funding and resource needs.
  2. To address the existing gap in the fleet's ability to defend itself against fielded anti-ship cruise missiles, the Navy should accelerate testing against the full anti-ship cruise missile threat set.

TB-34 Towed Array

Executive Summary
- The Navy completed operational testing of the TB-34 towed array in accordance with the DOT&E-approved test plan in January 2010 and DOT&E issued a classified Beyond Low-Rate Initial Production (BLRIP) report on the test results in November 2010.
- The TB-34 towed array meets the technical and performance requirements and is an acceptable and operationally suitable replacement for the TB-16 legacy array. The TB-34 towed array provides enhancements to the towing and self-noise characteristics compared to the TB-16.
- Future testing will be needed to determine if the TB-34 towed array's full capability, once implemented with new processing software, provides the anticipated performance improvements.

System
- The TB-34 towed array is one of several acoustic sensors that provide data to the Acoustic Rapid Commercial Off-the-Shelf Insertion (A-RCI) sonar system installed on U.S. submarines.
- A-RCI provides the computer processing and displays necessary for the TB-34 towed array to provide acoustic information to sonar operators. This array, along with the spherical array, hull array, wide aperture array, and high frequency array, enables submarines to conduct a variety of missions.
- The TB-34 towed array is intended to replace the legacy TB-16 tactical towed array, and provides additional hydrophones for future capability in passive sonar processing. The array is intended to provide improved capability for Anti-Submarine Warfare and contact avoidance in cluttered littoral environments as well as maintain the U.S. Submarine Force's Ready for Issue fat-line towed array inventory.



Mission
Submarine crews equipped with a TB-34 towed array should be able to complete the following submarine force missions:
- Covertly search, detect, track, and attack submarine and surface vessels in open-ocean and littoral sea environments
- Covertly conduct Intelligence, Surveillance, and Reconnaissance
- Covertly search and select appropriate locations to conduct other submarine missions (e.g., Strike Warfare, Naval Special Warfare, and Mine Warfare)

Major Contractor
Chesapeake Sciences Corporation – Millersville, Maryland

Activity
- The Navy completed operational testing of the TB-34 towed array in January 2010 in accordance with a DOT&E-approved test plan. Additional testing and data collection occurred during the deployment of the host submarine in early 2010.
- The Navy's Operational Test Agency, Commander, Operational Test and Evaluation Force (COTF), issued his report in April 2010. DOT&E delayed the release of a BLRIP report until operational data from the host submarine's deployment were received and analyzed.
- The TB-34 towed array testing was conducted in conjunction with the operational testing of A-RCI Advanced Processor Build 2007 (APB-07) and the APB-07 version of the AN/BYG-1 fire control system. DOT&E did not approve a Test and Evaluation Master Plan (TEMP) for the TB-34 towed array, but did approve TEMPs for the A-RCI and BYG-1 APB-07 programs in 2009, which included TB-34 towed array testing.
- DOT&E issued a classified BLRIP report on the test results in November 2010.

Assessment
- The Navy completed all planned operational testing of the TB-34 towed array.
- The DOT&E classified BLRIP report on TB-34 performance concluded the following:
  - The TB-34 towed array meets the technical and performance requirements and is an acceptable and operationally suitable replacement for the TB-16 legacy array.

- The TB-34 towed array provides enhancements in regards to towing and self-noise characteristics. DOT&E considers the TB-34 towed array a useful tool in U.S. submarines' sonar suites that contributes to providing safety-of-ship and situational awareness during submerged operations.
- In addition to the requirement of the TB-34 towed array's performance to be equivalent to the TB-16 legacy array, all other requirements were technical in nature and were successfully demonstrated during developmental testing. Operational testing provided information to assess mission performance in an operational environment against actual submarine and surface targets.
- The Navy conducted adequate in-water operational testing to provide a baseline comparison of the TB-34 towed array to the legacy TB-16 towed array. Additional testing will be required when the Navy introduces software processing to take advantage of the TB-34 towed array's full capability. This upgrade is currently planned for the APB-11 version of A-RCI.
- There were indications from the test data that the TB-34 towed array with the current processing software may exhibit a slight degradation in performance in comparison to the legacy TB-16 array. However this effect did not generally degrade operational performance for a well-trained crew.
- The Navy discovered during operational testing that the first TB-34 array exhibited a noisy channel problem due to a hardware design flaw. Additional testing and analysis will be needed to validate the effectiveness of the Navy's planned fixes.

• The Navy has achieved some testing efficiencies by combining operational testing of several programs into consolidated test events. Since testing is interdependent, the consolidation of A-RCI, TB-33, TB-34, and AN/BYG-1 TEMPs into an Undersea Enterprise Capstone document would increase testing efficiency and enable a full end-to-end evaluation of submarine capability in the applicable mission areas.

Recommendations

• Status of Previous Recommendations. This is the first annual report for this program.
• FY10 Recommendations. The Navy should address the recommendations contained in DOT&E's classified BLRIP report issued in November 2010 on the TB-34 towed array. Specifically,
  1. Complete the development, implementation, and testing of the TB-34 towed array's full capability.
  2. Conduct additional testing to characterize the self-noise and reliability of the TB-34 when it is towed with short tow cable scopes.
  3. Conduct additional testing to determine the extent of a potential degradation in performance relative to the TB-16.
  4. Continue to collect reliability and availability data on the TB-34 towed array.
  5. Conduct additional testing of the first array manufactured with the hydrophone wiring modification to correct the noisy channel issue. Verify that this correction improves array performance.
  6. Combine future test and evaluation of the TB-34 towed array with A-RCI testing since the TB-34 towed array is not functional without the power, processing, and displays provided by A-RCI.
  7. Consolidate A-RCI, TB-33, TB-34, and AN/BYG-1 TEMPs into an Undersea Enterprise Capstone document.

Tomahawk Missile and Weapon System

Executive Summary

- The Navy continues to conduct Operational Test Launches to verify reliability and performance of fielded Block II, III, and IV Tomahawk missiles; their associated weapon control systems; and the Tomahawk Command and Control System (TC2S). DOT&E considers the planned Operational Test Launch program to be adequate for continued verification of system reliability and accuracy.
- Based on FY10 test flights, the Tomahawk Weapon System continues to meet Navy standards for reliability and performance.
- Based on the FY10 FOT&E Operational Test Launch results, the Tomahawk Weapon System continues to be effective and suitable.

System

- The Tomahawk Land Attack Missile is a long-range, land attack cruise missile designed for launch from submarines and surface ships.
- Production of Tomahawk Block II and III missiles is complete. There are currently three fielded variants, delivering a nuclear warhead (Block II only, not deployed), a conventional warhead, or a conventional warhead with submunitions.
- Tactical Tomahawk (Block IV) is currently in production as the follow-on to the Block III conventional warhead variant. These missiles are produced at lower cost and provide added capability, including the ability to communicate with and retarget the missile during flight.
- The Tactical Tomahawk Weapons Control System (TTWCS) also includes the TC2S and the shipboard Tomahawk Weapon Control Systems (TWCS). The TC2S and TWCS provide for targeting, mission planning, distribution of Tomahawk tactical data, and in-flight control of Block IV missiles.

Mission

The Joint Force Commander can employ the Tomahawk missile for long-range, precision strikes against land targets.

Major Contractor

Raytheon Missile Systems – Tucson, Arizona

Activity

- The Navy continues to conduct Operational Test Launches to verify reliability and performance of fielded Block II, III, and IV Tomahawk missiles; their associated weapon control systems; and the TC2S. The Navy conducted a total of nine Tomahawk missile test launches during FY10.
- The Navy utilized the Tomahawk flight test program to verify correction of a Block IV missile engineering deficiency (Armed Fire Device) that had the potential to reduce missile reliability on some vertical-launched missiles. In FY10, the Navy initiated corrective actions for affected fielded missiles.
- DOT&E has been participating with the Tomahawk program's T&E Integrated Product Team to update the Test and Evaluation Master Plan and develop a test plan to support the next phase (OT-IIIF) of Tomahawk Weapon System FOT&E. This phase includes improvements to TTWCS as well as correction of deficiencies remaining from OT-IIIE.

Assessment

- As demonstrated during FY10 test flights, the Tomahawk Weapon System continues to meet Navy standards for reliability and performance. As demonstrated by the FY10 FOT&E results, the Tomahawk Weapon System continues to be effective and suitable.
- DOT&E considers the current Operational Test Launch program for all Tomahawk missile variants to be adequate for continued verification of system reliability and accuracy. However, while Block IV testing is funded through FY13, the Navy has not funded Block II and Block III test launches after FY12. The Block III missiles are to remain in operational use until 2020. DOT&E places high value on continuing to collect flight data to evaluate end to end system performance and reliability for all deployed and deployable Tomahawk missile variants.

- Due to differing weapon control systems configurations in the fleet, the ability to plan and conduct strike operations over Secret-level communication circuits, Strike Over Secret, is not available on all Tomahawk firing platforms; therefore, all users must retain the ability to revert to TOP SECRET strike operations. When TOP SECRET and Strike Over Secret users combine for a strike mission, an increased level of difficulty in strike coordination is encountered as all users must guard against cross-contamination of classification levels.

Recommendations

- Status of Previous Recommendations. The Navy has addressed the one remaining FY07 recommendation.
- FY10 Recommendations. None.

Air Force Programs

Air Force Programs

Advanced Extremely High Frequency (AEHF) Satellite Communications System

Executive Summary

- The Air Force Operational Test and Evaluation Center (AFOTEC) conducted an Operational Utility Evaluation (OUE) to support fielding of the initial release of the Advanced Extremely High Frequency (AEHF) Mission Control Segment (MCS). The testing confirmed that the new AEHF MCS was capable of operating and sustaining the existing Milstar constellation.
- AEHF Space Vehicle-1 (SV-1), launched in August 2010, suffered a maneuver anomaly while trying to achieve geosynchronous orbit during the initial boost phase. This will, at a minimum, delay AEHF SV-1 reaching the planned orbital position and could delay testing.

System

- The AEHF system represents the third generation of Extremely High Frequency Satellite Communications capability protected from nuclear effects and jamming activities.
- The AEHF system will follow the Milstar program as the protected backbone of the DoD's integrated military satellite communications architecture. The AEHF is expected to increase system throughput capacity by a factor of ten.
- The overall AEHF system has three segments:
  - Space segment - The space segment comprises an integrated constellation of Milstar and AEHF satellites.
  - Mission Control segment - The control segment includes fixed and mobile telemetry, tracking, and commanding sites; fixed and transportable communication planning elements; and the common user interface with the Space Ground-Link Subsystem and the Unified S-Band capability.
  - Terminal (or User) segment - The terminal segment includes ground-fixed, ground-mobile, man-portable, transportable, airborne, submarine, and shipboard configurations.
- The first AEHF satellite is intended to have the capabilities of a Milstar II satellite at launch, but the software will be upgraded to full AEHF capability after the launch of the second satellite, which will be launched as a fully-capable AEHF satellite. This upgraded capability will dramatically increase the available bandwidth to the deployed users.
- The operational AEHF constellation is defined as four interconnected satellites per the AEHF Operational Requirements Document, dated October 2, 2000. The Defense Acquisition Executive authorized fabrication and assembly of the first four satellites and development of the Control and User segments. The Defense Acquisition Executive also directed the Air Force to plan for the acquisition of satellite vehicles five and six. The exact number of satellites in the AEHF constellation is yet to be determined.

Mission

Combatant Commanders and operational forces worldwide will use the AEHF system to provide secure, responsive, and survivable space-based, strategic, and tactical military communications.

Major Contractor

Lockheed Martin Space Systems – Sunnyvale, California

Activity

- AFOTEC conducted an OUE to support fielding of the initial release of the AEHF MCS. The testing confirmed that the new AEHF MCS was capable of operating and sustaining the existing Milstar constellation prior to launch of the first AEHF satellite.
- AFOTEC cancelled a program to develop a jamming simulator and is now exploring an alternate means of testing anti-jamming capability.
- AFOTEC initiated a program with Arnold Engineering Development Center to develop a scintillation test capability.

Scintillation is a fluctuation in radio wave propagation that can result from atmospheric effects or as a result of a nuclear detonation.

- The program office conducted High Altitude Electromagnetic Pulse (HEMP) certification testing on the three transportable Interim Command and Control (IC2) vehicles.
- AEHF SV-1, launched on August 14, 2010, suffered a maneuver anomaly while trying to achieve geosynchronous orbit during the initial boost phase. This will, at a minimum, delay AEHF SV-1 reaching the planned orbital position and could delay testing.
- Due to the SV-1 maneuver anomaly, AFOTEC and the program manager will be updating the Test and Evaluation Master Plan to incorporate a revised test strategy once the future acquisition and operational deployment strategies for the program are understood.

Assessment

- The combined contractor and government test team continues to identify and fix problems prior to entry into operational testing. Software problems that were observed during testing last year have been corrected. Problems identified early in the integrated testing process led to two emergency software drops that corrected critical deficiencies.
- The operational testers have made limited progress since last year in developing a modeling and simulation strategy to assess nulling antenna performance in order to supplement operational testing. AFOTEC is studying how to best simulate a threat jammer, but details of that testing have not been finalized and the threat jammer capability is only partially funded. Testing of the anti-jam capability must be conducted in support of IOT&E.
- IC2 HEMP test results indicate that additional filters are required to meet HEMP certification. The program manager is adding the necessary filters to the low power amplifiers of two of the vehicles and plans additional testing this year.
- The OUE was adequate to support the initial fielding of the MCS to operate and sustain the existing Milstar constellation. The AEHF MCS is capable in its backward-compatible mode of operating and sustaining the Milstar constellation. The MCS successfully provided mission planning at deployed locations, resource monitoring at the satellite communications (SATCOM) support centers, and satellite command and control.
- Testing identified suitability deficiencies with the fixed mission control element (MCE), the transportable MCE, and the AEHF Satellite Mission Control Subsystem (ASMCS). Both MCEs experienced multiple failures for an average mean time between critical mission failures of 113 hours for the fixed MCE and 138 hours for the transportable MCE, both below the requirement of 221 hours. The transportable mission control element and the ASMCS both exceeded the one hour mean repair time requirement with measured repair times of 1.83 hours and 3.43 hours, respectively.

Recommendations

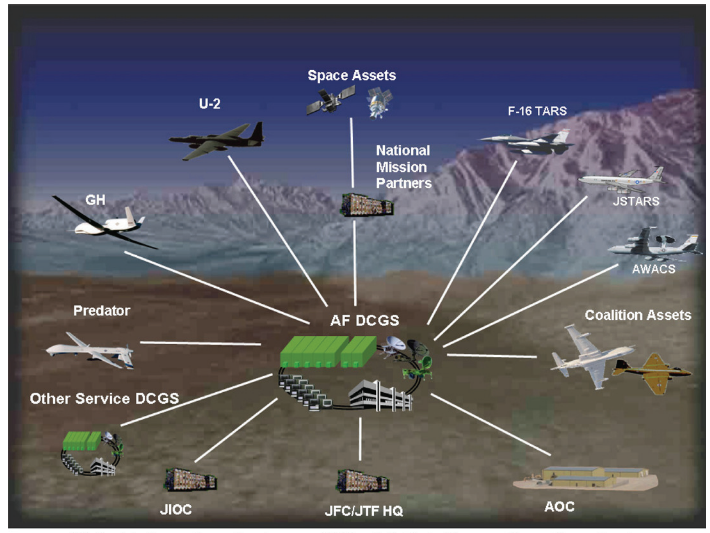
- Status of Previous Recommendations. The Air Force has made satisfactory progress on two of the three FY09 recommendations, but has not provided a strategy to operationally test the anti-jam capability.
- FY10 Recommendations. In addition to addressing the remaining FY09 recommendation, the Air Force should:
  1. Track and test reliability growth of the MCS.

Air Force Distributed Common Ground Segment (AF DCGS)

Executive Summary
- The Air Force conducted a Force Development Evaluation (FDE) of Air Force Distributed Common Ground System (AF DCGS) Block 10.2 in March 2010. DOT&E evaluated the system as not effective and not suitable.
- The system is in the sustainment phase, and the Air Force is conducting a study to determine their future plans for AF DCGS.

System
- AF DCGS Block 10.2 is an upgrade to the legacy Block 10.1. The Block 10.2 upgrades make the applications available via the internet to allow collaboration among intelligence analysts located at multiple sites.
- The DCGS Integration Backbone (DIB) provides the software framework that supports the net-centric enterprise capability that allows sharing of services and data via web services. The DIB consists of commercial off-the-shelf software products.
- The five AF DCGS Block 10.2 core sites are Langley AFB, Virginia (Distributed Ground System 1 (DGS-1)); Beale AFB, California (DGS-2); Osan Air Base, Korea (DGS-3); Ramstein Air Base, Germany (DGS-4); and Hickam AFB, Hawaii (DGS-5). Worldwide, the Air Force has installed components of Block 10.2 at an additional 16 sites that include seven Air National Guard Sites, a DGS-Experimental at Langley AFB, and eight special purpose sites.

Mission
- The Air Force uses AF DCGS to provide the capability to task sensors, process sensor data, exploit sensor data from multiple sources, and disseminate intelligence products.
- The Joint and Combined Force Air Component Commander will use AF DCGS to produce and disseminate intelligence, surveillance, and reconnaissance (ISR) information.



AOC - Air Operations Center
AWACS - Airborne Warning and Control System
GH - Global Hawk
HQ - Headquarters
JFC - Joint Forces Command
JIOC - Joint Intelligence Operations Center
JSTARS - Joint Surveillance Target Attack Radar System
JTF - Joint Task Force
TARS - Tactical/Theater Airborne Reconnaissance System

- The ISR products support ISR management, intelligence preparation of the battlespace, predictive battlespace awareness, indications and warning, current intelligence, analysis of enemy courses of action, targeting and weapon selection, mission planning, and execution of air combat training missions.

Major Contractor
Raytheon – Garland, Texas

Activity
- In December 2009 and January 2010, the 46th Test Squadron conducted regression developmental tests to verify fixes to problems that the Test Squadron discovered during prior developmental testing.
- In February 2010, the 605th Test and Evaluation Squadron conducted Phase 1 of a two-phase FDE in accordance with the DOT&E-approved test plan to assess the operational effectiveness and suitability of AF DCGS Block 10.2. The 605th Test and Evaluation Squadron suspended the FDE after five days of testing due to multiple software problems that precluded conduct of missions.
- In March 2010, the 605th Test and Evaluation Squadron resumed operational testing with a five-day regression FDE.
- The system is now in the sustainment phase and the Air Force has not provided any plans for future operational testing. The Air Force is conducting a study to determine the future of the program.

Assessment

- The system, as tested, performs many missions well, but is not effective and not suitable to support the full range of Air Force ISR missions. During the regression FDE, AF DCGS could not support the simultaneous load of full motion video from Predator and Reaper, Global Hawk, and U-2 missions. In addition, a software problem adversely affected the planning and tasking of U-2 missions.
- Testing of multi-site operations that had been scheduled for Phase 2 of the FDE has not been conducted due to the performance shortfalls discovered during Phase 1.

Recommendations

- Status of Previous Recommendations. This is the first annual report for this program.
- FY10 Recommendation.
  1. If the study regarding the future of AF DCGS includes a new materiel solution, the Air Force should plan and conduct the appropriate level of testing.

ALR-69A Radar Warning Receiver (RWR)

Executive Summary
- The Air Force program office continues to update ALR-69A Radar Warning Receiver software to improve operation in dense and dynamic flight test environments; however, system maturity is still less than expected and the system is not currently ready for IOT&E.
- In April 2010, based upon poor program progress through developmental test, the Air Force directed a pause of ALR-69A developmental test to evaluate the program's overall status and progress toward IOT&E.
- Government flights in late FY09 and FY10 revealed several limitations and deficiencies in the radar warning receiver system. The program's decision to pause developmental tests provides an opportunity to re-assess the program's overall performance and construct a realistic schedule for conducting the remainder of the program, including IOT&E.

1 - Legacy ALR-69 Components
2 - Primary ALR-69 Components
3 - Radar Receiver
4 - Countermeasure Signal Processor

System
- The ALR-69A is a Radar Warning Receiver (RWR) that detects, identifies, and locates threat electronic signals.
- The Core ALR-69A RWR is designed to improve performance over the Air Force's primary RWR system, the ALR-69, by enhancing:
  - Detection range and time
  - Accuracy of threat identification
  - Location of threat emitter systems
  - Performance in a dense signal environment
  - Reliability and maintainability
- The system integrates with transport and fighter aircraft. The lead platform is the C-130H, with other platforms possibly to be added at a later date.
- Core ALR-69A RWR components include:
  - Radar Receivers (previously the digital quadrant receivers)
  - Modular Countermeasures Signal Processor (previously the countermeasures computer)
  - Control indicator
  - Azimuth indicator

Mission
- Combatant Commanders will use ALR-69A to enhance the survivability of transport, fighter, and Special Operations aircraft on missions that penetrate hostile areas.
- Commanders use the ALR-69A to provide aircraft self-protection by warning pilots of radar threats, supporting threat avoidance, and/or permitting timely use of defensive countermeasures.

Major Contractor
Raytheon, Space and Airborne Systems – Goleta, California

Activity
- During April 2010 the Air Force conducted several developmental test missions at Eglin AFB, Florida, China Lake, California, and Naval Air Station (NAS) Fallon, Nevada, to evaluate the performance of new ALR-69A software.
- In April 2010, based upon poor program progress through developmental testing, the Air Force directed that developmental testing be paused to evaluate the program's overall status and readiness for IOT&E.
- As part of the pause period, the Air Force program office is performing a root cause analysis effort to identify the source of repeated discrepancies and address system problems.
- The Air Force program office is updating the ALR-69A Test and Evaluation Master Plan to reflect reorganization of the program following substantial delays.
- In August 2010, Raytheon conducted contractor tests at the Integrated Demonstrations and Applications Laboratory at Wright-Patterson AFB, Ohio, in order to further evaluate software updates.
- The Air Force will continue developmental and operational testing, with IOT&E tentatively rescheduled for October 2011 and a full-rate production decision planned for 2012.

Assessment

- Government flights in late FY09 and FY10 revealed several limitations and deficiencies in the RWR system. The program's decision in April 2010 to pause developmental tests provides an opportunity to re-assess the program's overall performance and construct a realistic schedule for completing development.
- The ALR-69A continues to update software to improve operation in dense and dynamic flight test environments; however, system maturity is still less than expected and the program is not ready for IOT&E at this time.

Recommendations

- Status of Previous Recommendations. No recommendations were made in FY09.
- FY10 Recommendations.
  1. The Air Force should review the program's progress and correct shortfalls identified in deficiency reports and flight testing.

B-2 Radar Modernization Program (RMP)

Executive Summary
- The B-2 Radar Modernization Program (RMP) completed FOT&E for Mode Set 2 in December 2009. Mode Set 2 includes nuclear mission capabilities and enables the delivery of conventional and nuclear weapons in a GPS-degraded/denied operating environment.
- B-2 RMP Mode Set 2 is operationally effective and suitable with limitations in the weather avoidance mode, maintenance technical publications, and integrated diagnostic software.

System
- The B-2 is a multi-role, low-observable bomber capable of delivering conventional and nuclear munitions. It has four turbofan engines and twin side-by-side weapons bays.
- The B-2 RMP features an Active Electronically Scanned Array radar operating on a new frequency. The RMP replaces the B-2 legacy radar antenna and transmitter and changes radar operating frequency to avoid conflicts with other radio frequency spectrum users. The RMP does not add additional capabilities to the B-2 radar beyond those in the legacy system.
- System avionics include a multi-mode radar, GPS-aided navigation, and a Defensive Management System for radar warning functions.
- The bomber's principal conventional weapons are the 2,000-pound and 500-pound Joint Direct Attack Munition.
- The B-2 RMP delivers capability in two separate radar Mode Sets. Mode Set 1 consists of conventional mission and weapons delivery capabilities. Mode Set 2 incorporates nuclear mission capabilities and enables the B-2 to conduct both nuclear and conventional missions in a GPS-degraded/denied environment.

Mission
- Combatant Commanders use the B-2 aircraft to attack global targets during the day or at night, in all weather, in highly defended threat areas at the strategic, operational, and tactical levels of warfare.
- Commanders use the B-2 to engage high-value, heavily defended target sets including: command and control facilities, airfields, industrial complexes, logistical and air defense systems, lines of communication, and battlefield forces and equipment.

Major Contractor
Northrop Grumman – Los Angeles, California

Activity
- The Air Force Operational Test and Evaluation Center (AFOTEC) conducted B-2 RMP Mode Set 2 FOT&E from November through December 2009 in accordance with the DOT&E-approved Test and Evaluation Master Plan and FOT&E plan.
- Air Combat Command conducted a B-2 Force Development Evaluation (FDE) assessing B-2 RMP Mode Set 2 performance in conjunction with an Integrated Functional Capability upgrade to the B-2 weapon system from November 2009 through January 2010.

Assessment
- B-2 RMP Mode Set 2 is operationally effective and suitable with some limitations in the weather avoidance mode, maintenance technical publications, and integrated diagnostic software.
- The RMP navigational update, targeting, and weapons delivery accuracy capabilities are no worse than those of the legacy radar system. B-2 aircrews can effectively use the RMP system to align the aircraft navigation system, fly formation, avoid weather, and deliver conventional and nuclear weapons in the GPS-available, degraded, and denied environments.
- Mode Set 2 FOT&E provided additional missions in which to examine RMP weather avoidance capabilities previously tested during FY09 RMP Mode Set I IOT&E. RMP detection and display of weather phenomena in the weather avoidance mode was inconsistent with the actual weather location relative to the aircraft, but the inconsistency is less

than previously reported in Mode Set 1 IOT&E. Weather phenomena such as thunderstorms were approximately two to three miles closer to the aircraft than cockpit-displayed RMP detections as opposed to five miles closer as previously reported in the Mode Set 1 IOT&E. DOT&E assesses that this does not adversely affect B-2 mission accomplishment.
- The RMP Mode Set 2 FOT&E and Air Combat Command FDE results demonstrated that RMP is suitable with some limitations. FOT&E results demonstrated that the RMP system mean time between failures is greater than that of the legacy system based on accumulated RMP system flight test data and modeling and simulation using component reliability data. However, both FOT&E and FDE results identified shortfalls in maintenance technical publications and integrated diagnostic software that precluded the ability to accurately diagnose all RMP system failures in a timely manner. The Air Force is in the process of updating technical publications and incorporating B-2 software updates to improve RMP fault diagnostics, with planned fielding dates beginning in early FY11.

Recommendations
- Status of Previous Recommendations. The Air Force is addressing B-2 RMP technical publications and fault diagnostics shortfalls identified in FY09 testing. Additionally, previously identified weather avoidance mode discrepancies proved to be smaller than previously reported, and do not adversely affect mission accomplishment.
- FY10 Recommendation.
  1. The Air Force should evaluate the efficacy of planned RMP fault diagnostics software improvements in conjunction with subsequent FY11 B-2 aircraft system operational flight program test and evaluation efforts.

Battle Control System – Fixed (BCS-F)

Executive Summary

- The Air Force is finalizing developmental and operational testing on the Battle Control System – Fixed (BCS-F) Increment 3, Release 3.1 (referred to as Increment 3.1) at all U.S. air defense sites.
- Interim results from operational testing at the two continental U.S. sectors found Increment 3.1 supports North American Aerospace Defense Command (NORAD) air defense operations with shortfalls in training and technical system documentation, in system security management, information assurance, data link, and system combat identification operations.
- A complete assessment of Increment 3.1 performance will not be available until all testing is completed in FY11.

System

- The BCS-F is a tactical air battle management command and control system that provides NORAD air defense sectors, as well as the Hawaii and Alaska regional air operation centers, with common commercial off-the-shelf hardware based on an open architecture software configuration.
- BCS-F Increment 2 replaced the legacy AN/FYQ-93 system. The BCS-F Increment 3.1 upgrade provides a new air defense operating system that integrates the National Capital Region (NCR) Sentinel radars and replaces the NORAD Contingency Suite (NCS) at the two continental U.S. sectors. The DoD employed the NCS system following 9/11 to allow the integration of continental U.S. interior radar data and to meet the expanded mission requirements of Homeland Defense.
- The Increment 3.1 upgrade transitions the system to a Linux operating system and integrates an improved human-machine interface through the Raytheon-Solipsys Tactical Display Framework.
- The Increment 3.1 upgrade also provides internet protocol-based radar and flight plan interfaces and a remote tactical air picture to Headquarters NORAD.
- BCS-F is employed by the U.S. and Canada.

Mission

- BCS-F provides NORAD and Pacific Command commanders with the capability to execute command and control and air battle management in support of air sovereignty and air defense missions for Homeland Defense.
- Air defense operators employ BCS-F to conduct surveillance, identification, and control of U.S. sovereign airspace and control air defense assets, including fighters, to intercept and identify potential air threats to U.S. airspace.

Major Contractor

Thales-Raytheon – Fullerton, California

Activity

- The Air Force completed operational testing of Increment 3.1 at all four U.S. sites and the Canadian site in May 2010. The testing was executed in accordance with the DOT&E-approved test plan. Only system security penetration testing remains outstanding in order to complete all operational testing specified in the DOT&E-approved test plan.
- The Air Force approved Increment 3.1 for operations at the two continental U.S. sectors following initial operational testing and a Full Deployment Decision Review (FDDR) in February 2010. The FDDR also approved deployment and testing of the system at the remaining U.S. air defense sites.
- The Joint Interoperability Test Command (JITC) completed a Joint Interoperability Test data link certification for Increment 3.1 in August 2009. The JITC reported in February 2010 that Increment 3.1 conforms to required joint and DoD standards. A final JITC Interoperability Certification is pending data collection and analysis from operational testing in FY11.

- The Air Force conducted interoperability testing between Increment 3.1 and the NCR Sentinel radars in March 2010.
- The Air Force conducted operational testing of the Increment 3.1 Remote Tactical Air Picture (RTAP) and Remote Workstations (RWS) in June 2010. Five RWS have currently replaced the NCS remote suites at Headquarters NORAD facilities and are providing the RTAP from the two continental air defense sectors.
- The Air Force canceled initial operational level security penetration testing of BCS-F scheduled for November 2009 due to outstanding system information assurance deficiencies. Penetration testing is rescheduled for 1QFY11.
- The Air Force began system development for BCS-F Increment 3.2 to meet operational requirements as defined in the 2003 Operational Requirements Document (ORD) and to address emerging user requirements. The program is working on the Increment 3.2 Test and Evaluation Master Plan.
- The Air Force plans to develop a new Joint Capabilities Integration and Development System (JCIDS) document to accurately reflect the user's current and future requirements and support a follow-on Increment 4 upgrade.

Assessment

- A complete assessment of Increment 3.1 performance will not be available until all testing is completed in FY11 and the data have been analyzed. However, DOT&E preliminary analyses indicate:
  - BCS-F Increment 3.1 is able to support NORAD air defense operations, providing the ability to adequately perform core competencies and tasks required to accomplish the air defense mission.
  - BCS-F Increment 3.1 provides an improved functionality and capability over the legacy Increment 2 system. Operators from each sector overwhelmingly stated Increment 3.1 enhanced situational awareness and ability to perform their missions.
  - Shortfalls in system security management and deficiencies in all information assurance assessment areas jeopardize secure system operations. The Air Force has implemented some corrections but the final suitability determination will not be complete until initial penetration testing and additional information assurance tests are completed and analyzed.
  - Test data collected to-date indicates Increment 3.1 has demonstrated adequate reliability, maintainability, and availability with an average system availability of 99.89 percent with over 1,930 hours of system operation during operational test.
  - Deficiencies exist in Increment 3.1 training and technical system documentation for data link operations, the intrusion detection system, the firewall, the local area network, the gateway manager, system doctrine, and combat identification. Additionally, Increment 3.1 lacked adequate security plans specifically in system vulnerability management.
  - The data transferred from the Sentinel Radars and received on the BCS-F Increment 3.1 are timely and accurate.
  - Results from RWS testing highlight major deficiencies with training, documentation, logistics/spares, help desk support, and information assurance that may significantly affect RWS long-term sustainment.
- The program conducts some developmental and operational testing at the operational sites due to limitations of its test-bed, the System Support Facility (SSF), and uniqueness of each air defense site. If the Air Force upgraded the SSF to more accurately represent the air defense sites, it would support more robust BCS-F developmental and operational testing capability at the SSF and would minimize the overall impact of testing on the operational sites.

Recommendations

- Status of Previous Recommendations. The Air Force satisfactorily addressed one of the three FY09 recommendations. The Air Force still needs to upgrade the SSF to support more robust BCS-F developmental and operational testing capability in order to minimize the impact of overall testing on the operational sites and document current and future user requirements through a new JCIDS document.
- FY10 Recommendations. The Air Force should:
  1. Develop a plan to track all information assurance deficiencies to resolution. Operational users should prioritize those deficiencies with the greatest operational impact.
  2. Correct and formalize all BCS-F Increment 3 system documentation and training deficiencies.

C-5M

Executive Summary

- The C-5M program completed operational testing in January 2010. The modernized and re-engined C-5 aircraft, the C-5M, is operationally effective. The C-5M has the potential to increase the cargo carrying capacity of the fleet and offers new cargo delivery options not possible with the legacy system. The new engines provide enhanced capabilities for nonstop routes and increased flexibility with respect to routes, runways, and environmental conditions.
- The C-5M is not operationally suitable. The system's ability to conduct the strategic airlift mission was limited by deficiencies in the All-Weather Flight Control System, by problems with the Embedded Diagnostics System (EDS) and Built-In Test (BIT) functionality, by inadequate support equipment, and a lack of dedicated training systems. The C-5M did not achieve required wartime mission capable rates or logistics departure reliability, which affect the overall amount of cargo that can be delivered in a specific period of time. These shortfalls were not operationally significant.
- The C-5M is survivable in a low-threat environment. C-5M survivability in a medium-threat environment was not tested or assessed.
- The DOT&E Combined Operational and Live Fire Test and Evaluation report for the C-5 Reliability Enhancement and Re-engining Program (RERP), dated October 1, 2010, contains additional details.

System

- The C-5 is the largest four-engine, military transport aircraft in the United States. The C-5 has 36 pallet positions and can carry a maximum payload of 270,000 pounds. The typical C-5 crew size is seven.
- The C-5M designation is the result of two separate but related modernization efforts:
  - The Avionics Modernization Program (AMP) incorporates a mission computer, a glass cockpit with digital avionics (including autopilot and auto-throttles), and state-of-the-art communications, navigation, and surveillance components for air traffic management.
  - The RERP provides reliability enhancements, plus new commercial engines, nacelles, thrust reversers, and pylons.

Mission

- Units equipped with the C-5 perform strategic airlift, emergency aeromedical evacuation, transport of brigade-size forces in conjunction with other aircraft, and delivery of outsize or oversize cargo (cargo that does not fit on a standard pallet).
- Units equipped with the C-5 execute missions at night, in adverse weather conditions, and in civil-controlled air traffic environments around the world. The units are capable of completing extended-range missions because the C-5 can receive in-flight aerial refueling.

Major Contractor

Lockheed Martin Aeronautics Company – Marietta, Georgia

Activity

- The Air Force completed the OT&E for the C-5M in January 2010, accumulating 1,333 flight hours. Additional OT&E data were collected through July 2010 from C-5M flight operations tasked by Air Mobility Command (AMC).
- The Air Force performed high tempo operations (415.9 flight hours) from a forward operating base (Naval Air Station Rota, Spain) from June 14, 2010 to July 15, 2010, utilizing the two currently available C-5M aircraft.
- DOT&E approved the Test and Evaluation Master Plan to support the Full-Rate Production decision in October 2010.
- DOT&E completed a Combined Operational and Live Fire Test and Evaluation report for the C-5 RERP on October 1, 2010.
- Developmental testing of software version 3.5 began in August 2010.

Assessment

- The C-5M is operationally effective. The new General Electric F138-GE-100 engines enhance the ability of the aircraft to deliver cargo. The increased thrust and modern

design of the new engines allowed the aircraft to meet the four Key Performance Parameters relating to engine performance: time to climb, one engine out climb gradient, noise compliance, and emission compliance.
- While the C-5M did not meet the predicted Million-Ton-Miles per Day (MTM/D) capability during OT&E, it could significantly increase the transported cargo capacity of the fleet. Since the new engines have increased performance over the legacy engines in all environmental conditions, this offers new scenario options not possible with the legacy system, such as overfly and nonstop routes.
- The C-5M has several significant deficiencies, identified before OT&E, which persisted throughout testing and affected the ability to successfully accomplish missions without workarounds and additional aircrew workload:
  - Restricted use of thrust reversers in flight – until the thrust reversers can be deployed reliably in flight, there will be a limited capability for procedures such as emergency descent and some tactical operations and descents.
  - Auto throttles – overactive in cruise operations, especially during turbulent conditions; numerous pitch and speed changes occurred, in addition to the failure of the auto throttles to maintain commanded airspeed during critical phases of flight.
  - Environmental Control System – degraded performance because of the auto-throttle instability. During flight through turbulent air, overactive auto throttles affected the bleed air supply, resulting in little control over the ECS. This caused cabin pressure fluctuations and cabin temperatures dipped below 50 degrees Fahrenheit.
  - Communication, navigation, and surveillance/air traffic management capabilities – shortfalls affected aircrew workload and will eventually restrict global airspace access if unaddressed.
- The C-5M is not operationally suitable. The system's ability to conduct the strategic airlift mission was limited by deficiencies in the All-Weather Flight Control System, by problems with the EDS and BIT functionality, by inadequate support equipment, and a lack of dedicated training systems.
- Deficiencies in several aspects of C-5M support functions, identified before testing began, had a significant effect on the suitability, specifically the maintainability, of the aircraft, including:
  - BIT – a very high false alarm rate combined with the low fault isolation rate increased the time to troubleshoot and complete maintenance actions. BIT detections of critical faults did not meet the requirement of 99 percent during testing.
  - Training Systems and Devices – aircrew and maintainer training devices specific to the C-5M are not yet available. Simulators at the contractor facility and on-aircraft training are used to mitigate the lack of aircrew simulators. Maintainers are trained on the aircraft, which is restricted by the aircraft availability. Some maintenance personnel during the operational testing saw maintenance procedures and performed corrective actions for the first time because that training had not yet been accomplished.
  - Information Assurance – the C-5M is susceptible to the same information assurance problems as the C-5 AMP, KC-135, and C-17 aircraft. The additional risk from information operations on the EDS is low. The AMC is addressing the information assurance deficiencies in the interface of the EDS and the aircraft in the next block upgrade.
- The RERP modification provided improvements in the reliability, maintainability, and availability of the C-5M aircraft.
  - The C-5M met three of the six reliability requirements successfully, including the mean times between inherent failures, unscheduled maintenance actions, and removals of the flight and engine instruments subsystems.
  - The rate of occurrence of unscheduled maintenance actions met the time requirements throughout the OT&E, as did the failure rate.
  - Adequate spares were available for the OT&E, and spares were rarely a cause of delays during the OT&E.
- The C-5M is survivable in a low-threat environment. The Live Fire program did not test C-5M survivability in a medium-threat environment.
  - Analysis revealed hydraulic system failure to be the number one vulnerability. This is counter to other aircraft where dry bay fire is the number one vulnerability.
  - The C-5M's susceptibility to evaluated threats is high but the vulnerability (aircraft kill) is low.
  - Ullage inerting system tests showed the system reduces oxygen concentration to levels that prevent ullage explosions from ballistic threats.
  - The C-5M is vulnerable to wing leading and trailing edge dry bay fires. The current dry bay fire suppression system is ineffective against threat-induced fires in the wing leading edge bays. These fires could lead to mission abort or aircraft loss. Engine pylon ballistic tests demonstrated vulnerabilities to fires in the two dry bays that contain flammable materials. These fires could cause engine loss and potentially wing damage that would result in a mission abort.
  - Engine nacelle fire suppression systems are effective against fires resulting from engine failures, but were not tested against ballistic threat-induced fires.
  - The radio frequency vulnerability is low. Flight controls are entirely mechanical and hydraulic and are unaffected by radio frequency disturbances. Each of the four engines has dual redundant, radio frequency hardened, Fully Automated Digital Engine Controllers.

Recommendations
- Status of Previous Recommendations. The Air Force has made satisfactory progress on all but one of the previous recommendations. The Air Force needs to enhance the wing leading and trailing edge fire suppression system performance.

- FY10 Recommendations. The Air Force should:
  1. Correct the deficiencies in the auto-throttles, environmental control system, thrust reversers, BIT, training, information assurance, EDS, technical orders, and engine support equipment to enable C-5M personnel to operate and maintain the aircraft as intended.
  2. Add dry bay fire suppression for the wing leading and trailing edge dry bays based on current technologies employed in the F/A-18E/F and P-8A aircraft.
  3. Add additional dry bay fire suppression systems into the engine pylons.
  4. Conduct ballistic testing to validate analysis results showing that C-5M hydraulics are vulnerable to man-portable air defense systems. Should test results validate the analysis, consider the addition of flight control system hydraulic line fluid shutoffs (fuses or hydraulic fluid reservoir level sensing and shutoff of damaged lines).
  5. Conduct analysis of engine nacelle fire suppression system effectiveness against ballistic threat-induced fires. External airflow from ballistic damage may prevent the system from suppressing ballistic threat-induced fires.
  6. Complete defensive system testing and certification to evaluate the C-5M survivability in a medium-threat environment.

C-130 Avionics Modernization Program (AMP)

Executive Summary

- The Air Force completed primary developmental testing in December 2009. The C-130 AMP performed satisfactorily during developmental testing except for high crew workload during airdrop activities while flying in formation. The Air Force plans to address high crew workload problems through system software updates.
- The C-130 AMP achieved 10.2 hours Mean Time Between Failures (MTBF) in March 2010 (1,705 operational hours), and is on track to achieve the Capability Production Document (CPD) requirement of 12.4 hours MTBF once the system has achieved 33,600 operational hours.
- The Under Secretary of Defense Acquisition Technology and Logistics (USD (AT&L)) approved the C-130 Avionics Modernization Program (AMP) into low-rate initial production (LRIP) on June 19, 2010.

System

- Legacy C-130s, (excluding the C-130J), are four-engine turboprop aircraft used by the Air Force, Navy, Marines, and Special Operations units. Crew size varies from 4 to 13, depending on aircraft mission.
- The AMP adds glass cockpits, integrated digital avionics, and an integrated defensive systems suite. It eliminates the need for a crew navigator on all Combat Delivery missions. The AMP provides new communications, navigation, and surveillance capabilities for Air Traffic Management functions.
- Combat Delivery C-130 AMP aircraft have six pallet positions for cargo.

Mission

- Units equipped with the C-130 primarily perform the tactical portion of the airlift mission, flying shorter distances and using austere airfields within combat zones.
- Combat delivery includes:
  - Airdrop of paratroopers and cargo (palletized, containerized, bulk, and heavy equipment)
  - Airland delivery of passengers, troops, and cargo

Major Contractor

The Boeing Company, Integrated Defense Systems – Wichita, Kansas

Activity

- The USD (AT&L) approved the C-130 AMP entry into LRIP via an Acquisition Decision Memorandum (ADM) on June 19, 2010. The ADM stated the approval is contingent upon the Air Force providing the Director, Portfolio Systems Acquisition with an update on the program, specifically addressing (1) software update status correcting the discrepancies identified during development testing, and (2) progress towards the mitigation of crew workload issues prior to the award of Lot 3 kit procurement.
- The Air Force completed initial developmental testing in December 2009. The Air Force is planning additional developmental testing starting in FY11 and continuing into FY12. Testing will focus on two Operational Flight Program (OFP) software releases intended to reduce crew workload during formation and airdrop phases of flight. Integrated Diagnostics and Mission Planning Alarm/Warning/Event (A/W/E) capabilities were not ready for test during earlier developmental testing.
- The Air Force updated the original Test and Evaluation Master Plan (TEMP) dated November 2, 2007. DOT&E approved the updated TEMP in June 2010. The updated TEMP supports the CPD, Change 1, dated November 17, 2008.
- The Air Force has scheduled the IOT&E to begin in FY12. It will last approximately six months.

Assessment

- The C-130 AMP performed satisfactorily during developmental testing except for high crew workload during airdrop activities while flying in formation. The Air Force plans to address high crew workload problems through system software updates.
- The C-130 AMP achieved 10.2 hours Mean Time Between Failures (MTBF) in March 2010 (1,705 operational hours) and is on track to achieve the Capability Production Document (CPD) requirement of 12.4 hours MTBF once the system has achieved 33,600 operational hours.

Recommendations

- Status of Previous Recommendations. The Air Force has satisfactorily addressed all FY08 and FY09 recommendations.
- FY10 Recommendation.
  1. The Air Force should continue to develop OFP software releases and/or tactics and training to reduce crew workload during formation and airdrop phases of flight.

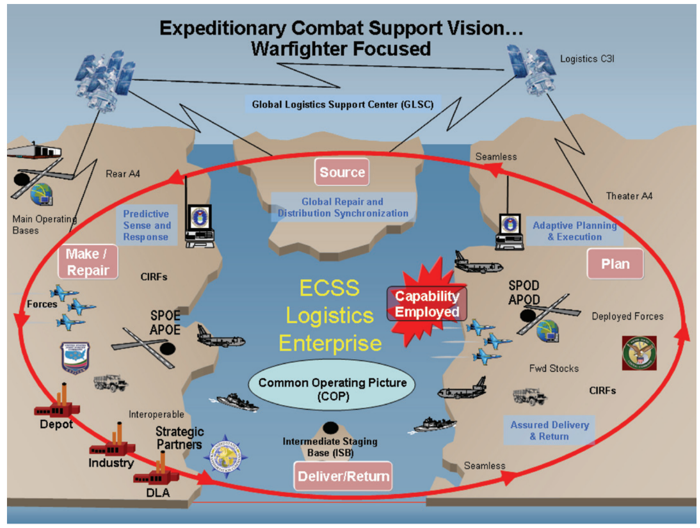
Expeditionary Combat Support System (ECSS)

Executive Summary

- The Air Force Operational Test and Evaluation Center (AFOTEC) conducted an Early Operational Assessment (EOA) during a contractor-led developmental test event of Release 1, Pilot A of the Expeditionary Combat Support System (ECSS) in Beavercreek, Ohio, from February 1 to April 9, 2010. The primary objective of the EOA was to assess system progress toward achieving Release 1 objectives.
- Due to the limited scope of Pilot A (with less than one-tenth of the planned Release 1 capability), AFOTEC was not able to collect sufficient quantitative data for DOT&E to determine if the program was on track to deliver desired performance at the conclusion of Release 1. However, interviews with functional subject matter experts (SMEs) and analysis of the limited data enabled testers to identify several areas requiring attention, including data quality, data conversion, handheld scanner needs, interoperability, usability, information assurance, and requirements testability.
- After the completion of the EOA, the program office took actions to address identified shortfalls and conducted further developmental tests to mitigate the concerns identified during the EOA. In addition, the program office planned additional time and significantly increased the resources to support the remainder of Release 1 development. On July 31, 2010, ECSS Release 1, Pilot A went live for users at Hanscom AFB, Massachusetts, after achieving an Authority to Operate in the DoD network. Based on the additional tests completed by the 46th Test Squadron, DOT&E assesses the program as having significantly increased the likelihood of now achieving its Release 1 goals.

System

- ECSS is a Major Automated Information System supporting Air Force worldwide logistics operations.
- ECSS is designed to transform existing Air Force logistics operations and business processes using commercial best practices and the commercial off-the-shelf Oracle Enterprise Resource Planning product suite to achieve increased equipment availability and decreased logistics cost.
- ECSS will operate on the Global Combat Support System – Air Force (GCSS-AF) Integration Framework to promote compatibility with other Air Force and DoD information technology systems.
- The acquisition strategy employs four releases (increments). Each release is treated as a separate acquisition with its own set of acquisition phases and milestones.



APOD - Aerial Port of Debarkation
APOE - Aerial Port of Embarkation
C3I - Command, Control, Communications and Intelligence
CIRF - Centralized Intermediate Repair Facilities
SPOD - Sea Port of Debarkation
SPOE - Sea Port of Embarkation

- Release 1 contains three pilots to be implemented primarily at Hanscom AFB, Massachusetts:
  - Pilot A – Foundational Configuration and Tools and Vehicles Management
  - Pilot B – Equipment Management
  - Pilot C – Base Supply Chain
- Release 2 will provide additional capabilities to support enterprise planning of materiel, management of depot-level supply, and product lifecycle management activities.
- Release 3 will support depot maintenance, repair, and overhaul.
- Release 4 will support flight line maintenance and ammunitions management.

Mission

- Air Force combat support personnel will use ECSS to provide an enterprise view of repair and overhaul capacity by managing the flow of repairable assets, to include physical return, disposition, maintenance, condemnation, and procurement of replacement assets.
- The Air Force and DoD leadership will use ECSS to access critical, standardized, real-time, logistics-related information to make sound strategic business decisions.

Major Contractors

- Computer Sciences Corporation (CSC) – Dayton, Ohio
- Oracle Corporation – Reston, Virginia

Activity

- AFOTEC conducted an EOA during a contractor-led developmental test event of Release 1, Pilot A in Beavercreek, Ohio, from February 1 to April 9, 2010. AFOTEC conducted the EOA in accordance with the DOT&E-approved Test and Evaluation Master Plan and EOA Plan. The primary objective of the EOA was to assess system progress toward achieving Release 1 operational effectiveness, suitability, and survivability criteria.
- The 46th Test Squadron completed a vulnerability assessment and a penetration test at Gunter Annex, Maxwell AFB, Alabama, where ECSS is hosted on a GCSS-AF-representative test infrastructure.

Assessment

- Due to the limited scope of Pilot A (with less than one-tenth of the planned Release 1 capability), AFOTEC was not able to collect sufficient quantitative data for DOT&E to determine if the program was on track to deliver desired performance at the conclusion of Release 1. However, interviews with functional SMEs and analysis of the limited data enabled testers to identify several areas requiring attention, including data quality, data conversion, handheld scanner needs, interoperability, usability, information assurance, and requirements testability.
- The EOA testers witnessed the completion of more than 50 test scenarios. SMEs indicated that vehicle management information was stored and displayed correctly. However, they questioned the system's ability to effectively manage the information for tools, primarily due to the lack of a suitable handheld scanner.
- The handheld scanner demonstrated during the EOA for Tools Management was slow, and required far more keystrokes than current legacy systems. An insignificant quantity of legacy data was used for the EOA, so data conversion was only marginally assessed. ECSS will rely heavily on legacy data for its success, and data conversion is a major concern for future pilot releases.
- ECSS Release 1 will have approximately 120 interfaces. However, Pilot A had only implemented two, so there were insufficient data to assess interface development. Interoperability also remains a major concern.
- SMEs indicated that too many steps are required to complete a work order and some steps seemed unnecessary. Since the mission scenarios were scripted, a comprehensive usability assessment could not be made.
- The 46th Test Squadron identified more than 100 vulnerability findings during their security test. About one-half of them were attributable to the test infrastructure, but the rest were attributable to ECSS, and most of those were considered to have high potential for allowing unauthorized access.
- Many requirements provided in the Capability Document were written at too high a level to support the objectives of the Expeditionary Logistics for the 21st Century initiative and were not written specifically to address the performance of ECSS.
- After the completion of the EOA, the program office took actions to address identified shortfalls and conducted further developmental tests to mitigate the concerns identified during the EOA. In addition, the program office planned additional time and significantly increased the resources to support the remainder of Release 1 development. On July 31, 2010, ECSS Release 1 Pilot A went live for users at Hanscom AFB, Massachusetts, after achieving an Authority to Operate in the DoD network. Based on the additional tests completed by the 46th Test Squadron, DOT&E assesses the program as having significantly increased the likelihood of now achieving its Release 1 goals.

Recommendations

- Status of Previous Recommendations. This is the first annual report for this program.
- FY10 Recommendation.
  1. The ECSS functional sponsor should revise the Capability Document prior to Milestone C to assure that requirements to support the IOT&E of Release 1 are testable and operationally relevant to the ECSS.

F-22A – Advanced Tactical Fighter

Executive Summary

- The Air Force F-22A developmental flight testing and operational test planning necessary to support Increment 3.1 Enhanced Global Strike FOT&E continued throughout FY10. FOT&E is scheduled to begin in January 2011.
- The Air Force completed the 2009 F-22A Mission Data Load (MDL), Mission Data Optimization (MDO) testing to assess the operational effectiveness of reprogrammable threat files supporting F-22A electronic warfare capabilities.
- The Air Force completed the first phase of a three-phase Force Development Evaluation (FDE) for the F-22A Update Three Operational Flight Program, assessing system software enhancements and electronic protection upgrades to the F-22A. Preliminary results indicate the software provides enhanced mission effectiveness and electronic protection capability.
- The Air Force F-22A Low Observables Stability Over Time (LOSOT) testing completed the fifth year of operational flight test to assess the validity of the F-22A low observable Signature Assessment System (SAS) tool, the durability and stability of the F-22A low observable system over time, and the low observables maintainability concept of operations.
- Low observables maintainability trends continue to suggest the Air Force may experience significant challenges in meeting a number of operational suitability threshold requirements specified in the current F-22A operational requirements and capabilities production documents when the system reaches maturity in early calendar year 2011.

System

- The F-22A is an air superiority fighter that combines low observability to threat radars, sustained high speed, and integrated avionics sensors.
- F-22A low observability reduces threat capability to engage with current weapons.
- The aircraft maintains supersonic speeds without the use of an afterburner.
- Avionics that fuse information from the Active Electronically Scanned Array radar, other sensors, and data linked information for the pilot enable employment of medium- and short-range air-to-air missiles, guns, and air-to-ground munitions..
- The F-22A is designed to be more reliable and easier to maintain than legacy fighter aircraft.
- F-22A air-to-air weapons are the AIM-120C radar-guided missile, the AIM-9M infrared-guided missile, and the M61A1 20 mm gun.

- F-22A air-to-ground precision strike capability consists of two 1,000-pound Joint Direct Attack Munitions.
- The F-22A program delivers capability in increments. The Air Force F-22A Increment 3.1 will deliver enhanced air-to-ground mission capability in 2011, to include incorporation of Small Diameter Bomb Increment One.

Mission

A unit equipped with the F-22A:

- Provides air superiority over friendly or enemy territory
- Defends friendly forces against fighter, bomber, or cruise missile attack
- Escorts friendly air forces into enemy territory
- Provides air-to-ground capability for counter-air, strategic attack, counter-land, and enemy air defense suppression missions

Major Contractor

Lockheed Martin Aeronautics Company – Fort Worth, Texas

Activity

- The Air Force conducted F-22A testing in accordance with the DOT&E approved Test and Evaluation Master Plan and FOT&E and FDE test plans.
- The Air Force continued F-22A Increment 3.1 Enhanced Global Strike developmental testing throughout FY10. The Air Force Operational Test and Evaluation Center (AFOTEC) finalized test planning efforts for Increment 3.1 FOT&E, scheduled to begin in January 2011.
- AFOTEC conducted a series of simulator test events supporting F-22A Increment 3.1 FOT&E development in the F-22 Air Combat Simulator (ACS). The ACS facility consists of four F-22 cockpits installed in visual scene domes and ten other manned interactive cockpit stations and is designed to model the dense surface-to-air and air-to-air threat and electronic signals environment that is impractical or too costly to generate in open-air flight test. Ongoing validation, verification, and accreditation of the ACS for use in AFOTEC Increment 3.1 mission effectiveness evaluation occurred throughout FY10.
- Air Force Air Combat Command (ACC) completed F-22A electronic warfare testing conducted under the May 2009 F-22 MDL, MDO FDE Test Plan.
- Air Force ACC concluded the first phase of a three-phase FDE in July 2010 for the F-22A Update Three Operational Flight Program assessing system software enhancements and electronic protection upgrades to the F-22A system.
- Air Force ACC concluded the final year's flight testing for the five-year LOSOT test and reported on findings from the fourth year of testing. This evaluation assesses the validity of the F-22A low observable SAS, durability and stability of the F-22A low observable system over time, and the low observables maintainability concept of operations.
- The Air Force instituted the F-22A Signature Management Program, a flight test program to verify the long term signature stability of the operational F-22A fleet and to continue to verify and refine SAS. In addition, the Signature Management Program assesses the completeness, correctness, and process clarity in management of the F-22A low observables system across the operational fleet.

Assessment

- The Increment 3.1 Enhanced Global Strike program experienced developmental challenges requiring additional software releases and flight test in FY10. The originally planned November 2010 through May 2011 FOT&E period is now scheduled from January through August 2011. Increment 3.1 FOT&E will include both open-air flight testing and complex missions conducted in the F-22 ACS. Evaluating F-22A Increment 3.1 capabilities in the context of the F-22's anticipated operational threat and electronic signals environment requires that the ACS provide the realistic threat density and fidelity to complement open-air flight testing.
- ACC 2009 MDL MDO testing verified and validated upgrades in F-22A reprogrammable mission data loads resulting in the fielding of updated electronic warfare capabilities to operational units enabling enhanced global mission operations.
- Preliminary results from ACC Update Three FDE Phase One testing indicate the software provides enhanced mission effectiveness and electronic protection capability.
- ACC LOSOT fourth year interim findings indicate the following:
  - The F-22A SAS appears to be adequate for low observables maintenance documentation. Continual emphasis must be placed on training personnel to assure that low observable damages are properly identified and input into SAS so that accurate results are reported and proper maintenance can occur.
  - SAS is improving through periodic updates to increase the speed and usability of the program.
  - SAS data integrity should be maintained with regular audits and database checks performed by experienced low observables maintenance personnel.
  - As noted in the third year interim findings, continuation training for low observables maintenance personnel should be emphasized for the proper damage documentation and identification of correct logistics control numbers when using SAS.
- LOSOT findings are consistent with F-22 operational fleet trends and DOT&E FY07 follow-on operational testing observations. Low observables maintainability continues to account for a significant proportion of the man hours per flight hour required to maintain the F-22. This affects aircraft operational availability, mission capable rates, and sortie generation rates. LOSOT testing should be continued under the Signature Management Program or similar test venue after final reporting of the current ACC five year test and should include an assessment of the F-22A operational test fleet in addition to operational unit aircraft.
- The F-22A will reach 100,000 fleet flight hour system maturity in early 2011. Given the maintainability metrics achieved in operational testing to date, the Air Force is likely to experience significant challenges in meeting a number of "at maturity" operational suitability thresholds specified in the current F-22 operational requirements and capabilities production documents. DOT&E will assess the operational effectiveness and suitability of the mature F-22A system in conjunction with oversight of Increment 3.1 Enhanced Global Strike FOT&E.

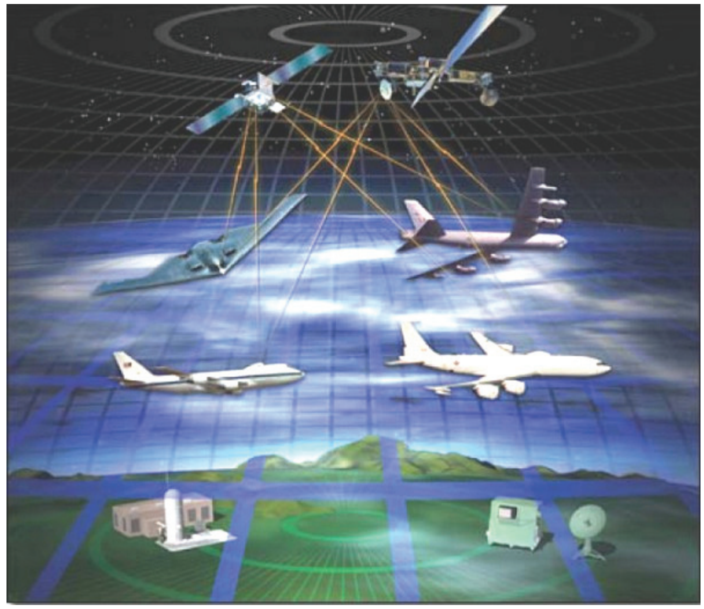
Recommendations

- Status of Previous Recommendations. The Air Force continues to address all previous recommendations.
- FY10 Recommendation.
  1. The F-22A LOSOT testing should be continued under the Signature Management Program or similar test venue after final reporting of the current ACC test and should continue to include an assessment of the F 22 operational test fleet as well as operational unit aircraft.

Family of Advanced Beyond Line-of-Sight Terminals (FAB-T)

Executive Summary

- The Family of Advanced Beyond Line-of-Sight Terminals (FAB-T) program determined the remaining program cost exceeded its budget and has been working with its contractors to establish a new baseline. The program manager plans to seek approval of the new baseline by the Defense Acquisition Executive in 1QFY11. The program schedule is likely to slip by 21 months or more.
- The Air Force Operational Test and Evaluation Center (AFOTEC) conducted a second operational assessment (OA-2) in 4QFY09. Integrated developmental/operational flight tests aboard the test bed aircraft demonstrate the Advanced Wideband Terminal (AWT) is capable of over-the-air communication with other FAB-T terminals through the Milstar satellite.
- Based upon OA-2 results, the FAB-T Increment 1 AWT is not on track to meet mission requirements and not on track to become operationally effective and operationally suitable.



System

- FAB-T is an evolutionary acquisition program intended to provide ground- and aircraft-qualified beyond line-of-sight satellite communications terminals with the capability to move large amounts of information to and from ground installations and airborne platforms.
- FAB-T is intended to support both beyond line-of-sight and line-of-sight satellite communications (SATCOM) systems.
- Depending on the terminal configuration, capabilities may include transmission and reception of voice, data, imagery, and video as well as broadcast reception over protected and wideband satellites and line-of-sight systems.
- The FAB-T Program Office will develop Increment 1 terminals capable of providing air and ground communications using the Extremely High Frequency (EHF) and Advanced Extremely High Frequency (AEHF) waveforms. Increment 1 Airborne Wideband Terminals are planned for the B-2, B-52, and RC-135 aircraft. The Command Post Terminal (CPT) will upgrade the existing fixed and transportable terminals employed with the ground and airborne (E-4 and E-6B) command posts.
- The FAB-T program plans multiple hardware and software releases (referred to as 'Blocks') within Increment 1. Block 6 terminals are intended to be Low Data Rate capable and backward compatible with the legacy Milstar satellites. Block 6 terminals are developmental terminals and will not be fielded. The plan is to field Increment 1 terminals in a Block 8 configuration that will be fully capable of operating with the AEHF satellites, in addition to being backward compatible with Milstar.
- Future capabilities of FAB-T include interoperability with two other satellite payloads:
  - Ultra High Frequency Follow-on - Enhanced/EHF satellite payload
  - Enhanced Polar System satellite payload.

Mission

The entire chain of command, including the President, the Secretary of Defense, Combatant Commanders, and support component forces, will use FAB-T for worldwide, secure, survivable transmission and reception of voice, data, imagery, and video. FAB-T is also intended to be used for broadcast reception over protected and wideband SATCOM systems to support the full range of military operations including nuclear warfare and all aspects of conventional warfare.

Major Contractor

The Boeing Company, Command, Control & Communication Networks – Huntington Beach, California

Activity

- The FAB-T program manager determined that the remaining program cost exceeded budget and has been working with the contractor team to establish a new integrated baseline. The program manager plans to seek approval of the new baseline by the Defense Acquisition Executive in 1QFY11. The program schedule is likely to slip by 21 months or more.
- AFOTEC conducted OA-2 July through October 2009 to inform the AWT Low-Rate Initial Production (LRIP) decision originally scheduled for 2QFY10. The AWT and CPT LRIP decisions have been combined into one decision and moved into FY13, pending a new program baseline.
- AFOTEC is planning for a third operational assessment in FY12 to inform the LRIP decision scheduled for 1QFY13. AFOTEC plans to conduct an IOT&E in FY13 to inform the FAB-T Increment 1 full-rate production decision scheduled for FY14. The test schedule is contingent on approval of the new program baseline.
- The program manager conducted a reliability improvement test in 1QFY10.
- The integrated test team is updating the Test and Evaluation Master Plan (TEMP) to provide greater detail on future test events in preparation for the LRIP decision; to strengthen the testing in the threat environment; and to incorporate plans for reliability growth testing.

Assessment

- Based upon OA-2 results, the FAB-T, Increment 1 AWT is not on track to meet mission requirements and needs further development and testing to become operationally effective and operationally suitable.
- Flight tests aboard the test bed aircraft during OA-2 demonstrated that the Block 6 AWT terminal is capable of over-the-air communication with other FAB-T terminals and legacy Air Force CPTs through the Milstar satellite. Multiple software failures led to a poor reliability result. The program manager has identified the root cause of the reliability problems and a fix is planned for Block 8. Reliability Growth Testing is planned to inform the LRIP decision.
- The scheduled delivery of the FAB-T CPT does not support the Air Force need for command and control of AEHF. The Massachusetts Institute of Technology Lincoln Laboratory is developing an interim terminal to provide command and control of AEHF satellites until FAB-T CPTs are ready.
- The current program is schedule-driven, leading to an aggressive test schedule with little reserve for correction of any significant deficiencies discovered during software testing, formal qualification testing, and reliability growth testing.
- Qualification testing does not include over-the-air testing with AEHF satellites due to an aggressive schedule. Over-the-air testing with the AEHF constellation is planned after the LRIP decision.
- Reliability testing in 1QFY10 demonstrated that the AWT Block 6 terminals had a mean time between critical mission failure rate of 250 hours against a 785-hour requirement.
- The program has reinstituted a more robust reliability growth test into their schedule and is currently planning the activity. However, the program has not defined their reliability growth program beyond the LRIP decision point; this may result in supportability risks to the program.
- The program did not anticipate the complexity of the AEHF Extended Data Rate waveform software development and integration effort, creating significant risk and schedule delays. The revised baseline schedule is designed to reduce concurrency risk of Block 8 development and integration paths. A result of reducing Block 8 concurrency risk is a potential 21-month or more delay to the LRIP decision.

Recommendations

- Status of Previous Recommendations. The Air Force is satisfactorily addressing the three FY09 recommendations.
- FY10 Recommendation.
  1. The Air Force should perform over-the-air testing with orbiting AEHF satellites during qualification testing to inform the LRIP decision.

Global Hawk High-Altitude Long-Endurance Unmanned Aerial System, RQ-4

Executive Summary

- The Global Hawk Block 20 and Block 30 systems completed initial developmental testing and entered IOT&E in October 2010.
- Poor aircraft and system-level reliability and availability remain the most significant Global Hawk operational performance deficiencies. The Global Hawk Block 20 and Block 30 systems are unlikely to meet operational availability or reliability performance thresholds during IOT&E or for initial fielding in FY11. Enhanced Integrated Sensor Suite (EISS) technical performance, aircraft all-weather capabilities, and system interoperability with supporting intelligence exploitation systems also experienced problems during developmental testing.
- The Airborne Signals Intelligence Payload (ASIP) sensor successfully completed initial integration testing on the Global Hawk Block 30 aircraft. The system demonstrated a useful level of operational utility with some notable shortfalls in communication signal collection and processing.
- Multi-Platform Radar Technology Insertion Program (MP-RTIP) sensor testing on the Proteus surrogate test aircraft demonstrated improved radar system stability. Both stand-alone and concurrent ground map and moving target indicator modes showed improved performance and were approved for integration on the Global Hawk Block 40 system.
- The Global Hawk Combined Test Force (CTF) completed the first phase of Global Hawk Block 40 aircraft performance and envelope expansion testing. The first MP-RTIP sensor was delivered for ground testing on the Block 40 aircraft.
- A Global Hawk "Nunn-McCurdy-like" program review led by the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD (AT&L)) concluded that major revisions to the Global Hawk acquisition, development, and test strategies will be required to successfully complete the program and deliver mature system performance.
- The Air Force successfully integrated and tested the Battlefield Airborne Communications Node (BACN) payload on two Block 20 aircraft in response to a U.S. Central Command (CENTCOM) Joint Urgent Operational Need (JUON) request.

System

- Global Hawk is a remotely piloted, high-altitude, long-endurance airborne intelligence, surveillance, and reconnaissance system.
- The Global Hawk system includes:
  - The RQ-4A (Block 10) aircraft or the larger RQ-4B (Blocks 20, 30, and 40) aircraft.
  - A payload consisting of electro-optical, infrared, and radar imaging sensors, electronic emission detection sensors, or communications relay systems.
  - Launch and recovery and mission control ground stations.
- The RQ-4A Block 10 payload is the Integrated Sensor Suite (ISS) which includes infrared, optical, and synthetic aperture radar sensors for imaging ground targets.
- The RQ-4B Block 20 payload can be either the EISS or the BACN system. The EISS sensor includes infrared, optical, and synthetic aperture radar sensors for imaging ground targets. The BACN system is a theater communications relay system.
- The RQ-4B Block 30 multi-intelligence payload includes both the EISS infrared, optical, and synthetic aperture radar sensor and the ASIP electronic signal collection sensor.
- The RQ-4B Block 40 payload is the MP-RTIP synthetic aperture radar designed to simultaneously collect imagery intelligence on stationary ground targets and track ground moving targets.
- Ground crews use line-of-sight and beyond line-of-sight satellite and radio communications to control the Global Hawk system and transmit collected data.
- Distributed ground stations receive collected intelligence data directly from the air vehicle via data link or from the mission control ground station across existing ground or satellite data distribution systems.

Mission

- Air Force Global Hawk units provide high-altitude, long-endurance intelligence collection capabilities not available in other theater intelligence collection systems. Progressive fielding of the RQ-4B Block 30 system will enable the eventual retirement of the Air Force U-2 intelligence, surveillance, and reconnaissance aircraft.
- The RQ-4 Global Hawk system collects and provides still imagery and/or signals intelligence information to the theater commander's intelligence exploitation assets, such as the Distributed Common Ground Station. Global Hawk can also provide imagery intelligence directly to forward-based personnel through direct line-of-sight data link systems. Ground-based intelligence analysts exploit collected imagery and signals information to provide intelligence products in support of the entire spectrum of theater operations.
- The theater Air Operations Center tasks Air Force Global Hawk reconnaissance units to collect imagery and signals data in order to answer essential elements of information identified by the theater commander or to directly support a ground unit.

Major Contractor

Northrop Grumman Aerospace Systems, Strike and Surveillance Systems Division – San Diego, California

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Activity

Block 10

- All Block 10 Global Hawk aircraft are fielded in support of deployed CENTCOM operations or Air Force training activities. Sustainment activities necessary to support these aircraft continued during 2010. Current Air Force plans call for these aircraft to be replaced by Block 30 aircraft beginning in FY11.

Block 20 and Block 30

- The combined Global Hawk Block 20 and Block 30 developmental test program continued in 2010 in preparation for the Global Hawk Block 20/30 IOT&E and initial fielding. In August 2010, the Global Hawk Combined Test Force (CTF) completed Global Hawk Block 20 and Block 30 aircraft, sensor, and ground station developmental test events required to enter IOT&E. Some planned Global Hawk Block 20/30 operational capabilities were deferred for future delivery in order to maintain the Block 20/30 acquisition program schedule.
- Global Hawk Block 20 and Block 30 production acceptance test responsibilities were transferred from the Global Hawk CTF at Edwards AFB, California, to the Global Hawk operational unit at Beale AFB, California. This transfer was intended to increase the pace of Global Hawk Block 20 and Block 30 developmental testing.
- In February 2010, DOT&E participated in a Global Hawk Block 20/30 Comprehensive Test Review conducted by the USD (AT&L) staff. This review assessed the progress of the Global Hawk Block 20/30 developmental test program. Results were reported to the OSD Overarching Integrated Product Team in March 2010.
- In March 2010, the Air Force conducted a Global Hawk Block 20/30 Integrated Systems Evaluation (ISE) as a system-level developmental test "graduation" event. The ISE was intended to demonstrate Global Hawk end-to-end system performance for imagery and signals intelligence collection and dissemination. This test revealed significant interoperability, radar moving target detection, and EISS image quality problems. Following a technical review of these deficiencies, the Air Force conducted additional interoperability flight tests in July and September 2010 that verified interoperability corrective actions.
- In August 2010, the Air Force certified the Global Hawk Block 20 and Block 30 systems ready for IOT&E. Global Hawk Block 20/30 IOT&E began in October 2010 and is scheduled to conclude in January 2011.
- In September 2010, the Air Force initiated a multi-year Global Hawk Block 30 FOT&E program to complete system development and deliver all remaining operational capabilities specified in the Global Hawk operational capabilities documents. The initial phases of this program will deliver hardware and software improvements necessary to commence Pacific Command (PACOM) and European Command (EUCOM) operations in 2011.
- In response to a CENTCOM JUON request, the Air Force completed a separate Block 20 developmental and operational flight test program to support rapid fielding of the BACN communications relay payload on two Global Hawk Block 20 aircraft. The Global Hawk CTF executed this test program concurrently with the ongoing Block 20/30 and Block 40 developmental test programs. Testing was completed in September 2010.

Block 40

- In 2010, the Air Force continued MP-RTIP sensor risk-reduction developmental flight testing using the Proteus surrogate test bed aircraft. These flight tests focused on improving radar technical performance for the basic MP-RTIP radar ground map and moving target indicator modes. These tests evaluated system improvements necessary to operate these basic radar modes simultaneously. The program also accomplished limited testing of the high-range resolution radar mode.
- The Air Force proposed an initial Global Hawk Block 40 development and test schedule leading to a Global Hawk Block 40 and MP-RTIP IOT&E and initial fielding in FY13.

The Air Force began execution of this schedule with the first Global Hawk Block 40 aircraft in March 2010. The Global Hawk CTF completed eleven aircraft flight envelope expansion test missions focusing on flying qualities, aircraft performance, and flight safety. These missions were accomplished using a basic Block 40 aircraft with no sensor installed. This initial phase of testing was delayed for 3 months due to competing Block 20 and Block 30 test program priorities.
- In July 2010, the first MP-RTIP sensor payload was delivered for integration and ground testing on the Global Hawk Block 40 aircraft. Ground sensor integration testing will continue through February 2011. Integrated Block 40 and MP-RTIP sensor flight testing is planned to begin in February 2011.

All Blocks
- In July 2010, in response to continued Global Hawk program cost growth, USD (AT&L) initiated a Global Hawk "Nunn-McCurdy-like" program review covering the entire Global Hawk acquisition, development, and test program. USD (AT&L) deferred further Global Hawk procurement decisions pending completion of this review.

Assessment

Block 20 and Block 30
- The Global Hawk CTF stabilized test schedule execution for the combined Global Hawk Block 20 and Block 30 developmental test program in 2010. The CTF was able to maintain the revised Block 20/30 flight test schedule leading to the start of Global Hawk Block 20/30 IOT&E in October 2010. Transfer of Global Hawk production acceptance flight test activities from the Global Hawk CTF at Edwards AFB, California, to the operational unit at Beale AFB, California, significantly improved the pace of Global Hawk Block 20/30 flight test execution. The final transition of production acceptance flight test activities from Beale AFB to Air Force Plant 42 in Palmdale, California was completed in September 2010.
- Poor aircraft system reliability and availability remain the most significant operational deficiencies for all Global Hawk systems. The operational advantages inherent in the long endurance Global Hawk aircraft platform will not be realized unless system reliability improves. USD (AT&L) directed the Global Hawk program to develop a comprehensive reliability improvement program to address critical system reliability shortfalls. Program reliability metrics have been refined to improve identification and tracking of reliability shortfalls. However, the final Global Hawk Reliability Performance Improvement Plan has not been finalized or funded for implementation.
- DOT&E concurs with the OSD Global Hawk Comprehensive Test Review findings and conclusions. As of February 2010, the Global Hawk Block 20/30 development program was making progress, but remained short of required operational capability thresholds in several key areas. The review concluded that the program would not deliver some key operational capabilities in time to support IOT&E and initial fielding. Identified high-risk areas included system-level reliability and availability, EISS technical performance, and some aircraft all-weather and communications capabilities required for worldwide operations.
- The Air Force deferred development of some Block 20/30 operational capabilities in order to maintain program schedule. Deferrals include EISS ground moving target detection, EISS sensor resolution, imagery-derived target geolocation, some all-weather and communication system capabilities, and system-level reliability and availability performance thresholds. These capabilities will not be delivered for the Global Hawk Block 20/30 IOT&E or initial fielding. The Joint Requirements Oversight Council (JROC) did not approve these operational capability deferral decisions.
- Due to Global Hawk program delays and decisions to defer significant operational capabilities, the current Global Hawk Capabilities Development Document (CDD) no longer provides an accurate roadmap to guide Global Hawk Block 30 and Block 40 development and test planning.
- The March 2010 Global Hawk Block 20/30 ISE end-to-end system flight tests identified significant EISS image quality, radar moving target detection, and system interoperability deficiencies. These deficiencies were discovered near the end of the Global Hawk Block 20/30 developmental test program. Additional corrective actions and re-test efforts appeared to resolve many of the interoperability problems prior to IOT&E. Late discovery of these issues indicates a need to increase emphasis on Global Hawk interoperability and end-to-end operational performance during follow-on Block 30 and Block 40 developmental testing.
- The Global Hawk CTF completed the pre-IOT&E phase of Global Hawk Block 30 ASIP developmental testing in April 2010. The ASIP sensor did not meet all system specification requirements. However, with the exception of some specific signal collection problems, observed specification shortfalls did not appear to have a significant operational impact.
- Low spare parts availability is expected to limit system operational availability during the Global Hawk Block 20/30 IOT&E and initial fielding. Spare parts shortages will be exacerbated by the system reliability shortfalls observed during developmental testing.
- In August 2010, the Air Force certified the Global Hawk Block 20 and Block 30 systems ready to enter IOT&E. DOT&E concurs with this decision despite known system performance and reliability shortfalls. A comprehensive operational test of the Global Hawk 20/30 system is required to evaluate delivered system operational performance prior to further Global Hawk production decisions and the FY11 operational employment decision.

- Following the FY11 Global Hawk Block 20/30 IOT&E, the Air Force will continue Block 30 system development and testing. Follow-on developmental and operational tests are required to correct known deficiencies, enable FY11 Block 30 EUCOM and PACOM initial operations, support eventual U-2 aircraft retirement, and meet all remaining operational capability thresholds. The first phase of a multi-year, Block 30 FOT&E program was initiated by the Air Force in August 2010. Concurrent execution of this long-term Global Hawk Block 30 test program with ongoing Global Hawk Block 40 testing and other program test priorities will be a challenge. The Air Force has not complied with previous USD (AT&L) direction to submit a comprehensive and resourced Global Hawk Test and Evaluation Master Plan (TEMP) for a Block 30 follow-on test program. The full scope, schedule, and cost of the Block 30 follow-on test program have not been defined.
- In September 2010, the Air Force successfully completed the Global Hawk Block 20 BACN test program in support of the CENTCOM JUON request. The program executed 13 developmental and operational flight test missions leading to initial fielding in October 2010. Operational test results indicate that the BACN payload, as installed on the Global Hawk Block 20 aircraft, provides the expected operational communications relay capability. However, Global Hawk aircraft reliability and availability shortfalls may limit the operational utility of deployed Block 20 BACN systems.

Block 40

- In 2010, the Air Force and Raytheon continued risk reduction developmental flight testing of the MP-RTIP sensor on the Proteus surrogate test bed aircraft. Contractor test results indicate that system stability improved significantly for the two MP-RTIP "core" radar modes: Synthetic Aperture Radar (SAR) ground map imagery and Ground Moving Target Indicator (GMTI) tracking. Fewer system resets were reported and system in-flight availability rates appear to be approaching operational requirement thresholds. System stability for the "concurrent" SAR/GMTI radar mode also improved, but remained short of required operational thresholds. Based on these improved test results, all three radar modes will be included in the Global Hawk Block 40 development and integration test program. Other MP-RTIP modes such as high range resolution (HRR), airborne moving target indicator (AMTI), and maritime moving target indicator (MMTI) were deferred for future development.
- The Global Hawk CTF completed the first phase of Global Hawk Block 40 aircraft envelope expansion and safety verification flights in July 2010. These tests evaluated the impact of Block 40 airframe design changes on aircraft flying qualities and performance characteristics. Initial test results showed good aircraft flight stability and a positive correlation between predicted and actual flight performance. The second phase of Block 40 radar flight integration and verification testing in early 2011 will assess aircraft power and cooling system performance with the MP-RTIP sensor installed.
- Although the Global Hawk Block 40 flight test program commenced in 2010, the Air Force has not yet complied with previous USD (AT&L) direction to submit a comprehensive and resourced Global Hawk Block 40 TEMP. The Air Force has not fully defined the Block 40 test strategy, schedule, test requirements, or the resources necessary to complete this test program.
- The proposed Air Force Global Hawk Block 40 test schedule, leading to IOT&E and initial fielding in FY13, is high risk. Funding reductions will reduce Global Hawk CTF test capacity by at least 30 percent in 2011. It is unclear whether the Global Hawk CTF can execute the proposed Global Hawk Block 40 flight test program concurrently with Global Hawk Block 40 production acceptance tests, Block 30 follow-on tests, and other competing program test priorities. The availability of Global Hawk ground stations to support concurrent execution of the Global Hawk Block 40 test program and other competing Global Hawk test activities at Edwards AFB, California, is emerging as a critical limiting factor.
- Interoperability testing of the Global Hawk Block 40 system with supporting battle management command and control (BMC2), and intelligence tasking, processing, exploitation, and dissemination (TPED) systems is a critical part of the Block 40 development and operational test program. However, uncertainty regarding the Air Force and Army BMC2 and TPED architectures intended to integrate Block 40 intelligence collection capabilities continues to hinder system development.

All Blocks

- DOT&E concurs with the USD (AT&L) Global Hawk "Nunn-McCurdy-like" program review finding that the current Global Hawk program and test strategies are not adequate to match program complexity. A significant test strategy revision is required to support delivery of required Global Hawk Block 30 and Block 40 capabilities. Current system development and test schedules are no longer consistent with documented program operational requirements.
- DOT&E concurs with the Global Hawk "Nunn-McCurdy-like" review technical performance findings and conclusions. Global Hawk system reliability, sensor performance, and spare parts availability problems are likely to affect IOT&E results and limit initial operational capabilities.

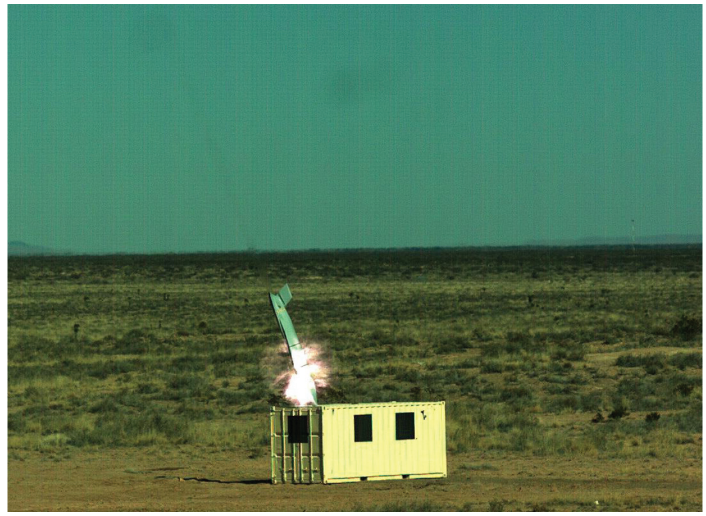
Recommendations

- Status of Previous Recommendations. The Air Force made progress on all seven recommendations from previous annual reports. Five of the seven recommendations were resolved.
- FY10 Recommendations. The Air Force should:
  1. Finalize and implement a Global Hawk Reliability Performance Improvement Plan to address identified system reliability and operational availability deficiencies.
  2. Update Global Hawk Block 30 and Block 40 operational requirements to provide clear expectations and priorities for future development of Global Hawk operational capabilities.
  3. Develop a comprehensive Global Hawk Block 30 follow-on test strategy to support 2011 PACOM and EUCOM fielding, correction of known deficiencies, testing of previously deferred capabilities, and delivery of all future capabilities defined in Global Hawk operational requirements documents.
  4. Develop a comprehensive Global Hawk Block 40 test strategy and schedule to support delivery of Block 40 MP-RTIP radar modes and operational capabilities.
  5. Evaluate Global Hawk Block 30 follow-on test requirements, Block 40 development test requirements, and other Global Hawk test priorities to determine if concurrent FY11 through FY13 execution of these programs can be accomplished within the capacity of the Global Hawk CTF.
  6. Increase emphasis on early Global Hawk Block 30 and Block 40 interoperability testing with the supporting intelligence data exploitation "system-of-systems." Early discovery and correction of deficiencies is required to assure that Global Hawk systems are effectively integrated with existing intelligence data transmission and exploitation systems.
  7. Define the supporting Global Hawk Block 40 BMC2 and intelligence TPED architectures planned for Global Hawk Block 40 IOT&E and initial fielding.

Joint Air-to-Surface Standoff Missile (JASSM)

Executive Summary

- The Air Force executed one successful baseline Joint Air-to-Surface Standoff Missile (JASSM) shot in January 2010. This live shot focused on testing the new or re-designed Missile Control Unit, Digital Engine Controller, Actuator Control electronics, and Air Data Probe.
- There were no production lot Reliability Acceptance Program shots in 2010.
- The Air Force executed four JASSM-Extended Range (JASSM-ER) live fire shots in FY10. Three of four missiles accurately located and subsequently destroyed the associated targets at both nominal and maximum JASSM-ER ranges. The fourth missile experienced an engine over-speed during flight and after one hour of flight impacted the ground 14 nautical miles short of the target area. A failure review board identified the cause for the failure and the program implemented corrective action and screening.
- The Air Force should continue the pursuit of the Electronic Safe and Arm Fuze (ESAF), assuring the availability of a second fuzing option, as well as pursuing technological advancement in fuzing and increasing JASSM's reliability.
- The Air Force should continue to characterize the reliability of baseline missile production lots, incorporating reliability and program management improvements.



System

- Baseline JASSM is a stealthy cruise missile that flies a preplanned route from launch to a target, using GPS guidance and an internal navigation system. JASSM:
  - Has a 1,000-pound penetrating warhead.
  - Has an imaging infrared seeker that can be used for greater accuracy and precision; the seeker uses image templates prepared by a rear echelon intelligence unit.
  - Can be launched by B-1, B-2, B-52, and F-16 aircraft.
  - Includes a container that protects the weapon in storage and aids ground crews in moving, loading, and checking the missile.
  - Uses the same Air Force mission planning systems used for aircraft and other weapons.
- JASSM ESAF is intended to be a more reliable fuze with the same capabilities as the baseline fuze. Continued development is unfunded.
- JASSM-ER is intended to fly longer ranges using a more efficient engine, larger capacity fuel tanks, and other modified components (all within the same outer shape).
- JASSM Anti-Surface Warfare (ASuW) adds the capability to attack maritime targets using two way data-link for in-flight retargeting. Requirements development is ongoing. This effort is unfunded.

Mission

- Operational units equipped with JASSM intend to employ the weapon from multiple aircraft platforms against high value or highly defended targets from outside the lethal range of many threats. Units equipped with JASSM intend to use it to:
  - Destroy targets with minimal risk to flight crews and support air dominance in the theater
  - Strike a variety of targets greater than 200 miles away
  - Execute missions using automated preplanned or manual pre-launch retargeting planning
  - Attack a wide range of targets including soft, medium, and very hard (not deeply buried) targets
- Units with JASSM-ER intend to support the same missions with a range more than twice the baseline JASSM.
- Units with JASSM ASuW would add the capability to attack maritime targets and expanded retargeting capabilities in executing JASSM missions.

Major Contractor

Lockheed Martin, Missile and Fire Control – Orlando, Florida

Activity

- All testing was conducted in accordance with the DOT&E-approved Test and Evaluation Master Plan and test plan.

JASSM Baseline

- The Air Force executed one successful live shot in January 2010. The primary objectives of this flight were to provide final validation of a new Missile Control Unit, recently upgraded Actuator Control electronics and Digital Engine Controller, and a redesigned Air Data Probe, all of which enhance missile performance and reduce the risk of obsolescence in these components.
- The Air Force is certifying JASSM for carriage and employment on the F-15E Strike Eagle. A series of jettison and separation tests continued in May 2010, which included the first separation (unpowered employment) of a JASSM from the centerline station of the F-15E. The jettison testing continued in August and September 2010, and included the first and second jettison from the right wing, the third and fourth jettison overall.
- There were no production lot Reliability Acceptance Program shots in 2010. The program office planned to test retrofitted Lot 6 weapons in 3QFY10. Due to a failure of Flight Termination System batteries in the Test Instrumentation Kits (TIKs), Lot 6 testing was postponed. The limited number of TIKs were used primarily for JASSM-ER testing to meet production contractual obligations.

JASSM ESAF

- The ESAF program remains unfunded; however, the Air Force renewed technical interest in the program. The ESAF has more Built-in Test (BIT) capability than the current electro-mechanical FMU-156/B fuze. The ESAF would be used in both baseline and ER variants.

JASSM-ER

- The Air Force executed four JASSM-ER live fire shots in FY10. Three of four missiles accurately pinpointed and subsequently destroyed three of the four associated targets at both nominal and maximum JASSM-ER ranges. The fourth missile experienced an engine over-speed during flight and after one hour of flight impacted the ground 14 nautical miles short of the target area. A failure review board identified the cause for the failure and the program implemented corrective action and screening.

Assessment

- Despite improvements in workmanship and production processes, there is still a need to evaluate the inherent reliability of production lot missiles to assure that the reliability growth plan is successful.
- DOT&E is concerned with the Air Force's current decision not to fund the ESAF program. The ESAF program should replace the current electromechanical fuze, which relies on moving parts prone to reliability failures. LFT&E requirements (sled and flight tests) will need to be reexamined for data completeness should the Air Force chose to reinitiate the ESAF program.
- The late summer and fall JASSM-ER shots indicate that the JASSM-ER may meet requirements. However, full characterization of the weapon requires the two final integrated test shots scheduled for 1QFY11. These shots will support the Milestone C Defense Acquisition Board scheduled for late 1QFY11.

Recommendations

- Status of Previous Recommendations. Due to the battery problems in the TIKs, the Air Force could not formally address the FY09 recommendation on reliability characterization. The program office is re-invigorating the availability of a second fuzing option and upgrading the current fuze to have less moving parts. Their objective is to improve fuze reliability, provide a second fuzing source, increase electronic BIT function, and improve testability.
- FY10 Recommendation.
    1. The Air Force should continue to characterize the reliability of baseline missile production lots, incorporating reliability and program management improvements once TIK batteries return to inventory.

Joint Cargo Aircraft (JCA)

Executive Summary

- Resource Management Decision 802 transferred the Joint Cargo Aircraft (JCA) program to the Air Force. DOT&E approved the Test and Evaluation Master Plan in April 2010.
- The Army and Air Force Multi-Service Operational Test and Evaluation (MOT&E) occurred from May through September 2010. Full-rate production for the JCA is scheduled for February 2011.
- Preliminary results from the MOT&E show effectiveness and suitability deficiencies. DOT&E expects to publish a Combined Operational and Live Fire Test and Evaluation Report in 2QFY11.
- The survivability of the JCA against the threats tested and analyzed is comparable to other military cargo aircraft.

System

- The JCA is a two-engine six-blade turboprop tactical transport aircraft.
- The aircraft is designed to operate from short (2,000 feet) unimproved or austere runways. It has a 2,400 nautical mile range and a maximum payload of 13,000 pounds. The JCA is to be capable of self-deployment to theater.
- The JCA can carry three standard pallets, six bundles for airdrop, 40 passengers, 26 combat-equipped paratroopers, or 18 litters for medical evacuation.
- The JCA incorporates a fully integrated defensive systems suite consisting of the AN/AAR-47A(V)2 (missile and laser warning system), AN/APR-39B(V)2 (radar warning receiver), and AN/ALE-47(V) (chaff and flare dispenser) onboard the aircraft.

Mission

- Air Force units equipped with the JCA primarily transport time sensitive and mission-critical cargo and personnel to forward deployed forces in remote and austere locations.
- The Air Force intends to use the JCA to support their intra-theater airlift operations.
- Secondary missions for the JCA include performing routine sustainment operations, medical evacuation, support of Homeland Defense, airdrop of personnel and equipment, and other humanitarian assistance missions.

Major Contractor

L-3 Communications Integrated Systems, L.P. – Greenville, Texas

Activity

- Production Qualification Testing (PQT) took place from December 2008 through September 2010 at China Lake, California; Eglin AFB, Florida; Huntsville, Alabama; Fort Rucker, Alabama; Yuma Proving Grounds, Arizona; Fort Bragg, North Carolina; and Patuxent River, Maryland. The PQT accumulated a total of 519 flight hours.
- Multi-Service Operational Test Phase I (Air Drop) took place from May 4 through June 11, 2010, at Fort Bragg, North Carolina. The JCA flew approximately 61 hours. Test scenarios included static line and military free fall jumps and bundle and container delivery system drops.
- Multi-Service Operational Test Phase II (Air Land) took place from July 26 through August 31, 2010, at Peterson AFB, Colorado. The JCA flew approximately 147 flight test hours. Test scenarios included Air Land Delivery, Aerial Sustainment, and Aeromedical Evacuation.
- The Multi-Service Operational Test Self-Deployment phase took place on September 9-13, 2010, from Peterson AFB, Colorado, to Naval Station Rota, Spain. This phase evaluated the JCA's capability to fly an unrefueled distance of 2,400 nautical miles with a 45-minute fuel reserve while carrying the full aircraft crew and 2,000 pounds of cargo.
- The program completed Live Fire Test and Evaluation in FY09 and delivered several final test results reports in FY10.
- Testing was conducted in accordance with the DOT&E-approved test plan.

Assessment

- The MOT&E consisted of operationally realistic missions, aircrews, and support. Operational test missions included time-sensitive combat delivery to austere airfields, aerial delivery of cargo and personnel, medical evacuation, and troop resupply.

- Data analysis of the May through September MOT&E is ongoing. DOT&E expects to publish a Combined Operational and Live Fire Test and Evaluation Report to support the full-rate production decision scheduled for 2QFY11.
- Preliminary results indicate the JCA can perform critical support missions across the spectrum of military operations with deficiencies in the following areas:
  - The JCA was unable to demonstrate the enhanced take-off and landing performance Key Performance Parameter due to Federal Aviation Administration (FAA) restrictions, service policy, and the operating manual. The climb gradient required by the FAA limits the maximum weight for JCA take-off. By relaxing the climb gradient, the JCA could take off with higher weights, perhaps meeting the KPP requirement. A wartime commander in theater would have the option of relaxing the FAA requirement to allow take-off with larger payloads.
  - During Phase II of the MOT&E, the loadmasters discovered that standard 463L pallets used for internal cargo delivery would not consistently load or unload when the rail locking mechanism was actuated. Often, the loads were dislodged from the aircraft with help from additional personnel and/or aircraft start/stop actions. The inability to consistently off-load cargo significantly degrades the JCA capability to accomplish the Air-Land delivery mission (specifically, the delivery of cargo on pallets). Analysis is ongoing.
  - The Heads-Up Display (HUD) often shifted during flight and resulted in vertical readings about 2-3 degrees off true horizon. This could be a potential safety issue if the pilots were following the HUD in Instrument Meteorological Conditions or using the HUD to land at a poorly marked airfield or unfamiliar landing zone.
  - The pilots reported that the Flight Management System (FMS) was not user friendly and "dumped" route information if the crew did not follow the exact route loaded into the computer. The pilots frequently had to rebuild flight plans and landing zones while en route to the intended destination.
- Preliminary results indicate the JCA can communicate and is interoperable with required military, government, civil, and non-government organizations with the following shortcomings:
  - Subject matter expert support was required to set up the Blue Force Tracker through the electronic data module and for filling secure communications. The Blue Force Tracker was operational intermittently throughout the MOT&E.
  - The public service radio caused interference on the other aircraft radios even after it was powered down.
- Preliminary results indicate the JCA has suitability deficiencies. In order to meet the 90 percent probability that the system could complete a 5.6 hour mission successfully without experiencing a system abort at an 80 percent confidence level, the system needed to demonstrate a Mean Time Between System Aborts (MTBSA) of at least 53 flight hours. During MOT&E, the observed MTBSA was 22.5 flight hours at an 80 percent confidence level. The following suitability shortcomings need improvement:
  - Poor reliability of Electronic Data Manager and Blue Force Tracker
  - Training of federated (not integrated) systems
  - Operators' manuals and checklists need improvement
- The survivability of the JCA against the threats tested and analyzed is comparable to other military cargo aircraft.

Recommendations

- Status of Previous Recommendations. The program satisfactorily addressed the FY09 recommendation.
- FY10 Recommendations.
  1. Prior to fielding and deployment, the Air Force should reduce fit interference in the rail locking system and operationally evaluate the adjusted system's ability to prevent the pallets from jamming.
  2. The Air Force Program Office should implement an aggressive reliability growth program and continue to monitor reliability improvements.
  3. Prior to fielding and deployment, the Air Force should improve the stability of the HUDs and evaluate those improvements during operationally realistic missions that include take-offs and landings at unimproved runways.

Joint Direct Attack Munition (JDAM)

Executive Summary

- The Direct Attack Moving Target Capability (DAMTC) became a program of record in February 2010 and competitively selected Laser Joint Direct Attack Munition (LJDAM) as the non-developmental material solution. The program conducted the first part of an Integrated Test, which will result in an Operational Assessment prior to a December 2010 Low-Rate Initial Production (LRIP) decision. As a non-developmental program, the Integrated Test is the only test phase prior to commencement of operational testing.
- The Navy released eight weapons designated as operational assessment free-flight events during the Integrated Test, followed by an Air Force eight-weapon test of the system's ability to attack maneuvering targets using the new Operational Flight Program (OFP) released before DAMTC became a program of record.

System

- The Joint Direct Attack Munition (JDAM) is a low-cost, autonomously controlled, adverse weather, accurate guidance kit tailored for Air Force/Navy general purpose bombs to include:
  - 2,000-pound Mk 84 and BLU-109 bombs
  - 1,000-pound Mk 83 and BLU-110 bombs
  - 500-pound Mk 82, BLU-111, and BLU-126 bombs
- A GPS-aided inertial navigation system provides primary guidance to the weapon. Augmenting the JDAM inertial navigation system with GPS signals enhances accuracy.
- Guidance and control designs enable accuracy of less than 5 meters when GPS is available and less than 30 meters when GPS is absent or jammed after release.
- The LJDAM provides an increased capability to attack moving targets. In addition to retaining the precision of JDAM, the LJDAM provides enhancements for moving target attacks, precise laser target designation to eliminate Target Location Error, capability to operate beneath a cloud layer, and ability to select weapon impact angle in combination with laser-guided precision.

- DAMTC uses LJDAM with the updated Block 8 OFP as its material solution for a Navy and Marine Corps dual-mode weapon. This is a non-developmental program using LJDAM, whose original capability was restricted by a less developed OFP and limited testing that occurred because the program was fielded as part of an Urgent Operational Need.

Mission

- Combatant commanders use JDAMs employed by fighter, attack, and bomber aircraft to engage targets day or night, in all weather at the strategic, operational, and tactical levels of warfare.
- Combatant commanders employ JDAM against fixed and relocatable soft and hard targets, to include command and control facilities, airfields, industrial complexes, logistical and air defense systems, lines of communication, and all manner of battlefield forces and equipment.
- Navy and Marine Corps fighter and attack aircraft employ JDAM and LJDAM to engage stationary targets in all weather, as well as to reactively target stationary and moving targets.

Major Contractor

The Boeing Company, Integrated Defense Systems – St. Louis, Missouri

Activity

- The Navy established DAMTC as a program of record February 2010 selecting LJDAM as the non-developmental material solution. As a non-developmental program, the Integrated Test is the only test phase prior to commencement of operational testing. DOT&E engaged with the Navy in May 2010 to put DAMTC on oversight and assure future testing was in accordance with DOT&E-approved test plans.
- Naval Commander, Operational Test and Evaluation Force (COTF) completed the first portion of its Integrated Test Phase (IT-C1), which included eight free-flight weapon releases. The Operational Assessment, scheduled for May to December 2010, should provide a basis for assessment of DAMTC testing and results to date. COTF intends to release an Operational Assessment report prior to the anticipated LRIP decision in December 2010.
- The Air Force released eight free-flight guided weapons as part of LJDAM Block 8 OFP testing to demonstrate a maneuvering target capability.

- DOT&E and COTF, as well as Department of the Navy acquisition personnel, collaborated significantly to develop a Design of Experiments plan for the Operational Test Phase of DAMTC. An updated Test and Evaluation Master Plan is anticipated prior to the December LRIP decision.

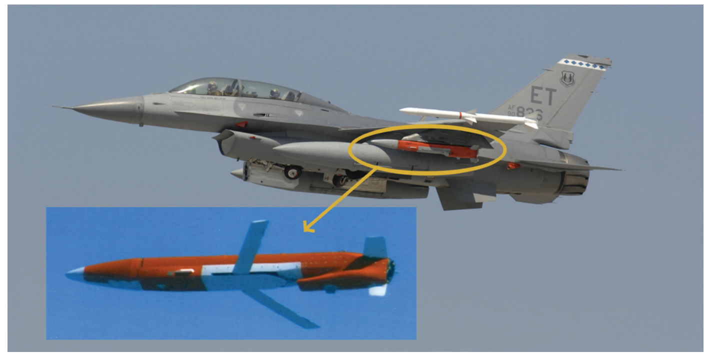
Assessment

- Both the Air Force eight-weapon OFP test and the Navy's eight weapons released during Integrated Test as part of the Operational Assessment indicate that the weapon has the potential to meet DAMTC requirements.
- DAMTC's preliminary results on six of eight weapons assessed so far demonstrate average miss distances within the threshold requirement of six meters with no major system shortfalls or performance deficiencies.
- Review of the current test strategy indicates a properly resourced program for both the Integrated Test and Operational Test Phases.

Recommendations

- Status of Previous Recommendations. The Navy is completing the FY08 recommendation by updating the Test and Evaluation Master Plan as a result of additional procurement and development of the LJDAM system.
- FY10 Recommendation.
    1. The Navy should closely monitor and allow adequate time to analyze the results of the remaining 10 Integrated Test weapons before initiating the Operational Testing Phase.

Miniature Air-Launched Decoy (MALD) (including Miniature Air-Launched Decoy – Joint (MALD-J))



Executive Summary

- The Nevada Test and Training Range (NTTR) does not have sufficient resources to support all Miniature Air Launched Decoy (MALD) and Miniature Air Launched Decoy – Jammer (MALD-J) test requirements.
- The Air Force MALD/MALD-J Concept of Operations (CONOPS) states that the vehicles are limited and expendable, and not meant to be used during exercises or training. To ensure aircrew weapon system proficiency and adequate combat readiness, the CONOPS needs to enable F-16 and B-52 aircrews to plan and launch vehicles during training exercises to ensure aircrew weapon system proficiency.

MALD

- Test results from the May 2010 modeling and simulation portion of IOT&E included algorithm and data errors that must be resolved to support a valid assessment of MALD in a complex threat environment with many MALDs versus numerous threat radars.
- In July 2010, following two MALD mission-critical failures during the final phase of IOT&E, the Air Force decertified MALD for operational test and the program office convened a failure review board (FRB) to investigate the events, determine the root cause(s), and define the necessary corrective actions.

MALD-J

- The MALD-J program achieved a successful Milestone B decision in May 2010. In May 2010, DOT&E approved the AFOTEC MALD-J Operational Assessment test plan. In April 2010, DOT&E approved the MALD-J Milestone B Test and Evaluation Master Plan (TEMP).
- In 3QFY10, the Air Force began the engineering, manufacture and development (EMD) phase, which will include the Air Force Operational Test and Evaluation Command (AFOTEC) Operational Assessment.
- Due to the commonalities of the two vehicles, the MALD-J EMD test program is dependent upon the resolution of the MALD operational test failures. This will likely delay the completion of the MALD-J EMD, Operational Assessment, and Milestone C decision.
- MALD-J modeling and simulation will require a more complex threat system modeling environment than MALD to enable an adequate assessment of jammer effectiveness in a complex threat setting with many MALD-Js versus numerous threat radars.

System

- MALD is a small, low-cost, expendable, air-launched vehicle that replicates how fighter, attack, and bomber aircraft appear to enemy radar operators.
- MALD-J is an expendable close-in jammer designed to degrade and deny an early warning or acquisition radar's ability to establish a track on strike aircraft while maintaining the ability to fulfill the MALD decoy mission.
- The F-16 C/D and B-52 are the lead aircraft to employ MALD and MALD-J.

Mission

- Combatant Commanders will use the MALD to allow an airborne strike force to accomplish its mission by forcing enemy radars and air defense systems to treat MALD as a viable target.
- Combatant Commanders will use the MALD-J to allow an airborne strike force to accomplish its mission by jamming enemy radars and air defense systems to degrade or deny detection of friendly aircraft or munitions.
- MALD and MALD-J-equipped forces should have improved battlespace access for airborne strike forces by deceiving, distracting, or saturating enemy radar operators and Integrated Air Defense Systems.

Major Contractor

Raytheon Missile Systems – Tucson, Arizona

Activity

MALD

- AFOTEC began MALD IOT&E in June 2009 to support an FY11 full-rate production (FRP) decision. Reliability and performance flight tests were conducted at Eglin AFB, Florida overwater ranges and at the NTTR.
- In July 2010, during the final free-flight portion of IOT&E, two MALD vehicles terminated flight prematurely. The Air Force subsequently decertified MALD for IOT&E and the program office convened an FRB to investigate the events, determine the root cause(s), and define the corrective actions.
- In May 2010, AFOTEC conducted a modeling and simulation assessment of MALD in a complex, many-on-many threat environment (e.g., many MALDs versus multiple threat radar systems) at the Simulation and Analysis Facility (SIMAF), Wright-Patterson AFB, Ohio.
- In May 2010, the program office evaluated MALD in a GPS jamming environment in conjunction with the Air Force Weapon System Evaluation Program (WSEP) conducted at the Utah Test and Training Range (UTTR).
- AFOTEC conducted the IOT&E in accordance with the DOT&E-approved TEMP and test plan.

MALD-J

- During 2QFY10, the Air Force completed MALD-J technology development and a critical design review (CDR).
- In April 2010, DOT&E approved the MALD-J Milestone B TEMP.
- The MALD-J program achieved a successful Milestone B decision in May 2010.
- In May 2010, DOT&E approved the AFOTEC MALD-J Operational Assessment test plan. The AFOTEC Operational Assessment will occur in coordination with the EMD phase.
- In 3QFY10, the Air Force began the EMD phase with a free-flight test conducted at Eglin AFB overwater ranges and a captive-carry flight test at the NTTR using a Sabreliner aircraft configured with a hard-wired MALD-J test vehicle.
- In June 2010, the Air Force identified requirements for the MALD-J Increment II in a draft update to the MALD-J Capability Development Document (CDD).
- The Air Force conducted MALD-J testing in accordance with the DOT&E-approved TEMP and test plans.

Assessment

- The Air Force's primary open-air electronic warfare range, the NTTR, does not have sufficient resources to support all of MALD's test requirements. Scheduling two IOT&E missions added eight months to the IOT&E schedule because of limited range availability, while data processing and transfer to the user slowed timely test evaluation and reporting. In addition, the NTTR availability schedule does not have test time for MALD-J IOT&E until the summer of FY12, leaving insufficient time for AFOTEC to complete analysis and reporting to support achieving Initial Operational Capability in FY12.
- The Air Force MALD/MALD-J Concept of Operations (CONOPS) states that the vehicles are limited and expendable, and not meant to be used during exercises or training. As a result of post-mission debriefs and experience from observing other MALD test events, the Air Force should strongly consider altering its MALD/MALD-J CONOPS to enable F-16 and B-52 aircrews to employ vehicles during training exercises to ensure adequate weapon system proficiency and combat readiness.

MALD

- The program office FRB convened in response to the July 2010 MALD failures should result in a thorough investigation and define the necessary corrective actions. Depending on the failure modes identified, some developmental testing will likely be required prior to completing the IOT&E. The scope of the remaining IOT&E is to be determined and will be coordinated among the program office, AFOTEC, and DOT&E.
- Test results from the IOT&E modeling and simulation events at SIMAF included algorithm and data errors that must be resolved to support a valid assessment of MALD in a many-on-many threat environment.

MALD-J

- Due to the commonalities of the two vehicles, the MALD-J EMD test program is dependent upon the results of the MALD FRB to resume EMD free-flight testing. This will likely delay the completion of the MALD-J EMD, Operational Assessment, and Milestone C decision.
- MALD-J modeling and simulation will require a more complex threat system modeling environment than MALD to enable an adequate assessment of close-in jammer effectiveness in a complex threat setting with many MALD-Js versus numerous threat radars.
- MALD-J Increment II will require detailed threat system antenna patterns incorporated into modeling and simulation to support MALD-J Increment II OT&E. Any delay in this antenna pattern development will negatively affect the ability to conduct MALD-J Increment II OT&E.

Recommendations

- Status of Previous Recommendations. The Air Force satisfactorily addressed one of the three FY09 recommendations. The remaining recommendations concerning development of an integrated MALD/MALD-J CONOPS and increasing the test priority and Air Force Precedence Code of MALD-J require continued attention.

- FY10 Recommendations. In addition to addressing the remaining FY09 recommendations, the Air Force should:
  1. Provide sufficient resources to the NTTR to enable personnel to process and distribute test data in a timely manner.
  2. Revise the CONOPS to include a training requirement for aircrews to plan and launch MALD and/or MALD-J systems during training exercises to ensure the full capability can be employed during combat.
  3. Fix algorithm and data errors in the SIMAF simulation to allow a valid assessment of MALD in a many-on-many environment.
  4. Improve the modeling and simulation capability in support of MALD-J to enable an adequate assessment of close-in jammer effectiveness in a many-on-many complex threat environment.
  5. Expand electronic warfare test capabilities at other test ranges to more adequately support electronic warfare testing and training.

Mission Planning System (MPS)
(including Joint Mission Planning System – Air Force (JMPS-AF))

Executive Summary
- The Air Force completed operational testing of the F-16 Mission Planning Environment (MPE) version 4.3+, the F-16 MPE version 5.1, the F-22 MPE version 9, the A-10 MPE version 6.0, and the B-1 Release 4.0 MPE System Build 13. Each of these MPEs features tailored planning capabilities for their respective host platforms and associated precision-guided weapons.
- The Air Force is leading Service efforts to develop the new common core Joint Mission Planning System (JMPS) Framework version 1.4. This new framework, once matured, is intended for adoption by all Services as a common core to build Service and host platform-specific MPEs.
- The Air Force is currently completing a Critical Change Report to Congress for Increment IV MPEs and is restructuring the Increment IV MPE development process.

System
- MPS is a Windows XP, PC-based common solution for Air Force aircraft mission planning. It is a package of common and platform-unique mission planning applications.
- A Mission Planning Environment (MPE) is a set of developed applications built from a framework, common components, and Unique Planning Components (UPCs). The basis of an MPE is the Framework. Software developers add other common components (e.g., GPS-guided weapons, electronic warfare planner, etc.) and federated applications that support multiple users to the framework. Developers add a UPC for the specific aircraft type (e.g., F-15E) to the framework and common components to complete the MPE.
- The Air Force has split its Mission Planning System (MPS) development process into two increments for administrative and programmatic oversight.
  - Increment III MPEs are based on legacy flight planning software programs and include platforms such as F-16 and F-22A.
  - Increment IV MPEs are based on more advanced MPS versions and include platforms such as A-10 and B-1B.
- Depending on the MPE, MPS operates as an unclassified or classified system in either a stand-alone, workgroup, or domain environment.
- Although the MPS framework software is being codeveloped among DoD components, MPS is not a joint program. Each Service tests and fields it own aircraft-specific MPEs.

Mission
Aircrew use MPS to conduct detailed mission planning to support the full spectrum of missions, ranging from simple training to complex combat scenarios. Aircrew save the required aircraft, navigation, threat, and weapons data on a data transfer device that they load into their aircraft before flight.

Major Contractors
- BAE Systems – San Diego, California
- Lockheed Martin – Fort Worth, Texas
- Northrop Grumman – San Pedro, California
- Boeing – St. Louis, Missouri
- TYBRIN – Fort Walton Beach, Florida

Activity
- All MPE operational testing was conducted in accordance with DOT&E-approved Test and Evaluation Master Plans and operational test plans.

Increment III
- The 28th Test and Evaluation Squadron (28th TES) completed concurrent Force Development Evaluations (FDE) (equivalent to operational tests) of the Air Force MPS Increment III F-16 MPE versions 4.3+ and 5.1 in November 2009 at Eglin AFB, Florida.
- The 28th TES briefed DOT&E in September 2010 on the concept of test for the RC-135 Spiral 2.1 and E-3 MPEs.
- The 28th TES began preliminary test planning for the RC-135 Spiral 2.1 MPE at Eglin AFB, Florida. The FDE is scheduled for February 2011.

- Air Force Operational Test and Evaluation Center (AFOTEC) Detachment 2 completed the Air Force MPS Increment III F-22 MPE version 9 operational test in October and November 2009 at Nellis AFB, Nevada.
- The 28th TES initiated the FDE of Air Force MPS Increment III F-22 MPE version 11 in July 2010 at Eglin AFB, Florida. This FDE is scheduled for completion in FY11.

Increment IV

- The 28th TES conducted the FDE of the Air Force MPS Increment IV A-10 MPE version 6.0 in June 2010 at Barksdale AFB, Louisiana.
- The 28th TES conducted the FDE of the Air Force MPS Increment IV B-1 Release 4.0 System Build 13 MPE in July 2010 at Dyess AFB, Texas.
- The 28th TES conducted advanced planning in support of the E-3 MPE FDE in November 2010 at Tinker AFB, Oklahoma.
- In conjunction with the 28th TES, AFOTEC Detachment 2 conducted advanced planning to conduct operational testing of the E-8 MPE in May 2011 at Robins AFB, Georgia. The E-8 MPE is the representative test platform for Increment IV mission planning functionality.

Assessment

Increment III F-16 MPEs

- F-16 MPE version 4.3+ operational test results showed that the High Speed Anti-Radiation Missile (HARM) Targeting System (HTS) Training Mode Tool did not function properly. Also, the Joint Air-to-Surface Standoff Missile (JASSM) planning module was slow and difficult to use. The Take-off and Landing Data (TOLD) module generated incorrect data and is not certified for use. Installation of the MPE on host computers was a slow and complex procedure. The F-16 MPE version 4.3+ Mean Time Between Critical Failure (MTBCF) was 29.5 hours versus a threshold of 2.0 hours.
- F-16 MPE version 5.1 operational testing highlighted that developers had fixed the HTS Targeting System Training Tool discrepancy from MPE 4.3+ in this MPE. MPE version 5.1 MTBCF was 48.5 hours versus a threshold of 2.0 hours. The Take-off and Landing Data (TOLD) module generated incorrect data and is not certified for use. Installation of the MPE on host computers remains slow.

Increment III F-22 MPEs

- F-22 MPE version 9 operational testing showed that the operational test aircrew were able to plan missions within the Key Performance Parameter threshold requirement of 120 minutes, with a mean time to plan over 125 missions of 72 minutes. The F-22A Flight Performance Module software application provided erroneous fuel calculations. The automatic optimum routing application performed unsatisfactorily and provided plans that had the aircraft fly over threats that were resident in the database. The MPE demonstrated a MTBCF of 235.2 hours, exceeding the threshold requirement of 9.0 hours.
- DOT&E is still assessing the F-22 MPE version 11 FDE. This test was completed in two phases due to lack of combat aircrew availability; however, it was ultimately completed in September 2010. This MPE contains a number of fixes for version 9 deficiencies discovered during developmental and operational testing. Emerging results indicate users new to JMPS planning encountered no significant problems in learning and using the MPE during FDE testing.

Increment IV

- Lack of available aircrew led to two very experienced aircrew conducting operational testing on the A-10 MPE version 6.0. Test aircrew used A-10 MPE version 6.0 to plan missions well within the 120-minute requirement with a mean time to plan over 36 missions of 35 minutes per mission. However, less experienced users are likely to need extensive training to effectively plan missions. The MPE locks up too frequently and displays non-specific error messages. Installation of the MPE on the host computer equipment was complex and slow; installation help desk support was not always available and was uneven in quality. The MPE had two critical failures in 37.35 hours of test for a MTBCF of 18.7 hours; MTBCF threshold is 2.0 hours.
- B-1B Release 4.0 System Build 13 MPE operational testing showed that users' mean time to plan a mission was 59 minutes, well within the 7-hour requirement. TOLD data generated by the MPE did not agree with data generated by the B-1 Technical Order and were not certified for flight. The MPE did not experience a critical failure in more than 62 hours of operation, exceeding its MTBCF threshold requirement of 7 hours.

Recommendations

- Status of Previous Recommendations. The Air Force did not complete the FY09 recommendation to update the draft MPS Increment IV TEMP operational test strategy, focusing on early and continuous reliability growth and information assurance vulnerability testing.
- FY10 Recommendations. In addition to addressing the above recommendation, the Air Force should:
  1. Plan for adequate numbers of appropriately qualified personnel and sufficient funding to be involved in the Increment IV IOT&E and later FDE spiral testing.
  2. Develop and implement a dedicated process to implement required fixes to flight performance monitor TOLD data within all MPE's in order to eliminate bureaucratic delays with certification/de-certification of TOLD data for operational use.

MQ-9 Reaper Armed Unmanned Aircraft System (UAS)

Executive Summary

- The Air Force subdivided Increment I capability development into two Block upgrades to meet the Increment I Capability Production Document requirements: Block 1 (original capability) and Block 5 (improved capability).
- The Increment I Block 1 MQ-9 continues to lack an all-weather Hunter-Killer capability due to deficiencies in its Synthetic Aperture Radar (SAR) and Ground Control Station (GCS).
- The Air Force is developing the Increment I Block 5 systems to fully integrate needed capabilities within the SAR and GCS, thereby satisfying the Increment I requirements for the Hunter-Killer capability.
- The observations during the FY08 Increment I Block 1 IOT&E, combat operations, and Force Development Evaluation (FDE) events indicate an Increment I Block 5 IOT&E of the MQ-9 system will be required to fully assess and characterize its effectiveness, suitability, and satisfaction of KPPs.
- The deficiencies identified during the ongoing GBU-38 Joint Direct Attack Munition (JDAM) FDE indicate that the Developmental Testing of JDAM integration with the MQ-9 system was insufficient.
- Because the MQ-9 system has only completed limited Information Assurance (IA) testing, IA vulnerabilities and deficiencies are not well characterized, and the system continues to operate under an Interim Certification to Operate.

System

- The MQ-9 Reaper Armed Unmanned Aircraft System (UAS) is a remotely piloted, armed, air vehicle that uses optical, infrared, and radar sensors to locate, identify, target, and attack ground targets.
- This system includes Ground Control Stations (GCS) for launch/recovery and mission control of sensors and weapons.
- The MQ-9 is a medium-sized air vehicle that has an operating ceiling up to 50,000 feet, an internal sensor payload of 800 pounds, an external payload of 3,000 pounds, and an endurance of approximately 14 hours, with stronger landing gear than its predecessor, the MQ-1 Predator.
- The MQ-9 shares command and control characteristics with the MQ-1 Predator.
- The MQ-9 is commanded by ground elements via Ku-band satellite (employing remote split operations with GCS units in the United States) and C-band line-of-sight data links (for launch and recovery operations in theater.)
- The MQ-9 carries AGM-114, Hellfire II anti-armor precision laser-guided missiles and GBU-12, 500-pound laser-guided bombs.
- The Air Force is using an evolutionary acquisition approach for meeting Increment I Capability Production Document requirements, with Block 1 and Block 5 air vehicles and Block 15 and Block 30 GCSs. The Air Force plans to satisfy Increment II Capability Development Document requirements in FY15 and beyond with a Block 10 air vehicle and a Block 50 GCS.

Mission

- The Combatant Commander uses the MQ-9 onboard sensors and weapons to conduct armed reconnaissance and pre-planned strikes. Units equipped with MQ-9s can find, fix, track, target, engage, and assess critical emerging targets (both moving and stationary).
- MQ-9 units can also conduct aerial intelligence gathering, reconnaissance, surveillance, and target acquisition for other airborne platforms.

Major Contractor

General Atomics Aeronautical Systems Inc. – San Diego, California

Activity

- DOT&E approved the current MQ-9 Test and Evaluation Master Plan (TEMP) in October 2005, which included the original Increment I capability. The Air Force is currently staffing an updated draft TEMP (to support the Increment I Block 5 Milestone C decision scheduled for May 2011) outlining the testing needed to evaluate Increment I Block 1

and Block 5 capabilities. Testing in FY10 has not been conducted in accordance with a DOT&E-approved TEMP.
- In December 2009, the Air Force proposed that the MQ-9 Increment I Block 1 system had been granted a Milestone C approval in February 2008 as part of the Air Force low-rate initial production (LRIP) decision. The Under Secretary of Defense for Acquisition, Technology, and Logistics (USD (AT&L)) concurred that Milestone C approval had been granted. The Air Force bought 24 Increment I Block 1 air vehicles and 6 GCSs and associated equipment in FY10, and plans to buy 48 Increment I Block 1 LRIP systems in FY11. The Air Force plans to transition all production to the Increment 1 Block 5 configuration in FY12.
- In May 2010, the Air Force completed the Preliminary Design Review for the Increment I Block 5 system.
- The Air Force Operational Test and Evaluation Center (AFOTEC) submitted an Operational Assessment test plan for DOT&E approval in October 2010 to support the Increment I Block 5 Milestone C decision planned for May 2011.
- The Joint Interoperability Test Command conducted limited IA testing in 2010 to assess system vulnerabilities.

Developmental Test and Evaluation
- The Air Force is conducting developmental test and evaluation of software load 904.0 in test aircraft and 904.2 in the software integration laboratory. Both software loads bring capability improvement to the air vehicle and GCS to help meet the Increment I Block 5 requirements and are expected to field in FY11. In addition, software loads 904.4 and 904.6 will complete the Increment I Block 5 capability requirement in late FY11.
- The Air Force completed developmental test and evaluation of the new digital Bomb Rack Unit (BRU) 71 to replace the BRU-15.
- Significant government-led developmental testing continued through FY10, including testing of incremental operational flight program improvements, high capacity electrical system, improved landing gear, automatic takeoff and landing capability, and Lynx SAR targeting.
- Big Safari conducted developmental testing of the Gorgon Stare Quick Reaction Capability (QRC) Wide Area Airborne Surveillance (WAAS) system for the MQ-9 during FY10, and plans to complete the Operational Utility Evaluation by December 2010 to field the system in January 2011.

Force Development Evaluations
- The Air Force began an FDE in March 2009 to support the fielding of software load 903.8, which contains many improvements to the operator displays (including laser altimeter and heads up display pitch markers), situational awareness, and flight safety.
- The Air Force began an FDE in November 2009 to support the fielding of GBU-38 JDAM with the Joint Programmable Fuse (JPF) on the MQ-9 Reaper.
  - GBU-38 JDAM testing was paused twice due to unexpected proximity fuze functioning and discovery of several different anomalies resulting in five potential Category 1 deficiencies. Testing will resume (and will be conducted in accordance with a DOT&E-approved test plan) following resolution of the latest deficiencies and determination of path forward.
  - Software load 903.8 Rev H was fielded in September 2010 without the GBU-38 JDAM weapon system.

Assessment
- The Increment I Block 1 MQ-9 continues to lack an all-weather Hunter-Killer capability due to deficiencies in its SAR and ground control station. The SAR is the only onboard sensor with the ability to locate and track targets through clouds, providing all-weather capability. Functional control of the SAR is not fully integrated into the sensor operator station in the GCS, and the SAR cannot yet generate target coordinates with sufficient accuracy for JDAM targeting. JDAM is the only precision-guided Reaper weapon that can be employed in all weather conditions.
- The observations during the FY08 Increment I Block 1 IOT&E, combat operations, and FDE events indicate an Increment I Block 5 IOT&E of the MQ-9 system will be required to fully assess and characterize its effectiveness, suitability, and satisfaction of KPPs.
- The deficiencies identified during the ongoing GBU-38 JDAM FDE indicate that the developmental testing of JDAM integration with the MQ-9 system was insufficient.
- The Big Safari Gorgon Stare WAAS system is not an MQ-9 program of record, but is tested with MQ-9 personnel, processes, and infrastructure, and is distracting to the developmental test and evaluation activities of program of record components.
- Because the MQ-9 system has only completed limited IA testing, IA vulnerabilities and deficiencies are not well characterized, and the system continues to operate under an Interim Certification to Operate.

Recommendations
- Status of Previous Recommendations. The Air Force made little progress in addressing the recommendations in the MQ-9 Beyond Low-Rate Initial Production (BLRIP) Report submitted to Congress in March 2009.
- FY10 Recommendations. In addition to completing the FY09 BLRIP recommendations, the Air Force should:
  1. Plan the Increment I Block 5 IOT&E, FDE, and FOT&E activities required to fully assess Increment I effectiveness and suitability deficiency corrections, KPPs, incremental improvements, and intelligence, surveillance, and reconnaissance capabilities.
  2. Resolve deficiencies with GBU-38 JDAM integration and complete the JDAM FDE.

NAVSTAR Global Positioning System (GPS)

Executive Summary

- The Air Force launched the eighth and final NAVSTAR GPS Block IIR-M (Modernized) satellite in August 2009 and the first Block IIF (follow-on) satellite in May 2010. However, prototype Military-code (M-code) capable Military GPS User Equipment (MGUE) will not be available to conduct basic developmental testing of Block IIR-M and IIF unique capabilities until 2015.
- During integrated developmental and operational testing of the Architecture Evolution Plan (AEP) version 5.5.d, the Air Force discovered problems with some military GPS receivers.
- The GPS Integrated Test Team (ITT) successfully drafted an Enterprise-level Test and Evaluation Master Plan (TEMP).

System

- The NAVSTAR GPS is an Air Force-managed, joint Service precision navigation and timing space program used for DoD and non-DoD operations.
- The NAVSTAR GPS consists of three operational segments:
  - Space Segment - The NAVSTAR GPS spacecraft constellation consists of a minimum of 24 operational satellites in semi-synchronous orbit.
  - Control Segment -The control segment consists of primary and backup GPS master control stations, operational system control antennas, a pre-launch compatibility station, and geographically dispersed operational monitoring stations.
    - AEP 5.5.4 is the current version of the control system supporting Blocks II/IIA, IIR/IIR-M, and IIF.
    - Next Generation GPS Operational Control Segment (OCX) replaces AEP 5.5.4 and will support the current GPS constellation and the follow on Block III satellites.
  - User Segment - There are many versions of NAVSTAR GPS mission receivers hosted on a multitude of operational systems and combat platforms.
- The system is being modernized with an M-code enhanced capability to better meet the needs of operational users. Future GPS updates will improve service in signal interference/jamming environments; enhance military and civil signal integrity; and provide time-critical constellation status.

- The Air Force Space Command has launched three blocks of NAVSTAR GPS satellites and has two blocks of spacecraft in development:
  - Block I (1982-1992)
  - Block II/IIA (1990-1997)
  - Block IIR/IIR-M (Modernized) (1997 – present)
  - Block IIF development (May 2010 – present)
  - Block III development (replacement spacecraft)

Mission

- Combatant Commanders, U.S. military forces, allied nations, and various civilian agencies use the NAVSTAR GPS system to provide highly accurate, real-time, all-weather, passive, common reference grid positional data, and time information to operational users worldwide.
- Commanders use NAVSTAR GPS to provide force enhancement for combat operations and military forces in the field on a daily basis throughout a wide variety of global strategic, operational, and tactical missions.

Major Contractors

- Block IIR/IIR-M and Block III: Lockheed Martin Space Systems – Sunnyvale, California
- Block IIF: The Boeing Company, Integrated Defense Systems – Seal Beach, California
- OCX: Raytheon Company, Intelligence and Information Systems – Garland, Texas

Activity

- The Air Force launched the first NAVSTAR GPS Block IIF satellite in May 2010. It has completed operational testing and was declared operational in September 2010.
- The Air Force synchronized schedules across the GPS Enterprise to deliver the following in 2015: 24 M-code capable satellites on orbit, a control segment designed to be capable of operationally commanding modernized capabilities, and the first handheld user equipment designed to be M-code capable.

- During integrated developmental and operational testing of AEP version 5.5.d (2QFY10) the Air Force discovered problems with some military GPS receivers.
- GPS AEP Version 5.5.4 underwent testing in August and September of 2010. As directed by the OSD, the ITT developed a draft TEMP for the GPS Enterprise. The GPS Enterprise TEMP includes testing for Blocks IIF and III of the satellites, the AEP upgrade to the current Operational Control Segment, OCX, Selective Availability Anti-Spoof Module (SAASM) capable User Equipment, and M-code capable MGUE.
- The Joint Requirements Oversight Council released a Joint Capabilities Document in place of an Initial Capabilities Document for MGUE.

Assessment

- The test planning in 2010, for all segments of GPS (space, control, and user), continued the improvement displayed in 2009. Problems discovered with military GPS receivers during AEP testing have prompted the GPS Wing to obtain an extensive suite of test equipment, including a large number of receivers and test cases, to exercise user equipment prior to any future changes to the GPS. Testing against current threats has been included across the test program, from modeling and simulation, through developmental, and into operational testing.
- The amount of detail in the Enterprise-level TEMP differs between the User and Space and Control segments as the three segments are at different levels of maturity. These variations will hinder the development of the overall test strategy by placing limits on test planning and test scenario development.
- Based upon current progress, the SAASM mission-planning tool may not be available for the Multi-Service Operational Test and Evaluation (MOT&E) in FY11. Without this tool, there will be significant limitations on the operational realism of the MOT&E.
- Information assurance has been included in test planning during 2010. This is an improvement because previous information assurance testing through external interfaces has been significantly constrained. However, the scope of information assurance testing remains undetermined at this time.
- The results of AEP 5.5.4 testing demonstrated that further development will be needed to complete all functions associated with SAASM, Over the Air Re-keying, and Contingency Recovery.

Recommendations

- Status of Previous Recommendations. The Air Force has three previous recommendations that have not been satisfactorily addressed.
  1. The Air Force should assure comprehensive and realistic information assurance testing is conducted of all external interfaces that support GPS operations and performance.
  2. The SAASM program should synchronize the development of the Mission Planning System with the three segments of GPS to provide end-to-end SAASM and modernized capabilities for OT&E.
  3. The program should test new and legacy NAVSTAR GPS receivers as soon as possible to assure that as much capability as possible is consistently provided to operational users.
- FY10 Recommendations.
  1. Planning should continue to focus on end to-end testing of the space and control segments with GPS receivers (including ground equipment). Testing should assure GPS receivers are capable of receiving and processing the new modernized signals and are hosted on representative platforms (i.e., ships, aircraft, land, and space vehicles) in realistic operational environments.
  2. The synchronization of the development of the Space, Control, and User segments has improved but should continue to be watched because delays in any segment will delay operational testing of all segments.

Small Diameter Bomb (SDB)

Executive Summary

- Small Diameter Bomb (SDB) I completed testing on a new Electronic Safe Arm and Fuze (ESAF) during FY10. This was the last significant test event for the program as presently constituted. Testing met the objectives of demonstrating enhanced reliability while retaining existing system performance. Test results support the full range of fuzing options, incorporation of the redesigned/modified fuze, and the SDB I's lethality.
- SDB II finalized a new Test and Evaluation Master Plan (TEMP) and completed the source selection process by awarding the contract to Raytheon Missile Systems.
- The Integrated Test Team completed extensive work to fully examine test resource and planning requirements for developmental, live fire, and operational testing, resulting in an adequate test program as SDB II proceeds through Engineering and Manufacturing Development (EMD).

System

- SDB I combines GPS and internal inertial navigation to achieve precise guidance accuracy. The SDB I warhead is a penetrator design with additional blast and fragmentation capability. The weapon can be set to initiate on impact or a preset height above the intended target. Fuze function delays can be pre-set to either of these two options.
- SDB II combines Millimeter-Wave radar, infrared, and laser guidance sensors in a terminal seeker in addition to a GPS and inertial navigation system to achieve precise guidance accuracy in all weather.

Common Characteristics

- The SDB is a 250-pound air-launched, precision glide weapon using deployable wings to achieve standoff range. F-15E aircraft employ SDBs from the BRU-61/A four-weapon carriage assembly.
- SDB provides reduced collateral damage while achieving kills across a broad range of target sets by precise accuracy, small warhead design, and focused warhead effects.
- SDB may receive support from the Talon NAMATH system, which provides GPS differential corrections to the SDB through the F-15E data link prior to weapon release to increase SDB accuracy.

Mission

- Combatant Commanders use SDB I to attack fixed or relocatable targets that remain stationary from weapon release to impact. Units can engage both soft and hardened targets to include communications facilities, aircraft bunkers, industrial complexes, and lightly armored ground combat systems and vehicles.
- Combatant Commanders will use SDB II to attack moving targets in adverse weather at standoff ranges. SDB II can also be used against moving or stationary targets using its Normal Attack mode (radar/infrared sensors) or Semi-Active Laser mode, and fixed targets with its Coordinated Attack mode.
- SDB-equipped units can achieve an increased weapons load per aircraft compared to conventional air-to-ground munitions for employment against offensive counter-air, strategic attack, interdiction, and close air support targets in adverse weather.

Major Contractors

- SDB I: The Boeing Company, Integrated Defense Systems – St. Louis, Missouri
- SDB II: Raytheon Missile Systems – Tucson, Arizona

Activity

SDB I

- SDB I completed testing of a new fuze during FY10 in accordance with a DOT&E-approved test plan. The test items were live warhead assemblies with a redesigned/modified ESAF. Three dynamic sled tests each targeted a 15-foot by 15-foot, one meter thick reinforced concrete block. The fourth sled test targeted a bunker cross section comprised of one meter of soil and one meter reinforced concrete block, thus engaging the most robust family of targets in the SDB I target array. Incorporation of the redesigned/modified fuze should support the SDB I's lethality.

SDB II

- SDB II completed a new TEMP prior to passing Milestone B. The program also completed the source selection process by awarding the contract to Raytheon Missile Systems.
- The Integrated Test Team fully examined test resource and planning requirements for developmental, live fire, and operational testing resulting in an adequate test program as SDB II proceeds through EMD.

Assessment

- SDB I successfully completed the last significant test event for the program as presently constituted. ESAF testing demonstrated enhanced reliability while retaining existing weapon performance. The Program Office tested the full range of fuzing options by employing 10 weapons with the new fuze (six free-flight and four sled tests) with 10 successes, including highly stressful penetration scenarios.
- SDB II entered EMD with a properly resourced test program and no major programmatic testing problems.
- As SDB II has a small payload, a relatively modest degradation in weapon accuracy can lead to a major drop in weapon effectiveness; therefore, seeker performance and the ability to properly assess that performance are critical to the program progressing. Flying test bed seeker results will be the predominant source of data on seeker performance during the first years of EMD. Modeling and simulation will provide tools to interpret that data and evaluate weapon performance throughout program development. Both are critical aspects of the EMD program.

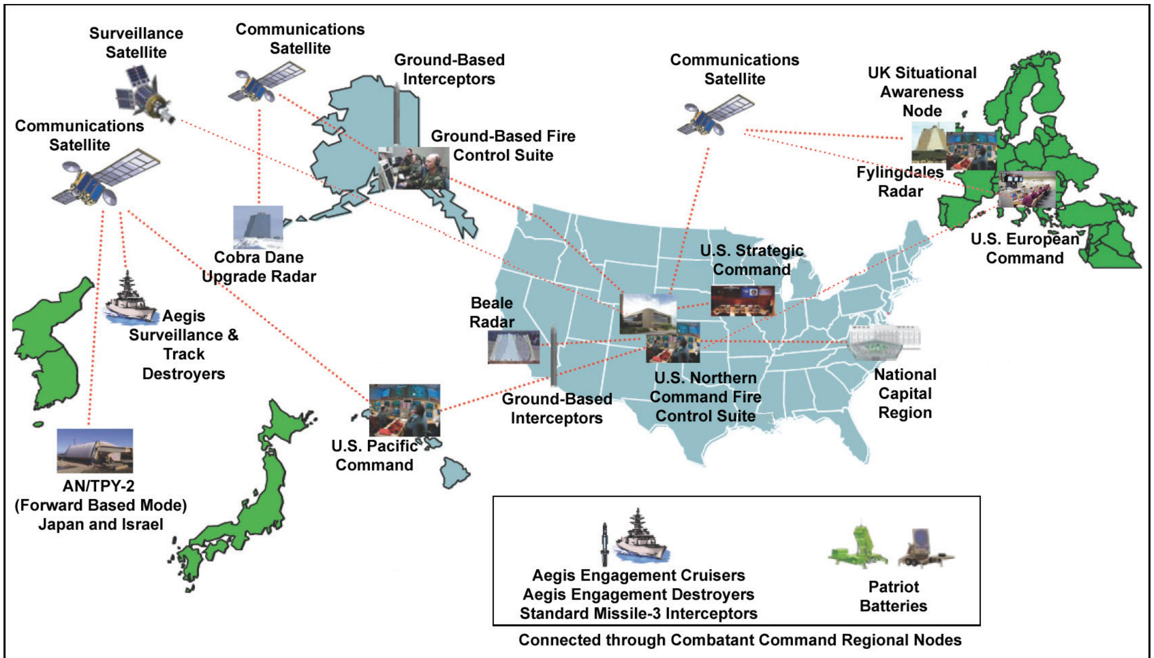
Recommendations

- Status of Previous Recommendations. The Air Force completed the FY09 recommendations.
- FY10 Recommendation.
  1. The SDB II Program Office should pay particular attention not only to the Critical Design Review results relating to seeker maturity and integration (including classification), but also provide a critical analysis on the progress of the modeling and simulation efforts and flying test bed seeker results. These will be crucial early indicators whether there are significant shortcomings in the weapon's performance prior to large-scale open-air testing in EMD.

Ballistic Missile Defense Systems

Ballistic Missile Defense Systems

Ballistic Missile Defense System (BMDS)



Currently Fielded Ballistic Missile Defense System

Executive Summary

- The Missile Defense Agency (MDA) began execution of its revamped Integrated Master Test Plan (IMTP) to collect the data needed to accredit the models and simulations used for assessing performance and effectiveness of the Ballistic Missile Defense System (BMDS).
- The Ground-based Midcourse Defense (GMD) element conducted an unsuccessful intercept flight test and a successful two-stage interceptor boost vehicle flight test during FY10.
- Aegis Ballistic Missile Defense (Aegis BMD) intercepted one separating ballistic missile target in a Japanese Aegis BMD flight test. Hardware-in-the-loop ground testing demonstrated potential Aegis BMD capability to contribute to theater-level defense missions spanning a range of ballistic missile defense scenarios.
- The Terminal High Altitude Area Defense (THAAD) system successfully intercepted one unitary short-range target in the low endo-atmosphere. Another flight test event experienced a target failure and did not achieve its test objectives. In addition to delaying THAAD test objectives, the target failure also prompted the grounding of all air-launched targets within the MDA test program until contractor recertification in 3QFY11. THAAD completed a series of nine reduced-scale light-gas-gun tests to characterize the interceptor's lethality against missile payloads.
- Patriot conducted five flight tests against ballistic missile targets, all of which resulted in target intercepts. Patriot also conducted a Limited User Test (LUT) in FY10.
- Command, Control, Battle Management, and Communications (C2BMC) demonstrated the ability to control a single AN/TPY-2 (Forward Based Mode, or FBM) radar, receive and forward tracks, receive and display weapon element status data from several elements (Aegis BMD, THAAD, and Patriot), and interact with the GMD element through the GMD fire control.

System

- The current BMDS architecture integrates ballistic missile defense capabilities against all ranges of threats.
- BMDS is a distributed system currently composed of four elements and five sensor systems.

Elements
- Aegis BMD
- C2BMC
- GMD
- Patriot

Sensors
- Aegis BMD AN/SPY-1 Radar
- Cobra Dane Radar
- Upgraded Early Warning Radars (UEWRs) – Beale AFB, California and Fylingdales, England
- AN/TPY-2 (FBM) radar (formerly Forward-Based X-band Transportable radar, or FBX-T)
- Space-Based Infrared System/Defense Support Program (SBIRS/DSP)

- BMDS is employed as part of the nation's integrated strategic response plans.
- Projected near-term additions to the BMDS include the Sea-based X-Band (SBX) Radar, an additional UEWR in Thule Air Base, Greenland, and the THAAD system.
- Advanced technology BMDS capabilities may include the following:
  - Airborne Laser Test Bed (ALTB)
  - Precision Tracking Space System (PTSS)
  - Airborne Infrared (ABIR) Sensors

Mission

- The U.S. Strategic Command is responsible for synchronizing and integrating ballistic missile defenses employing U.S. Northern Command, U.S. Pacific Command, U.S. Central Command, and U.S. European Command assets, as well as the BMDS to defend U.S. territory, deployed forces, friends, and allies against ballistic missile threats of all ranges, in all phases of flight. Initial capability permits defending U.S. territory against simple ballistic missile threats and defending deployed forces, friends, and allies from theater-level ballistic missile threats.
- U.S. Strategic Command, U.S. Northern Command, U.S. European Command, U.S. Central Command, and U.S. Pacific Command will maintain situational awareness across the full mission engagement space using the C2BMC system.
- The Army employs Patriot to provide theater defense for deployed forces against short- and medium-range threats. The MDA has transferred Patriot to the Army; it is reported as an Army program.

Major Contractor

The Boeing Company, Integrated Defense Systems, Missile Defense Systems – Huntsville, Alabama

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Activity

- The MDA began execution of its newly revised IMTP that uses a critical factors analysis (also referred to as Critical Engagement Conditions, or CECs) and other important data needs (also referred to as Empirical Measurement Events, or EMEs) to drive test design, planning, and execution.

GMD

- GMD executed the Flight Test Ground-based Interceptor-06 (FTG-06) event in January 2010. The SBX radar participated as the sole midcourse sensor. This test resulted in a failed target intercept. FTG-06 was the first flight test and intercept attempt by an interceptor equipped with the new Capability Enhancement II (CE II) Exo-atmospheric Kill Vehicle (EKV).
- GMD executed the Booster Vehicle Test-01 event in June 2010, successfully testing two-stage first-generation avionics and executing EKV data gathering maneuvers.
- The MDA executed the system-level event, Ground Test Integrated-04b (GTI-04b), in August 2010 using to be fielded element software and component representations.

Aegis BMD

- In FY10, the Aegis BMD program continued the test and evaluation of the Aegis BMD 3.6.1 software load with the Standard Missile-3 (SM-3) Block IA interceptors.
- The Aegis BMD program conducted two intercept tests: Japanese Flight Test Mission-3 (JFTM-3) in FY10 and JFTM-4 in early FY11. It also participated in several BMDS system flight and ground tests including:
  - Juniper Cobra 10 war game
  - Fast Contingency Analysis and Activation Team (CAAT) East-C (FCE-C)
  - Flight Test Other-06 (FTX-06) Events 1 through 4
  - Ground Test Other (GTX)-04a
  - GTI-04b

THAAD

- The MDA conducted Flight Test THAAD-11 (FTT-11) in December 2009. The air-launched target deployed from the C-17 aircraft, but failed to ignite.
- The MDA conducted FTT-14, a successful low endo-atmospheric intercept of a unitary short-range target, in June 2010.
- The Army Operational Test Agency conducted a Force Development Experiment and LUT supporting an FY11 materiel release decision.
- THAAD completed its series of nine reduced-scale light-gas-gun tests, participated in GTX-04a, GTI-04b, and FTX-06.
- THAAD radar participated in FTG-06 and JFTM-3. THAAD also participated in the Juniper Cobra 10 war game and FCE-C.

Patriot

- The Army conducted the Post-Deployment Build-6.5 LUT at White Sands Missile Range (WSMR), New Mexico, from November 2009 to July 2010. Patriot conducted four flight tests against ballistic missile targets:
  - Flight Test ATM-48 in October 2009, which resulted in a target intercept
  - Production Configuration Flight Test PC-08 in December 2009, which resulted in a target intercept
  - Flight Test 7-2A (second attempt) in February 2010, which resulted in a target intercept
  - Flight Test P6.5-2 in March 2010, a dual target engagement which resulted in intercept of both targets.

C2BMC

- The MDA completed C2BMC software spiral 6.2 (S6.2) fielding to the U.S. European Command and installed S6.2 hardware and software at the U.S. Central Command.

- C2BMC S6.2 participated in the Juniper Cobra 10 war game, FCE-C, and FTG-06.
- C2BMC S6.4 participated in GTX-04a, FTT-14, and GTI-04b.

Assessment

- The inherent BMDS defensive capability against theater threats increased during the last fiscal year. DOT&E anticipates continued increases in this capability over time.
- The designated military combatants actively participated in all system-level BMDS testing, as well as nearly all element-level testing. They perform operational roles at individual element levels through major combatant command levels using operational tactics, techniques, and procedures.
- Test planning for assessment of Phase I of the Phased Adaptive Approach for the Defense of Europe is on schedule consistent with achieving operational capability by the end of CY11.
- The elements that comprise the present and future BMDS are at different levels of testing and maturity.
- During THAAD flight test FTT-11, the MDA experienced a failure of the C-17 air-launched target system. The failure investigation revealed significant training and quality control problems. The MDA Director decertified the sole contractor providing air-launched target capability. The MDA plans a recertification flight test in 3QFY11.

GMD

- To date, GMD has demonstrated a limited capability against a simple threat. The FTG-06 failure to intercept delayed demonstration of the new CE II EKV-based interceptors and delayed progress in the execution of the revised IMTP by precluding obtaining specific critical engagement condition data. Ground testing continued to support increasing GMD interoperability with the BMDS sensors and elements.
- GMD capability assessments are complicated by:
  - Extant differences between fielded and flight-tested interceptor configurations.
  - Flight tests failures during the past year.
  - Interceptor design changes precipitated by parts obsolescence and previous ground and flight test failures.

Aegis BMD

- Aegis BMD flight testing continued to demonstrate the capability to engage separating ballistic missile targets in the midcourse phase with SM-3 Block IA interceptors.
- Intercept tests have demonstrated the efficacy of the SM-3 Block IA interceptor for some midcourse engagement missions.

THAAD

- THAAD continued progress, demonstrating much of the functionality necessary for challenging low endo-atmospheric intercepts in FTT-14.
- The FTT-11 target failure and a tight schedule forced the Army to conduct the LUT before the Sim-Over-Live-Driver could be fully accredited, which could result in an incomplete capability assessment supporting the materiel release decision and/or the need for additional testing. In addition to delaying THAAD test objectives, the target failure also prompted the grounding of all air-launched targets within the MDA test program.
- THAAD completed the planned lethality test program for FY10 and provided lethality information against several types of threat payloads, but some lethality data voids and knowledge gaps remain to be resolved.

Patriot

- With the FY10 deployment and LUT of the Post-Deployment Build 6.5 software, Patriot continued to provide mature and moderately well-understood capabilities against much of its theater-level missile threat set. This assessment is based also on the number and complexity of prior test and evaluation events in which Patriot participated (both flight and ground testing) as well as combat operations during Operation Iraqi Freedom.
- Understanding of Patriot performance against anti-radiation missiles and air-to-surface missiles is limited because Patriot interceptor lethality data do not yet exist for these threats.
- Understanding of Patriot performance against cruise missiles, fixed-wing aircraft, and unmanned aerial vehicles is limited because the Lower Tier Product Office has not performed the simulation runs necessary to characterize Patriot interceptor lethality against these threats.
- The Army Test and Evaluation Command will conduct a LUT for Post-Deployment Build-7 capability beginning in late FY11.
- The full report on Patriot can be found in the Army section of this Annual Report.

C2BMC

- C2BMC continues to demonstrate interoperability with all BMDS elements.
- Ground testing demonstrated the ability to control two AN/TPY-2 (FBM) radars, to execute limited automated sensor and battle management functionality, and to track processing enhancements of C2BMC S6.4.

Recommendations

- Status of Previous Recommendations. Although the MDA has made progress on previous recommendations, the two FY08 recommendations regarding the BMDS lethality program and BMDS computer network defense, as well as the FY09 recommendation regarding IMTP execution, are still valid.
- FY10 recommendations. None.

Aegis Ballistic Missile Defense (BMD)

Executive Summary

- Aegis Ballistic Missile Defense (BMD) intercepted one separating ballistic missile target in a Japanese Aegis BMD flight test in FY10 and one in early FY11.
- The Aegis BMD program remains in a phase of FOT&E for the 3.6.1 system with Standard Missile-3 (SM-3) Block IA interceptors.
- Aegis BMD continued to explore interoperability with the Terminal High Altitude Area Defense (THAAD) and other BMDS elements during ground testing and live-target tracking exercises in FY10.
- Hardware-in-the-loop ground testing demonstrated potential Aegis BMD capability to contribute to theater-level defense missions spanning a range of ballistic missile defense scenarios.
- Aegis BMD continued early developmental testing of the next-generation Aegis BMD system in FY10. Performance during live-target tracking exercises and simulated engagements demonstrated select next-generation capabilities.

System

- Aegis BMD is a sea-based missile defense system that employs the multi-mission shipboard Aegis Weapon System, with new radar and missile capabilities to engage ballistic missile threats. Capabilities of Aegis BMD include:
  - Computer program modifications to the AN/SPY-1 radar, which allow long-range surveillance and track (LRS&T) of ballistic missiles of all ranges.
  - A modified Aegis Vertical Launcher System, which stores and fires the SM-3 Block IA and modified SM-2 Block IV interceptors.
  - SM-3 Block IA interceptors, which use a maneuverable kinetic warhead to accomplish midcourse engagements.
  - Modified SM-2 Block IV interceptors, which provide the capability to engage short-range ballistic missile targets in the terminal phase of flight.
- Aegis BMD is capable of autonomous missile defense operations and can send or receive cues to or from other Ballistic Missile Defense System (BMDS) sensors through tactical data links.

Mission

The Navy can accomplish three missions using Aegis BMD:

- Provide forward-deployed radar capabilities to enhance defense against ballistic missile threats of all ranges
- Provide all short- to long-range ballistic missile threat data to the Command, Control, Battle Management, and Communications (C2BMC) system for dissemination to Combatant Commanders' headquarters to ensure situational awareness
- Defend deployed forces and allies from short- and medium-range theater ballistic missiles

Major Contractors

- Lockheed Martin Maritime Systems & Sensors – Moorestown, New Jersey
- Raytheon Missile Systems – Tucson, Arizona

Activity

- The Aegis BMD program continued to assess engagement capabilities for the midcourse defense mission during the ongoing FOT&E phase of test and evaluation for the Aegis BMD 3.6.1 software load with SM-3 Block IA interceptors. This follows the completed combined developmental/operational test phase that supported the transition of the Aegis BMD 3.6 system to the Navy in October 2008. Concurrently, the program is developing the Aegis BMD 4.0.1 system, which includes the SM-3 Block IB interceptor.

- The Aegis BMD program conducted one intercept mission in FY10 and one in early FY11:
  - In October 2009 during Japanese Flight Test Mission 3 (JFTM-3), a Japanese Aegis BMD destroyer using an SM-3 Block IA interceptor successfully intercepted a medium-range separating target.
  - The JFTM-3 campaign also included two tracking events with separating ballistic missile targets and an anti-air warfare event.
  - In October 2010 during JFTM-4, a Japanese Aegis BMD destroyer using an SM-3 Block IA interceptor successfully intercepted a medium-range separating target following a no-notice target launch.
  - The JFTM-4 campaign also included two tracking events with separating ballistic missile targets. One of these events was a cued engagement by a US 3.6.1 Aegis BMD destroyer.
  - An Aegis BMD cruiser with an engineering load of 4.0.1 software participated during the JFTM-3 and JFTM-4 firing missions and tracking events and conducted simulated engagements.
- In FY10, Aegis BMD participated in several BMDS system flight and ground tests to assess Aegis BMD functionality and interoperability with the BMDS.
  - Aegis BMD participated in Juniper Cobra 10 war game in October 2009.
  - Fast Contingency Analysis and Activation Team East-C, conducted in October and November 2009, was a hardware-in-the-loop and distributed ground test designed to assess system level capability to provide theater-level defense against a variety of ballistic missile threats. Participants included the Aegis BMD laboratory in Moorestown, New Jersey, as well as representations of theater-level defense systems such as THAAD, AN/TPY-2, and C2BMC.
  - Flight Test Other-06 Events 1 through 4, conducted in October and November 2009, consisted of a series of tracking exercises to support developmental testing of the new Aegis BMD 4.0.1 system. In Events 2 and 3, an Aegis BMD 4.0.1 (engineering load) cruiser exercised long-range surveillance and track functionality and conducted a simulated engagement against separating ballistic missile targets. Also, during Events 2 and 3, Aegis BMD and THAAD performed data exchange to test interoperability between the two systems. In Event 4, the Aegis BMD 4.0.1 cruiser conducted a simulated engagement against a complex short-range ballistic missile target, while exercising new radar-frequency discrimination algorithms.
  - During Performance Assessment-09 in November and December 2009, the MDA utilized a digital representation of the Aegis Weapon System (version 3.6.1), along with digital representations of other BMDS elements, to examine the interactions and performance of the BMDS system for a wide range of scenarios and threats.
  - Ground Test Other-04a in March 2010 used hardware-in-the-loop simulations to demonstrate the ability of the BMDS to engage short-, medium-, and intermediate-range ballistic missile threats in regional defense missions. The test used Aegis BMD 3.6.1 hardware-in-the-loop simulators at three laboratory sites (Pt. Loma, California; Moorestown, New Jersey; Dahlgren, Virginia). Other participants included THAAD, Patriot, Israeli Arrow Weapon System, AN/TPY-2, and C2BMC.
  - Ground Test Integrated-04b in August 2010 demonstrated BMDS operational functionality, connectivity, and interoperability in engagements against short-, medium-, and intermediate-range and intercontinental ballistic missile threats. The test used Aegis BMD hardware-in-the-loop simulators at three laboratory sites (Dahlgren, Virginia; Moorestown, New Jersey; Pt. Loma, California).

Assessment

- In FY10, Aegis BMD flight testing continued to demonstrate the capability to engage medium-range separating ballistic missile targets in the midcourse phase with SM-3 Block IA interceptors.
- The Aegis BMD program has not conducted a live intercept engagement against a ballistic missile target with the longer range expected as part of the new Phased Adaptive Approach to missile defense in Europe. The program plans to use such a target for Flight Test Standard Missile Interceptor-15 (FTM-15) in FY11.
- The successful intercepts of ballistic missile targets with SM-3 Block IA interceptors during JFTM-3 and JFTM-4 increase confidence in the reliability of the interceptor following the FY09 failure during the Japanese Aegis BMD flight test, JFTM-2.
- Aegis BMD and THAAD inter-element data transfer over tactical links continues to mature. Also, Aegis BMD continues to show increasing interoperability with other BMDS elements, as demonstrated in recent ground testing. However, Aegis BMD has not yet tested launch-on-remote capability in a live intercept mission, though the system plans to exercise this capability during FTM-15 in FY11. Also, Aegis BMD has not yet demonstrated cued engagement capability against medium-to intermediate-range ballistic missiles in a live intercept test.
- The next-generation Aegis BMD system (version 4.0.1) has demonstrated select new capabilities during recent live-target tracking exercises and simulated engagements. Development of that system continues, leading up to the first intercept mission with an SM-3 Block IB interceptor in FY11.

Recommendations

- Status of Previous Recommendations. The program addressed the single recommendation from FY09.
- FY10 Recommendation.
  1. The MDA should demonstrate the Aegis BMD capability to conduct cued and launch-on-remote engagements in live intercept missions against medium- to intermediate-range ballistic missiles.

Command, Control, Battle Management, and Communications (C2BMC) System

Executive Summary

- Command, Control, Battle Management, and Communications (C2BMC) (Spiral 6.2) repeatedly demonstrated the ability to control a single AN/TPY-2 radar, receive and forward tracks, and receive and display weapon element status data from and interact with Ballistic Missile Defense System (BMDS) elements. C2BMC also demonstrated interoperability with the Arrow Weapon System in theater-level ground tests.
- In FY10, C2BMC participated in five ground tests and three flight tests. C2BMC continues to demonstrate the ability to provide situational awareness by receiving and displaying data from a variety of BMDS sensors and weapons.
- The Missile Defense Agency (MDA) continues to track and correct C2BMC software anomalies and improve data presentation.
- The next version of C2BMC (Spiral 6.4) is currently participating in ground and flight testing. Once fielded, it is intended to enable automated sensor management of multiple AN/TPY-2 (FBM) radars, implement basic battle management functions, and provide enhanced situational awareness.

System

- Command, Control, Battle Management, and Communications (C2BMC) is a combatant command's interface to the fully integrated BMDS.
- Initial configuration includes C2BMC data terminals at the Missile Defense Integration and Operations Center (MDIOC), Schriever AFB, Colorado; Peterson AFB, Colorado; Cheyenne Mountain, Colorado; Fort Greely, Alaska; U.S. Strategic, Northern, European, Pacific and Central Commands; and the National Military Command System.
- The current C2BMC system provides situational awareness to combatant commands and the National Command Authority with information on missile events, BMDS status, and system coverage. C2BMC also provides above-element deliberative planning at the combatant command and component level, permitting a federation of planners across the BMDS. Aegis Ballistic Missile Defense (Aegis BMD) and Ground-based Missile Defense (GMD) elements use their own command, control, battle management systems and mission planning tools for stand-alone engagements.
- Currently, C2BMC Spiral 6.2 provides command and control for a single AN/TPY-2 (Forward Based Mode, or FBM) radar, with radars currently located at Shariki, Japan, and in Israel.
- C2BMC provides track forwarding of AN/TPY-2 (FBM) and AN/SPY-1 tracks to GMD. Additionally, it provides track forwarding of AN/TPY-2 (FBM) tracks to Aegis BMD for cueing.

- The next two significant upgrades will add new capabilities to the C2BMC:
  - Spiral 6.4: Initial implementation of the Global Engagement Manager is intended to manage multiple radars in the same area of responsibility.
  - Spiral 8.2: Although not fully defined by the MDA, the intent is to improve and expand the initial Spiral 6.4 capabilities with the addition of boost phase precision cue, engagement assessment, and recommendations, as well as the implementation of the common X-band interface as the next step toward integrated sensor management.

Mission

U.S. Strategic, U.S. Northern, U.S. European, U.S. Central and U.S. Pacific Commands currently use the C2BMC to provide communications necessary to support ballistic missile defense engagements, as follows:

- Deliberate planning
- Collaborative dynamic planning
- Situational awareness
- Consequence management
- Network management
- AN/TPY-2 (FBM) sensor management and control

Major Contractor

Lockheed Martin Information Systems and Global Services – Gaithersburg, Maryland

Activity

Spiral 6.2 (S6.2)

- S6.2 is the operational version of C2BMC software.
- The MDA utilized the digital representation of C2BMC S6.2 in Performance Assessment-09 (PA-09) in November and December 2009 to assess C2BMC sensor tasking functionality.
- The MDA completed S6.2 fielding to the U.S. European Command (USEUCOM) in July 2010. The MDA also installed S6.2 hardware and software at the U.S. Central Command (USCENTCOM); this installation is currently undergoing integration and testing.
- C2BMC S6.2 participated in the Juniper Cobra 10 war game in October 2009.
- In October and December 2009, C2BMC S6.2 participated in Fast Contingency Analysis and Activation Team (CAAT) East-C (FCE-C) integrated hardware-in-the-loop and distributed ground tests. C2BMC provided situational awareness and communications to BMDS theater elements including the Arrow Weapon System. Successful cross-COCOM data exchange occurred between C2BMC at USEUCOM and two Aegis BMD ships (one USEUCOM ship and one USCENTCOM ship).
- C2BMC S6.2 participated in Flight Test Ground-based Interceptor-06 (FTG-06) in January 2010. During the test, C2BMC provided status of BMDS under test and situational awareness displays.

Spiral 6.4 (S6.4)

- The next C2BMC software build, S6.4, is installed on the Parallel Staging Network at the Missile Defense Integration and Operations Center (MDIOC) at Schriever AFB, Colorado, and at the U.S. Pacific Command (USPACOM) for concurrent testing, training, and operations. The new C2BMC suite, Global Engagement Manager (GEM), is also available on the MDIOC and USPACOM Parallel Staging Network. The estimated fielding date for S6.4 is May 2011 at USPACOM, the U.S. Strategic Command (USSTRATCOM), and the U.S. Northern Command (USNORTHCOM), and is FY12 for USEUCOM. The ground test campaign GT-04, planned for FY11-FY13, will provide a system-level test for C2BMC S6.4.
- In February 2010, C2BMC S6.4 participated in Ground Test Other-04a (GTX-04a), an initial focused ground test of S6.4 in a hardware-in-the-loop test environment. C2BMC S6.4 GEM demonstrated control of multiple AN/TPY-2 (FBM) radars in a single area of responsibility and automated sensor and track management functions.
- During the GMD Booster Verification Test-01 (BVT-01) in June 2010, C2BMC S6.4 collected data for accreditation of C2BMC models and simulations and demonstrated command and control of an AN/TPY-2 (FBM) radar.
- C2BMC S6.4 participated in Flight Test Terminal High-Altitude Area Defense (THAAD)-14 (FTT-14) in June 2010, but had difficulty providing situational awareness and status of BMDS elements participating in FTT-14. These will be discussed in the classified FY10 BMDS report to Congress.
- In August 2010, C2BMC S6.4 participated in Ground Test Integrated-04b (GTI-04b) in support of the S6.4 fielding decision. This exercise tested enhanced sensor management and track processing and reporting functions in S6.4, as well as enhanced situational awareness functionality of S6.4.

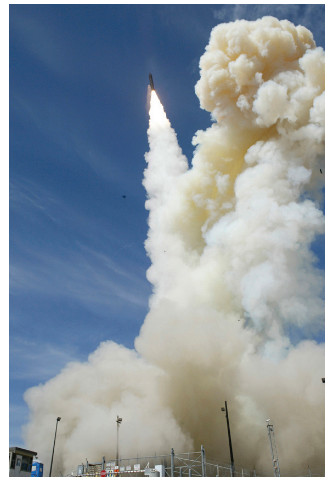
Assessment

- C2BMC is a critical component of the BMDS. C2BMC interactions with theater and strategic elements continued to increase and improve in FY10 and now include connectivity with the Arrow Weapon System.
- C2BMC has limited battle management capabilities allowing combatant command controllers sitting at C2BMC consoles to direct an AN/TPY-2 (FBM) radar to execute focused search plans or respond to a precision cue.
- C2BMC continues to demonstrate interoperability with BMDS elements, but requires more extensive tests in order to support development of tactics, techniques, and procedures.
- Apart from already existing C2BMC roles in providing situational awareness and some planning capability, S6.4 (as installed on the Parallel Staging Network) introduces the GEM component at USPACOM with a backup at MDIOC. GEM allows for automated management of multiple AN/TPY-2 (FBM) sensors located in a single area of responsibility. It also provides greater automation of sensor management and improved track processing and reporting while requiring less operator involvement as compared to S6.2 software.
- In ground testing to date, S6.4 has demonstrated the ability to manage two AN/TPY-2 (FBM) radars, automated sensor and battle management functionality, and track processing enhancements. In ground and flight testing, S6.4 has partially demonstrated the ability to provide situational awareness and status of weapon elements under test.

Recommendations

- Status of Previous Recommendations. The MDA addressed eight of the previous nine recommendations. The MDA continues to make progress on the one outstanding FY06 recommendation to include assessments of information assurance during BMDS-centric C2BMC testing.
- FY10 Recommendation.
  1. The MDA should conduct theater flight testing with S6.4 software with multiple threats and multiple weapon elements.

Ground-Based Midcourse Defense (GMD)



Executive Summary

- The Missile Defense Agency (MDA) conducted Flight Test Ground-based Interceptor-06 (FTG-06), an intercept flight test, in January 2010. FTG-06 experienced targeting radar and interceptor kill vehicle malfunctions, and failed to intercept its intended target. As a result, the MDA changed the GMD baseline test program by adding FTG-06a in 1QFY11 as a re-test. This re-test is necessary to collect data on GMD-critical engagement conditions. This re-test will likely delay the previous flight test program by at least six months.
- The MDA conducted Booster Verification Test-01 (BVT-01), a two-stage interceptor boost vehicle test, in June 2010. Data from BVT-01 suggest that the Ground-based Midcourse Defense (GMD) two-stage interceptor could prove a viable boost vehicle in addition to the currently deployed three-stage interceptor.
- Ground tests supported characterization of GMD performance and development of operational tactics, techniques, and procedures. Test results suggested GMD provides a capability to defend the United States against limited, emerging, uncomplicated, long-range, ballistic missile threats. Lack of sufficient data for comprehensive model and simulation validation and accreditation continues to preclude a full end-to-end performance evaluation.
- Continuing evolution of the interceptor design has resulted in multiple interceptor configurations among the fielded interceptors and test assets. These configuration differences complicate assessment of interceptor operational effectiveness and suitability.

System

GMD is the principal element used by the Ballistic Missile Defense System (BMDS) for the Homeland Defense mission. The current distributed GMD configuration consists of the following systems:

- Cobra Dane Upgrade Radar at Eareckson Air Station (Shemya Island), Alaska
- Upgraded Early Warning Radars (UEWR) at Beale AFB, California, and Fylingdales, United Kingdom.
- Ground-based Interceptor (GBI) missiles at Fort Greely, Alaska, and Vandenberg AFB, California.
- GMD Fire Control (GFC) nodes residing at the Missile Defense Integration and Operations Center, Schriever AFB, Colorado, and Fort Greely, Alaska. The ground system includes GFC, Command Launch Equipment (CLE), and In-Flight Interceptor Communications System Data Terminals at Vandenberg AFB, California; Fort Greely, Alaska; and Shemya Island, Alaska.
- External interfaces including Aegis Ballistic Missile Defense (Aegis BMD); North American Aerospace Defense – Northern Command (NORAD-NORTHCOM) Command Center (N2C2) and Command, Control, Battle Management, and Communications (C2BMC), Peterson AFB, Colorado; Space-Based Infrared System/Defense Support Program (SBIRS/DSP), Buckley AFB, Colorado; and AN/TPY-2 (Forward-Based Mission (FBM)) radar, Shariki Air Base, Japan.

Mission

U.S. Strategic Command operators will use the GMD system to defend U.S. territory, deployed forces, friends, and allies against threat ballistic missiles (intercontinental- and intermediate-range missiles).

Major Contractors

- The Boeing Company, Integrated Defense Systems, Missile Defense Systems – Huntsville, Alabama
- Orbital Sciences Corporation – Chandler, Arizona
- Raytheon Missile Systems – Tucson, Arizona
- Northrop Grumman Information Systems – Huntsville, Alabama

Activity

- The MDA conducted FTG-06, an intercept flight test attempt, in January 2010 to collect data on multiple critical engagement conditions and to demonstrate (for the first time) intercept of a target by an interceptor equipped with the new Capability Enhancement II (CE II) kill vehicle.
  - The MDA launched an intermediate range target missile with simulated re-entry vehicle from the U.S. Army Reagan Test Site at Kwajalein Atoll in the Republic of the Marshall Islands.
  - The Sea-Based X-band radar participated from a test location in the Pacific Ocean; no other BMDS radar participated in this test.
  - An Army 100th Missile Defense Brigade crew at Schriever AFB, Colorado directed the launch of a GMD interceptor from a test silo at Vandenberg AFB, California.
  - The GMD interceptor failed to intercept the target missile re-entry vehicle.
- The MDA conducted BVT-01, a boost vehicle verification test, in June 2010 to demonstrate launch and fly-out of a prototype 2-stage GMD interceptor and to collect data on multiple critical engagement conditions and one empirical measurement event. The MDA launched the interceptor from a test silo at Vandenberg AFB, California.
- The MDA and the BMDS Operational Test Agency Team conducted Ground Test Integrated-04b (GTI-04b), a BMDS-level hardware-, software-, and operator-in-the-loop ground test, in August 2010 to demonstrate functionality, interoperability, and performance of the BMDS and to characterize BMDS element capabilities.
  - The MDA used multiple ground test facilities located throughout the United States to replicate BMDS element responses, including GMD, to simulated threat scenarios.
  - GMD participated from the Army Advanced Research Center in Huntsville, Alabama.
  - An Army 100th Missile Defense Brigade crew from Schriever AFB, Colorado executed operational tactics, techniques, and procedures for the simulated GMD defensive operation against intercontinental ballistic missile threats.
- The MDA conducted BMDS Technical Assessment 2010, a fully digital BMDS-level simulation, in August 2010 to assess the performance capabilities of the to-be-fielded BMDS configuration. The MDA used multiple threat scenarios in conjunction with digital simulations of the BMDS and its elements. In particular, GMD simulated defense against intercontinental ballistic missile threats.
- Due to the failed FTG-06, the MDA changed the GMD test program by adding FTG-06a in 1QFY11 as a re-test to support data collection on GMD critical engagement conditions.

Assessment

- FTG-06 demonstrated launch and fly out of the GMD interceptor and limited threat detection, tracking, and engagement capability. In addition, FTG-06 employed, for the first time in flight test, a CE II kill vehicle. Undesirable performances of the Sea-Based X-band radar and the interceptor kill vehicle prevented intercept of the target and acquisition of data on critical engagement conditions. Details of the failed intercept will be discussed in the classified FY10 BMDS report to Congress. The added re-test, FTG-06a, will likely delay the previously planned flight test program by at least six months.
- BVT-01 demonstrated launch and flyout of the prototype GMD 2-stage interceptor. The MDA acquired critical engagement condition data on the launch and flyout environments, and additional data on 2-stage first generation avionics. The MDA is analyzing these data. BVT-01 also demonstrated deployment of a kill vehicle. The MDA collected data on specific critical engagement conditions from this kill vehicle. A malfunction of the kill vehicle, unrelated to problems associated with FTG-06 above, may have degraded the quality of data collected. The MDA is analyzing the data to determine the extent, if any, of the degradation.
- GTI-04b provided the most accurate representation to date of the BMDS and GMD for characterization of performance and for development and exercise of operational procedures. GTI-04b provided insight into GMD functionality, interoperability, and performance within the BMDS. Test results suggested that GMD provides a capability to defend the United States against limited long-range ballistic missiles with uncomplicated, emerging threat re-entry vehicles. The tests identified specific regions within the United States that posed greater difficulty to defend. Full end-to-end performance evaluation was not possible since specific models and simulations either lacked verification and validation data, or verification and validation data did not meet acceptability criteria as jointly established between the MDA and the BMDS Operational Test Agency Team.
- The MDA is currently analyzing the data from Technical Assessment 2010. As previously stated by the MDA, full end-to-end performance evaluation is still a minimum of 6 years away. Specific models and simulations either lack verification and validation data, or verification and validation data does not meet acceptability criteria as jointly established between the MDA and the BMDS Operational Test Agency Team.
- Evolution of interceptor design complicated assessment of operational effectiveness and suitability. Continued configuration changes driven by component obsolescence and problems discovered in flight test have resulted in differences

between fielded interceptors and flight test interceptors, further complicating assessment.
- Acquisition of suitability data continued to improve. Further refinements of the BMDS Joint Reliability and Maintainability Evaluation Team database are necessary to support evaluation of reliability, availability, and maintainability. Insufficient data on the GMD interceptor and command launch equipment limit database utility. In addition, the database lacks software maturity metrics for all components.
- The MDA evaluation of survivability is limited. As part of the annual Integrated Master Test Plan update process, the MDA continues to define the scope of required survivability testing, survivability assessment objectives, measures of performance, and data requirements.

Recommendations
- Status of Previous Recommendations. The MDA has satisfactorily addressed eight of the previous nine GMD recommendations. In FY07, DOT&E recommended the MDA re-examine the GMD-specific lethality simulation needs in light of test data that has emerged from MDA target lethality testing since its last accreditation. Although the MDA has made progress, this recommendation remains open.
- FY10 Recommendations. None.

Terminal High-Altitude Area Defense (THAAD)

Executive Summary

- The Terminal High Altitude Area Defense (THAAD) system successfully intercepted one unitary short-range target in the low endo-atmosphere in FY10.
- Another flight test event experienced a target failure and did not achieve its test objectives.
- In addition to delaying THAAD test objectives, the target failure also prompted the grounding of all air-launched targets within the Missile Defense Agency (MDA) test program. This was a necessary step to find the root cause of the problem, but it forced the THAAD program to further delay flight tests against longer-range targets.
- THAAD continued to make significant progress in executing the government ground test program, which is a critical component of the Army materiel readiness release process.
- THAAD completed a series of nine reduced-scale light-gas-gun tests to characterize the missile's lethality against missile payloads in FY10. This followed a series of nine lethality high-speed sled tests in FY08. THAAD also conducted lethality studies and analyses and ancillary lethality testing to support the THAAD lethality evaluation in FY10.
- A missile manufacturing problem delayed the materiel release decision for transitioning the first two THAAD fire units from the MDA to the Army until 2QFY11. This delay will allow the program to complete more testing before transition, but the program will still test significant additional capabilities after the materiel release decision.

- THAAD will complement the lower-tier Patriot system and the upper-tier Aegis BMD system.

System

- The THAAD ballistic missile defense system consists of five major components:
  - Missiles
  - Launchers
  - Radars (designated AN/TPY-2 (TM) for Terminal Mode)
  - THAAD Fire Control and Communications (TFCC)
  - Unique THAAD support equipment
- THAAD can accept target cues from the Aegis BMD, satellites, and other external theater sensors and command and control systems.

Mission

U.S. Strategic Command intends to deploy and employ THAAD, a rapid response weapon system, to protect critical assets worldwide. THAAD is designed to destroy short-range and medium-range theater ballistic missile threats to troops, military assets, and allied territories using hit-to-kill technology. Commanders will use the THAAD Kill Vehicle to intercept an incoming threat ballistic missile in the endo-atmosphere or exo-atmosphere, limiting the effects of weapons of mass destruction on battlefield troops and civilian populations.

Major Contractors

- Lockheed Martin Missile and Fire Control – Dallas, Texas
- Lockheed Martin Space Systems Company – Sunnyvale, California
- Raytheon Integrated Defense Systems – Tewksbury, Massachusetts

Activity

- Flight Test THAAD Interceptor-11 (FTT-11) occurred in December 2009. This test was intended to be the first THAAD intercept of a complex separating short-range target, but a target failure aborted the test. The air-launched target deployed from the C-17 aircraft, but failed to ignite. The program conducted some simulated intercept events after the failed live event using the Sim-Over-Live Driver (SOLD). The MDA has added the objectives from FTT-11 to the upcoming flight test FTT-12.
- FTT-14 took place in June 2010. This test was a successful low endo-atmospheric intercept of a unitary short-range target at a high lead angle and in a high-dynamic-pressure environment. Patriot participated in the test with a radar and command and control element to test radar debris

mitigation software and exercise engagement coordination procedures and software. The program conducted additional simulated intercept events using SOLD after the live event to demonstrate mass raid capability against short-range ballistic missiles.
- The THAAD government ground test qualification program completed electromagnetic-environmental-effects testing for the missile, launcher, radar, and TFCC in FY10. Safety testing for the missile is on-going. The radar Prime Power Unit was the final THAAD component to complete mobility testing. The full THAAD system also completed a series of natural environments tests at the McKinley Climatic Laboratory at Eglin AFB, Florida. Most THAAD ground qualification testing is now complete, although a few significant events, including cold region regression testing at McKinley, are scheduled for FY11 and FY12.
- THAAD participated in two Aegis BMD flight test events, Japanese Flight Test Mission-3 (JFTM-3) in October 2009, and FTX-06 in November 2009. In JFTM-3, the THAAD radar observed three simple separating targets in three separate events. In FTX-06, the THAAD radar observed two simple separating targets in two events, and TFCC exchanged data with Aegis BMD. In a third event, the program used SOLD to inject simulated threats in the presence of a live complex separating target and to conduct simulated intercepts.
- THAAD completed its series of nine reduced-scale light-gas-gun tests to characterize the missile's lethality against threat payloads in November 2009. Those tests supplemented a series of nine full-scale high-speed sled tests completed in FY08. Throughout 2010, THAAD also conducted various first-principle hydrocode analyses and ancillary lethality testing to support its lethality evaluation. (Note: supplementary testing and analysis has continued into FY11.)
- The Army Operational Test Agency conducted a Force Development Experiment, collecting data on the soldiers' use of doctrine, tactics, techniques, and procedures, and a Limited User Test, focusing on the capabilities and limitations of the THAAD system, from January through June 2010.
- In 1QFY10, THAAD also participated in both the Juniper Cobra 10 war game and the Fast Contingency Analysis and Activation Team East-C hardware-in-the-loop test event. In January 2010, the THAAD radar participated in Flight Test Ground-based Interceptor-06 (FTG-06), a Ground-based Midcourse Defense intercept flight test, collecting radar data and observing the behavior of the intermediate-range target used in the test. THAAD also participated in a focused Ground Test Other-04a (GTX-04a) in March 2010 and Ground Test Integrated-04b (GTI-04b) in August 2010, using hardware-in-the-loop to demonstrate interoperability with other BMDS components in a variety of defense scenarios.

Assessment

- THAAD made progress in FY10, demonstrating in FTT-14 much of the functionality necessary for intercepting challenging low endo-atmospheric threats.
- The FTT-11 target failure and a tight schedule forced the Army to conduct the Limited User Test before SOLD could be fully accredited. This risk may result in an incomplete capability assessment or the need for additional testing depending on the successful completion of upcoming tests FTT-12, FTT-13, and FTT-24.
- THAAD's planned lethality test program, which was completed in FY10, provided lethality information against several types of threat payloads. The additional analyses and tests that THAAD conducted to address some remaining lethality data voids supported the characterization of THAAD lethality, but extant lethality knowledge gaps remain to be resolved.
- Problems with target quality continue to interrupt the progress of the THAAD test program. The FTT-11 target failure delayed THAAD test objectives, and also prompted the grounding of all air-launched targets within the MDA test program. While this was a necessary step to find and fix the root cause of the problem, it forced the THAAD program to rearrange upcoming tests, further delaying flight tests against longer-range targets. The MDA anticipates air-launched targets will be available again in late 4QFY11 or 1QFY12.
- A manufacturing problem with a missile component has delayed the Army's Materiel Release Review Board for THAAD from the end of FY10 to the end of 2QFY11. This delay will allow more testing to be completed before the system transitions to the Army. Some THAAD testing, however, will still take place after the Materiel Release Review Board, including flight testing against longer-range targets. The absence of such testing will limit the assessment of proven capabilities delivered to the Army.

Recommendations

- Status of Previous Recommendations. Although the MDA continues to make progress on the FY09 recommendation to consider additional light-gas gun or sled testing to address lethality data voids and gaps in knowledge, the recommendation will remain open until the lethality assessment is complete.
- FY10 Recommendations. None.

Sensors

Executive Summary

- In January 2010, the Missile Defense Agency (MDA) conducted the Flight Test Ground-based Interceptor-06 (FTG-06) event employing the Sea-Based X-band (SBX) radar as the sole midcourse sensor. No other Ballistic Missile Defense System (BMDS) operational sensor participated in the flight test intercept attempt. The SBX exhibited undesirable performances that contributed to the failure to intercept.
- The MDA has gained significant operational experience with each of the BMDS sensors since the completion of sensor upgrade and development programs. However, the BMDS Operational Test Agency Team has not accredited any high fidelity performance models and simulations for assessing the performance of BMDS sensors.

System

The BMDS sensors are the following:

- **Aegis Ballistic Missile Defense (BMD) Radars**
  Aegis AN/SPY-1 radars modified to provide surveillance and tracking of long-range ballistic missiles.

Aegis BMD

- **AN/TPY-2 (Forward Based Mode (FBM)) Radar**
  (formerly called Forward based X-band Transportable (FBX-T))
  A Terminal High-Altitude Area Defense (THAAD) high resolution, X-band, phased array radar with modified software to provide acquisition and tracking of ballistic missiles of all ranges in the boost phase and transition to the midcourse phase of flight. There are two radars operationally deployed, one to Shariki, Japan, and the other to Israel.

AN/TPY-2

- **Cobra Dane Upgrade (CDU) Radar**
  An L-band, fixed site, fixed orientation, phased array radar located at Shemya, Alaska.

Cobra Dane

- **Space-Based Infrared System/ Defense Support Program (SBIRS/DSP)**
  An infrared satellite constellation and ground stations (primary and backup) that provide the BMDS with the initial notification of a ballistic missile launch and defended area determination.

SBIRS/DSP

- **SBX Radar** (in development)
  An X-band phased array radar on a movable mount, positioned on a fifth generation, twin hulled, semi-submersible, self-propelled ocean-going platform.

SBX

- **Upgraded Early Warning Radars (UEWRs)**
  Ultra High Frequency fixed site, fixed orientation, phased array radars located at Beale AFB, California (two radar sides or "faces," 240-degree azimuth field of view); Fylingdales, England (three "faces," 360-degree azimuth field of view); and Thule Air Base, Greenland (future addition) (two "faces," 240-degree azimuth field of view).

UEWR

Mission

U.S. Strategic Command, U.S. Northern Command, U.S. European Command, U.S. Pacific Command, and U.S. Central Command will use the BMDS sensors to:

- Detect, track, and classify ballistic missile threats targeting the United States, its allies, and its friends.
- Provide data for situational awareness and battle management to the BMDS Command, Control, Battle Management, and Communications (C2BMC) element.
- Provide track data to generate weapon task plans for ballistic missile defensive systems such as Aegis BMD and Ground based Midcourse Defense (GMD).

Major Contractors

- Aegis AN/SPY-1: Lockheed Martin – Moorestown, New Jersey
- AN/TPY-2: Raytheon Integrated Defense Systems – Tewksbury, Massachusetts
- CDU: The Boeing Company, Integrated Defense Systems, Missile Defense Systems – Huntsville, Alabama
- SBIRS: Lockheed Martin Space Systems Company – Sunnyvale, California
- SBX: The Boeing Company, Integrated Defense Systems, Missile Defense Systems – Huntsville, Alabama
- UEWRs:
  - Beale AFB and Fylingdales – The Boeing Company, Integrated Defense Systems, Missile Defense Systems – Huntsville, Alabama;
  - Thule – Raytheon Missile Defense Center – Woburn, Massachusetts

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Activity

- Aegis BMD AN/SPY-1: Aegis BMD AN/SPY-1 participated in multiple live tracking exercises and ground tests during FY10. Japanese Flight Test Mission-3 (JFTM-3) and Flight Test Other-06 (FTX-06) Events 2 through 4 performed live target tracking and simulated engagement support. AN/SPY-1 participated in hardware-in-the-loop and distributed ground tests, including Fast Contingency Analysis and Activation Team (CAAT) East-C (FCE-C), Ground Test Other -04a (GTX-04a), and Ground Test Integrated-04b (GTI-04b).
- AN/TPY-2 (FBM): An AN/TPY-2 (FBM) radar observed a number of targets of opportunity in FY10, such as Booster Verification Test-01 (BVT-01) in June 2010 and Flight Test Airborne Laser-01 in February 2010. The radar collected data on the performance of the software version (CX-1) that is planned for use in the first phase of the Phased Adaptive Approach in Europe. The radar also participated in focused GTX-04a in March 2010 and GTI-04b, using hardware-in-the-loop to demonstrate interoperability with other BMDS components. GTX-04a was a regional focused test using defense scenarios against short-, medium-, and intermediate-range ballistic missile threats, and GTI-04b was a full BMDS exercise using defense scenarios with short-, medium-, and intermediate-range and intercontinental ballistic missile threats. AN/TPY-2 (FBM) also participated in the Juniper Cobra 10 war game and the FCE-C test events in 1QFY10.
- Cobra Dane Upgrade: The Cobra Dane Upgrade viewed a number of targets of opportunity. A Cobra Dane Upgrade laboratory representation using operational software and operationally representative hardware participated in the system-level event, GTI-04b, in August 2010.
- SBIRS/DSP: A SBIRS/DSP laboratory representation using operational software and operationally representative hardware participated in GTI-04b.
- SBX: SBX collected track and discrimination data on the target during the FTG-06 flight test in January 2010. Undesirable SBX performances occurred that contributed to a failed intercept. An SBX laboratory representation using to-be-fielded software and operationally representative hardware participated in GTI-04b.
- UEWR: UEWR-Beale participated in the FTG-06 flight test in a passive role that did not affect the test. The UEWRs (Beale and Fylingdales) also participated in several MDA system-level ground test events, notably GTI-04b.

Assessment

- Overall: Since the completion of their respective upgrade or development programs, the MDA has gained significant operational experience with each of these sensors. An area of concern is the development of consistent, validated environmental and post-intercept debris models to assess integrated system performance.
- Aegis BMD AN/SPY-1: Aegis BMD AN/SPY-1 continues to evaluate its interoperability with the BMDS and to support BMDS testing and real-world activities. Aegis BMD has not participated in a BMDS flight test that uses AN/SPY-1 radar data in real-time as the primary data source for developing a GMD weapon task plan, although it has supported intercepts as part of an ensemble of sensors including AN/TPY-2 (FBM), SBX, and UEWR-Beale.
- AN/TPY-2 (FBM): AN/TPY-2 (FBM) had a number of opportunities to collect data on the performance of upcoming software build CX-1, but an opportunity to test it as a contributing sensor in a flight test is not scheduled until FTG-06a in 1QFY11. DOT&E cannot assess the utility of CX-1 until that time.
- Cobra Dane Upgrade: Due to its location and field-of-view, Cobra Dane Upgrade has not participated in BMDS intercept flight test events. Performance estimates for the current configuration of Cobra Dane Upgrade have been limited to the ground test results and targets of opportunity. These estimates rely on models and simulations that are not yet validated and accredited for use in assessing performance. To collect the required data, the MDA will fly another target through the Cobra Dane Upgrade field of view. This flight test event is currently scheduled during FY13.
- SBIRS/DSP: SBIRS/DSP continues to support the BMDS with timely and accurate launch data and with initial predictive impact data.
- SBX: SBX has not successfully supported a live intercept as the sole primary midcourse sensor. During FTG-06, SBX participated as the sole midcourse targeting sensor, but the SBX exhibited undesirable performances that contributed

to the failure to intercept. SBX performance estimates are currently based on unaccredited models and simulations. Significant work remains to collect the applicable data necessary to validate modeling of SBX performance.
- UEWRs: UEWR-Beale viewed the GMD interceptor flyout in FTG-06, but due to its location, it played no role in targeting. UEWR-Beale and UEWR-Fylingdales laboratory representations using operational software and operationally representative hardware participated in GTI-04b. UEWR-Beale and UEWR-Fylingdales performance estimates are based on unaccredited models and simulations.

Recommendations
- Status of Previous Recommendations. Although the MDA and Combatant Commanders have made progress on developing concepts of operations for the sensors to be used as part of the phased adaptive approach to providing missile defense in Europe, the FY09 recommendation remains open pending completion of those concepts and implementation in operational testing.
- FY10 Recommendations. None.

Technology Programs

Executive Summary

- The Missile Defense Agency (MDA) advanced the development of a number of technology programs, in particular, the Airborne Laser (ABL), the Precision Tracking Space System (PTSS), and the Airborne Infrared (ABIR) system.
- In February 2010, the ABL negated a liquid-fueled, metal-casing missile. A subsequent attempt to negate a similar target at twice the engagement range ended unsuccessfully due to a technical problem. In 2QFY10, the ABL became a national test bed, known as the Airborne Laser Test Bed (ALTB). The Department of Defense is currently assessing the future of the ALTB.
- The Precision Tracking Space System (PTSS) is pursuing a vigorous pre-launch technology development program, incorporating innovative infrared focal plane arrays, optical telescope designs, cooling systems, and on- and off-board data processing. In addition, PTSS is using the Space Tracking and Surveillance System (STSS) and the Near-Field Infrared Experiment (NFIRE) satellites to collect background and target flight test data to inform the PTSS design. In FY10, the MDA identified eight PTSS knowledge points with estimated completion dates through FY15.
- For the ABIR technology program, the MDA used existing unmanned aerial vehicle platforms and sensors to collect data during two flight tests in FY10. The MDA is currently working to identify a set of ABIR knowledge points with tentative completion dates through 1QFY13.

Systems

ALTB

The ALTB is a national test bed operated by the MDA. It consists of:

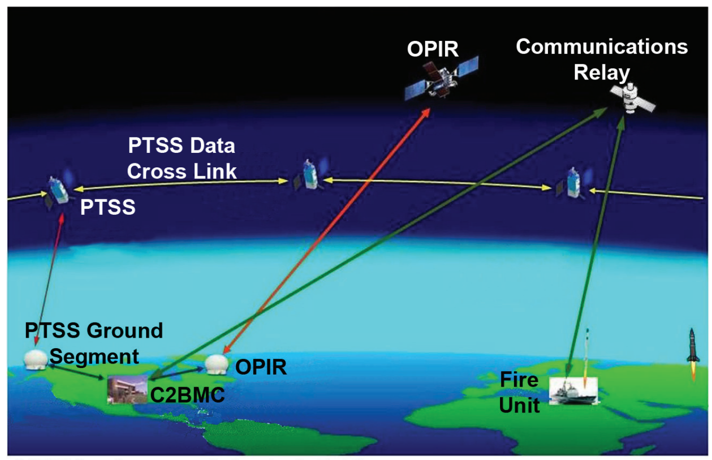
- A modified Boeing 747-400F commercial aircraft.
- A megawatt-class chemical oxygen-iodine laser.
- A laser turret on the aircraft nose and two illuminator lasers on a bench in the fuselage.
- Optical benches with highly sensitive cameras, sensors, and mirrors.
- Hardware and software for battle management, command, control, communications, computers, and intelligence.
- Ground support equipment for storing, mixing, transporting, and loading laser chemicals.

ALTB

PTSS

The PTSS, a follow-on to the STSS, is an advanced technology program that will consist of a:

- Low-earth-orbit satellite constellation (space segment) capable of the optical detection, tracking and characterization of ballistic missile target complexes from post-boost through the re-entry stages of flight.
- Ground segment capable of forwarding cues and tasking to the space segment and, receiving and processing sensor image data, and relaying detection information to command and control nodes.



C2BMC – Command, Control, Battle Management, & Communications
OPIR – Overhead Persistent Infrared
PTSS – Precision Tracking Space System

PTSS

ABIR

The ABIR is an advanced technology program that will consist of:

- Existing unmanned aerial vehicles (UAVs) modified to carry sensors, which can detect ballistic missiles in early stages of flight.
- Ground control stations for forwarding taskings to UAVs and relaying detection and tracking messages to command and control nodes.

ABIR

Missions

ALTB

As a test bed, the ALTB does not have an operational mission and is not equipped to be an operational asset. The future function and direction of the test bed, including amount and type of testing, is still being assessed. Currently, the ALTB has the capability to:

- Autonomously acquire and track threat ballistic missiles using its passive infrared sensors.
- Establish precise track on the missile nose and an aimpoint on the propellant tank using its illuminator lasers.
- Potentially destroy a missile by placing laser thermal energy on the tank or motor case to weaken the casing, allowing internal pressure to rupture the tank.

PTSS

Combatant Commanders intend to use the PTSS, a space based sensor element of the Ballistic Missile Defense System (BMDS), to:

- Track medium-range and intermediate-range ballistic missiles from post-boost through re-entry based on boosting tracks provided to PTSS by other space-based assets.
- Provide individual sensor track data to Command, Control, Battle Management, and Communications (C2BMC) for the generation of engagement quality tracks. Initially, PTSS will support Standard Missile-3 engagements while the support for engagements using other interceptors will be developed later.

ABIR

Combatant Commanders intend to use ABIR, together with other forward sensors to:

- Acquire, track, and assess ballistic missile events during early stages of flight.
- Report tracking information to C2BMC for engaging ballistic missile threats.

Major Contractors

- ALTB: Boeing, Integrated Defense Systems – Chicago, Illinois
- PTSS: To-be-determined following competitive bids and contractor selection
- ABIR: To-be-determined following competitive bids and contractor selection

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Test and Evaluation Activity and Knowledge Point Progress

For the technology programs, the MDA uses knowledge points to measure development progress by focusing on the set of critical activities that define each program's risk. This approach allows the MDA to make informed decisions on advancement of a development activity.

ALTB

- Since becoming a test bed managed outside the MDA, the system no longer has knowledge points.
- In January 2010, in accordance with the Duncan Hunter National Defense Authorization Act for Fiscal Year 2009, Section 235, DOT&E submitted a Report to Congress on the Assessment of Operational Effectiveness, Suitability, and Survivability of the Airborne Laser (ABL).
- In February 2010, the system had its first lethality demonstration, negating a liquid-fueled missile with a metal casing.
- In September 2010, after overcoming a number of technical problems during ground and flight test preparations, a subsequent attempt to negate a similar target at twice the engagement range of the February 2010 demonstration ended unsuccessfully when an automatic safety feature shut down the laser before it could successfully negate the target.

PTSS

- The STSS demonstration program and the NFIRE program are supporting the development and fielding of PTSS by acting as surrogate sensors. A series of targeted observations already have increased and will continue to increase the PTSS team's knowledge of the low-earth-orbit environment and possible constellation operational concepts.
- In addition to flight testing, the MDA plans to use the combination of analysis and hardware-in-the-loop testing to address the following PTSS knowledge points:
  1. Provisional identification of payload wavebands. The MDA completed this knowledge point in FY10.
  2. Provisional Quality of Service levels and deadlines; mass raid scheduling algorithms. The MDA completed this knowledge point in FY10.
  3. Provisional communications architecture defined; analysis of throughput, latency, and failure modes. The MDA completed this knowledge point in FY10.
  4. Concept of operations, end-to-end functional flow, and timing budgets under realistic raid loads. The MDA completed this knowledge point in 4QFY10.
  5. Optical payload processor and communication payload that can handle raid environment. The MDA plans to complete this knowledge point in 4QFY11.
  6. Payload design successfully operates against realistic backgrounds and signatures. The MDA plans to complete this knowledge point in 4QFY12.
  7. Space qualified payload successfully operates under realistic raid loads. The MDA plans to complete this knowledge point in 2QFY14.
  8. End-to-end operational readiness test of space segment (two spacecraft) and ground segment. The MDA plans to complete this knowledge point in 3QFY15.

ABIR

- The MDA is executing a plan that uses a combination of existing UAV platforms and sensors and a sequence of knowledge points to demonstrate the ABIR capability.
- In FY10, ABIR participated in two Ground-based Midcourse Defense (GMD) flight tests, Flight Test GMD-06 (FTG-06) in January 2010 and BVT-01 in June 2010. The platform, sensor, and ground equipment performed nominally and collected interceptor launch data. ABIR also participated in three additional flight tests during FY10, the Navy's Stellar Daggers flight test in December 2009, the ALTB lethality demonstration in February 2010, and THAAD's FTT-14 in June 2010. The ABIR team is analyzing the flight test data.
- The MDA identified the following candidate knowledge points, which will be completed using flight testing with the existing hardware:
  1. Measure ability of ABIR to generate a 2-dimensional track with sufficient accuracy and timeliness to support Aegis engagements. The MDA plans to complete this knowledge point in 4QFY11.
  2. Measure the ability to extract feature data with a two-color infrared sensor for discrimination. The MDA plans to complete this knowledge point in 3QFY12.
  3. Measure the raid size capacity of ABIR. The MDA plans to complete this knowledge point in 1QFY13.

Recommendations

- Status of Previous Recommendations. There were no recommendations for FY09.
- FY10 Recommendations. None.

Live Fire Test & Evaluation Program

Live Fire Test & Evaluation Program

Live Fire Test and Evaluation Program

DOT&E executed oversight of survivability and lethality test and evaluation for 117 acquisition programs in FY10. Of those 117 programs, 19 programs operated under the waiver provision of U.S. Code, Title 10, Section 2366, by executing an approved alternate LFT&E strategy in lieu of full-up system-level testing.

In addition, Section 2366 also requires DOT&E to report on a program's LFT&E results prior to that program entering into full-rate production.

LFT&E published the following special reports during the past year:

- Assessment of the Mine Resistant Ambush Protected (MRAP) Family of Vehicles
- Operational and Live Fire Report of the M915A5 Truck Tractor, Line Haul
- Live Fire and Operational Test and Evaluation Report on the Mine Resistant Ambush Protected (MRAP) – All Terrain Vehicle (M-ATV)
- Hard Body Armor Phase II and Phase II Follow-on Test and Evaluation, DOT&E Independent Assessment

DOT&E published the following combined OT&E/LFT&E reports on acquisition programs entering full-rate production:

- *Virginia* Class Submarine
- USS *San Antonio* (LPD 17) Amphibious Transport Dock Ship
- Littoral Combat Ship (LCS) 1
- USMC H-1 Upgrades (AH-1Z)
- C-5M

In addition to satisfying acquisition program oversight requirements, the LFT&E program funds and executes technical oversight on investment programs that provide joint munitions effectiveness data (Joint Technical Coordinating Group for Munitions Effectiveness), develops advanced technologies and analytical methods to increase aircraft survivability, (Joint Aircraft Survivability Program), and conducts vulnerability and lethality testing of fielded platforms and weapons systems, (Joint Live Fire). LFT&E investment programs also support quick reaction efforts aimed at addressing urgent operational commander's needs.

JOINT TECHNICAL COORDINATING GROUP FOR MUNITIONS EFFECTIVENESS (JTCG/ME)

The Joint Logistics Commanders chartered the Joint Technical Coordinating Group for Munitions Effectiveness (JTCG/ME) in 1968 to assure development of consistent, credible effectiveness estimates for conventional munitions across the DoD. The JTCG/ME develops the Joint Effectiveness Manuals (JMEM), that are the sole source for all authenticated non-nuclear weapons effectiveness data within the DoD. The primary application of the JMEM is to support weaponeering, defined as the detailed technical planning of a weapon strike that occurs at multiple levels in the operational chain of command before actual combat. The JTCG/ME produces, distributes, and regularly updates JMEMs. JMEMs provide computerized operational tools and data for rapid evaluation of using alternative weapons against specific targets. In many cases, collateral damage estimates generated by these tools are part of the decision criteria for strike missions. In FY10, the JTCG/ME developed and released two updated JMEMs.

The first updated product is the JMEM Weaponeering System (JWS) version 2.0.1, which is a combination of both Air-to-Surface and Surface-to-Surface weapons effectiveness data. It includes target vulnerability information for approximately 1,500 targets, descriptive information, data, graphics, computer programs, and methods needed to accomplish weaponeering, step-by-step training guides for weaponeering, and related Help files. JWS provides the capability to evaluate the effectiveness of various air-to-surface and surface-to-surface weapons against a variety of target types. JWS includes solutions on over 250 new or updated targets from the previous edition. The JTCG/ME continued direct support to the Joint Staff "No-Strike and The Collateral Damage Estimation Methodology" process by publishing an updated set of Collateral Effect Radii tables. The JTCG/ME provided data updates concurrent with deployment of rapidly fielded weapon systems supporting current operations in the Central Command (CENTCOM) Area of Responsibility.

The second updated product released by JTCG/ME during FY10 is the Joint Anti-Air Combat Effectiveness (J-ACE) System version 4.1, which includes the Joint Anti-Air Model. J-ACE incorporates 16 new threat models for enemy air-to-air and surface-to-air missiles. The model also performs checks for maximum off-boresight launch angle limits. Additionally, J-ACE contains updates on the weapon engagement zone, (launch control), effectiveness data for seven U.S. systems and various architectural and graphical user interface improvements.

This JMEM is used by fighter pilots to develop air superiority tactics and by U.S. Strategic Command for global strike mission planning.

The JTCG/ME continued efforts to support the integration of Information Operations tools into the JMEM format. These efforts, performed in coordination with the U. S. Strategic Command and others, resulted in enhancements to Computer Network Operations, Electronic Warfare, and various Psychological Operations tools. Information Operations training was also conducted at numerous locations. Initiatives related to JMEM development for other non-traditional effects (e.g., non-lethal weapons, high-energy lasers, high power microwave weapons) continued.

JOINT AIRCRAFT SURVIVABILITY PROGRAM (JASP)

DOT&E sponsors and funds the Joint Aircraft Survivability Program (JASP). The Naval Air Systems Command, Army Aviation and Missile Command, and Air Force Aeronautical Systems Center charter the program. DOT&E establishes objectives and priorities for the JASP and exercises oversight of the program. The mission of JASP is to increase the readiness and effectiveness of U.S. military aircraft through the joint coordination and development of survivability techniques, technology, and assessment methods. The program funds analyses and technology development projects. JASP also funds the Joint Combat Assessment Team (JCAT), which is deployed to the CENTCOM theater and uses data gathered from combat, threat exploitation, and LFT&E to provide combat commanders support for mission planning and developing operational tactics.

In FY10, JASP worked with the Office of the Under Secretary of Defense (OUSD) Acquisition Technology and Logistics/ Deputy Director Research and Engineering (AT&L/DDR&E) and DOT&E on the DDR&E-led Helicopter Survivability Task Force (HSTF). The multi-disciplinary team was tasked with rapidly fielding techniques and technology to improve helicopter survivability in Operation Enduring Freedom. JASP led the Study on Rotorcraft Survivability, completed and delivered to Congress on October 2, 2009, and focused the HSTF effort on addressing the leading causes of DoD helicopter losses. JASP provided expertise on aircraft survivability, especially vulnerability reduction technology. JASP recommended two specific vulnerability reduction technologies for funding: Firetrace™ passive fire protection for the V-22 main landing gear bay, and multi-hit transparent armor for the down look window in the MH-47G cockpit door. Congress provided funding for the Firetrace™ installation on the V-22, and fielding is expected to begin in the first quarter of FY11. While funding for fielding transparent armor in the MH-47G down-look window is pending, interest in the transparent armor for other helicopter applications is growing.

JASP funded 47-multiyear survivability projects for $9.7 Million and reported results of 29 projects in FY10. The following summaries illustrate current JASP efforts in four focus areas: susceptibility reduction, vulnerability reduction, survivability assessment, and combat damage assessment.

Susceptibility Reduction

JASP continues projects in susceptibility reduction science and technology efforts. These efforts address urgent aircraft survivability needs emerging from Operations Iraqi Freedom, Enduring Freedom, and New Dawn, as well as improving aircraft survivability against future threats.

Correlation of Seeker Test Van Data with Intelligence

The Naval Air Warfare Center, Weapons Division, China Lake, California, discovered discrepancies between flight test results and intelligence estimates of the performance of seekers in Man Portable Air Defense Systems (MANPADS). These discrepancies have significant implications regarding the proper interpretation of test results and their implications for coalition force survivability and implementation of tactics, engagement doctrine, and countermeasure deployment against Infrared (IR) guided MANPADS. A web-hosted common database was established by JASP at the Missile Systems Intelligence Center incorporating corrections to these discrepancies. In addition, recommendations for standardizing test procedures and data sets were provided to test agencies. The JASP-sponsored investigation of these discrepancies and recommended solutions will assure accurate seeker effectiveness assessments are provided to aircrews and commanders.

Imaging Infrared Seeker Countermeasures

This project develops countermeasures against missiles with advanced Imaging Infrared (IIR) seekers. In FY10, this project used digital modeling and simulation (M&S) to develop several promising countermeasures techniques. JASP supported the IIR Countermeasures Future Naval Capability program to counter IIR seekers. Techniques have now been developed that are ready for verification using hardware-in-the-loop facilities.

Enabling Technologies for Future IRCM Systems

This project funds enabling technologies for future infrared countermeasures (IRCM) systems such as the Common Infrared Countermeasures program. JASP supported the development of

Spinel (a rugged crystal of magnesium aluminum oxide) domes for turrets in IRCM systems, enhancing their reliability and performance against MANPADS. The laser bandwidth capability of IRCM systems was expanded by building, testing, and demonstrating an IR fiber wavelength converter. JASP is sponsoring the design, fabrication, test, and demonstration of anti-reflective surfaces on the ends of IR fibers to significantly improve laser transmission.

Advanced Techniques for Radio Frequency Countermeasures

This project supports the development and testing of countermeasures techniques to increase the survivability of Army, Navy, and Air Force rotary wing aircraft. The project is assessing the ability of an on-board radar warning receiver to receive, process, and display each mode of selected threat weapon systems. The results of the assessments are then used to develop countermeasures techniques and demonstrate their effectiveness against state-of-the-art threat radar weapon systems. In FY10, techniques were successfully demonstrated against two threat radars and are being transitioned to fielded helicopter radar warning and radar countermeasures equipment.

Developed Common Exciter Advanced Suppressor Exercise and Demonstration

This project funded development and testing of new electronic attack techniques against radars with significant electronic protection capabilities. The techniques developed are included in the performance specification for the AN/ALQ-214 Integrated Defensive Electronic Countermeasure system, as well as the EA-18G Next Generation Jammer.

WeaponWatch® Hostile Fire Determination

JASP is supporting the expansion of the current WeaponWatch® hostile intent determination system to include algorithms for detecting attacks by small arms, rocket propelled grenades, and rockets. System performance was successfully demonstrated in a large-scale live-fire field test event held in May 2010, providing algorithms that can be incorporated in systems used to identify hostile fire.

Acoustic Hostile Fire Detection

This project supports the acoustic component of the U.S. Special Operations Command (USSOCOM) multi-spectral Hostile Fire Indicating System (HFIS). JASP is funding requirements definition, analysis of optimum acoustics, sensor location, the number of sensors needed, and installation of prototypes on a demonstration helicopter, as well as ground and flight testing.

Vulnerability Reduction

In FY10, JASP continued to focus on developing lighter-weight opaque and transparent ballistic protection systems, fuel containment technologies for fuel system components, and fire protection technologies.

Multi-Hit Transparent Armor

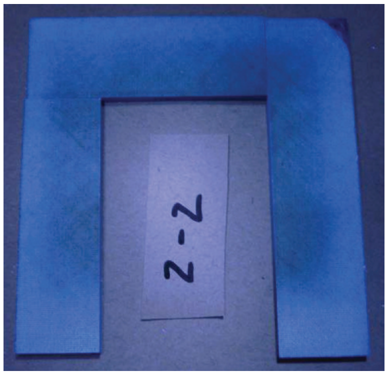
JASP, along with the U.S. Army Aviation Applied Technology Directorate and The Protective Group, Inc. (TPG), developed a transparent armor concept for aircraft that reduced areal density and thickness by 20 percent while improving multiple-hit performance and see-through visibility. Specifically, TPG developed a prototype MH-47G helicopter down-look window with three times the viewing area of the current window that is 17 percent lighter and provides greater ballistic protection and multi-hit visibility.

Critical Component Armor

JASP is developing critical component protection using lightweight, structurally integrated armored panels. JASP is exploring the use of rapid, low-cost ceramic and metal forming processes to integrate armor into aircraft exterior panels, mechanical frames, and structure. This project expects to produce an integrated armored panel capable of passing air worthiness release and defeating prevalent ballistic threats.

Joint Thermal Degradation of Composites

This project funded an effort to quantify the degradation of aircraft structural composite materials as a function of the thermal flux caused by short-lived fuel fires. Under this project, the ability of various Non-Destructive Inspection (NDI) techniques to detect equivalent measures of thermal degradation was assessed. The project expanded the understanding of thermal damage to graphite composites commonly used in fixed and rotary wing aircraft and demonstrated the ability of NDI to determine the magnitude of thermal damage from brief dry bay fires. NAVAIR is currently transitioning procedures to maintenance depots and Fleet Readiness Centers for use in making repair decisions on the F/A-18D/E/F, AV-8B, and V-22 aircraft.



Wireless Fire Detector

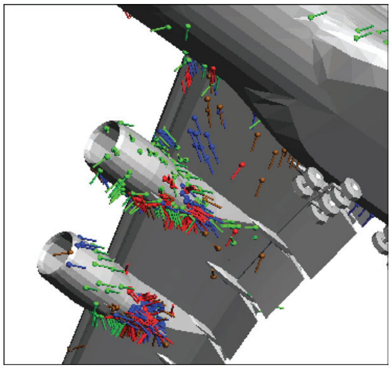
JASP continued to fund development of wireless fire detector technology for application in current and future aircraft. JASP is leveraging this Air Force Small Business Innovative Research (SBIR)-led project with the goal of producing a low-cost, lightweight, fast-acting, and reliable fire protection system that is easy to retrofit into fielded aircraft. In FY10, three SBIR contracts were awarded to develop prototype wireless fire detector systems. Fire detection tests of the prototypes in simulated aircraft dry bays began in late FY10 and will continue into FY11. The project will finish in FY11 with environmental testing, final demonstration/validation testing, and limited flight testing on an F-16C at the Air National Guard Command Test Center.

High Performance Fuel Bladder

JASP is working with the METSS Corporation to develop a cost-effective fuel bladder that is 50 percent lighter than current tanks while maintaining adequate ballistic protection. The approach uses an exoskeleton design that reduces the number of fabric reinforcing plies, and a high-performance synthetic sealant that is one-fourth as dense as the natural gum rubber used in existing bladders. In FY10, METSS completed design verification testing including crash impact, gunfire, and panel testing. In FY11, the team will work with the U.S. Army Aviation Engineering Directorate on approved designs and procurement plans for two AH-64 Apache helicopter lightweight fuel bladders, including qualification testing to meet appropriate military specifications.

Improved MANPADS Hit Point Prediction

JASP continues to address the issue of hit point prediction to support aircraft vulnerability analyses, design, and LFT&E. The vulnerability of aircraft to MANPADS is highly dependent on hit point, which cannot currently be reliably predicted or modeled. In FY10, three independent DoD MANPADS engagement M&S facilities modeled specific MANPADS threats. A statistical comparison of the results and an analysis to validate MANPADS hit point prediction simulations was conducted. In FY11, the team will complete correlation of M&S hit point prediction test results with available live fire data, and develop a standardized methodology for hit point prediction simulations, improving MANPADS vulnerability analyses.

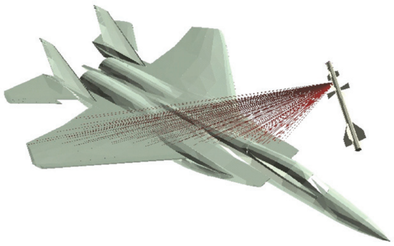


Survivability Assessment

JASP continues to establish projects designed to develop aircraft survivability assessment methodologies, spanning the engineering level through the engagement level. These methodologies are often used to generate pre-test predictions for LFT&E and OT&E activities.

Vulnerability Toolkit

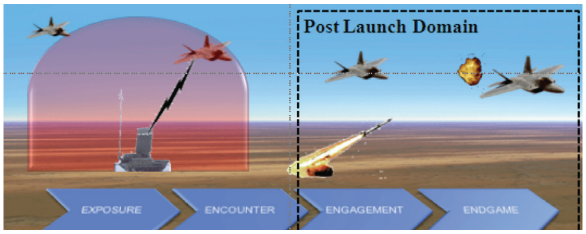
This project developed and documented standard means for characterizing threats used in performing vulnerability analyses. The project included improvements that enable detailed endgame analysis without the need for using simplified, and subsequently less accurate, approximations of targets or threats. In the future, all JASP-sponsored vulnerability assessment data and methods will use standard inputs, significantly improving user support and configuration management.



Crew and Passenger Survivability Methodology

JASP identified two potential methodologies for the assessment of crew and passenger casualties in combat. Both methodologies will be exercised to evaluate their strengths and weaknesses. The first method integrates casualty assessment models within standard vulnerability analysis tools taking into account vulnerability, crash conditions, crashworthiness, and egress capabilities to provide an assessment of crashworthiness. The second method applies discrete crew and passenger expected survivability values to the output of standard vulnerability analysis tools. A workshop of subject matter experts from all Services, NASA, and industry identified the data and models available to support the demonstrations in FY11, as well as the long-term data and modeling needs.

Suite of Anti-air Kill chain – Models and Data
This is a joint project between the JASP, JTCG/ME, and the U.S. Strategic Command (USSTRATCOM). The Suite of Anti-air Kill chain – Models and Data (SAK-MD) effort intends to provide a comprehensive and consistent set of models and data so that all friendly and threat systems are assessed with equal fidelity across the entire kill chain. The SAK-MD project will provide a set of analysis tools that will allow USSTRATCOM to evaluate different scenarios for the delivery of strategic weapons.



Combat Damage Assessment
JASP continued to support the Joint Combat Assessment Team (JCAT) in FY10. JCAT is a team of Air Force, Army, Marine Corps, and Navy personnel deployed in support of Operations Iraqi Freedom, Enduring Freedom, and New Dawn. JCAT forward locations in Iraq were closed down as OIF drew to an end. Conversely, JCAT expanded its operation in Afghanistan, establishing full-time deployments at Bagram, Kandahar, and Camp Bastion.

JCAT efforts include inspecting damaged and destroyed aircraft, acquiring available maintenance documentation, and conducting interviews with aircrew and intelligence personnel. Consultation is provided to weapons, tactics, and logistics personnel and comprehensive briefings are given to commanders in charge of daily air operations. These efforts provide valuable information to commanders allowing them to adjust their tactics, techniques, and procedures based on accurate threat assessments. These efforts, including forward deployments in Iraq and Afghanistan, resulted in the completion of 186 aircraft incident evaluations and reports as of September 25, 2010.

The Army component of JCAT provided deployed commanders with a reporting link accessible via the U. S. Army Aviation Center of Excellence web site. This link will expedite timely battle damage reporting and feeds the Combat Damage Incident Reporting System (CDIRS) hosted by the Survivability/Vulnerability Information Analysis Center (SURVIAC). This SURVIAC database is the repository for all U.S. aircraft battle damage events.

JCAT provides professional training to the U.S. aviation community. Air Force JCAT members hosted the 2010 Threat Weapons and Effects Seminar at Eglin AFB, Florida. Attendees included representatives of the U.S. Military Services, Department of State, Department of Homeland Security, Federal Aviation Administration, Department of Energy, Federal Bureau of Investigation, and the Bureau of Alcohol, Tobacco, Firearms and Explosives, and U.S. industry partners. JCAT also provides resources such as capabilities briefs, intelligence updates, recent "shoot-down" briefs to discuss enemy tactics, techniques, and procedures, and combat damage collection and reporting.

JOINT LIVE FIRE

Aircraft Systems Program
The goal of the Joint Live Fire Aircraft Systems Program (JLF-Air) is to identify vulnerable areas in current aircraft platforms, understand damage mechanisms, and provide this information to survivability engineers. Since the Vietnam War, there have been great strides in reducing the vulnerability of our aviation platforms. Many of our current helicopters and planes are tolerant to impacts from small arms fire and even some air defense artillery. Unfortunately, as the protection of our aircraft improved, hostile forces have been able to access increasingly lethal MANPADS weapons. These weapons will be present in current and future operational areas; the current challenge is reducing our vulnerability to this threat. As such, a primary emphasis in FY10 was to increase our understanding of lethality and damage mechanisms of MANPADS. In 2009, Army, Navy, and Air Force members of JLF, JASP, and JTCG/ME collaborated to identify and draft a plan, known as the MANPADS Roadmap, to resolve key deficiencies in available MANPADS threat data.

MANPADS Threat Model Development – Blast
This project is collecting data of sufficient accuracy and precision to improve the MANPADS threat models used in aircraft vulnerability assessment codes such as the Computation of Vulnerable Area Tool (COVART) and the Advanced Joint Effectiveness Model (AJEM), as well as damage prediction and assessment tools such as LS-DYNA and the Combat Assessment Tool (CAT). JLF-Air is coordinating test events with modelers to ensure the necessary data is being captured. During initial tests in September 2010, JLF-Air successfully collected static and dynamic blast pressure data. JLF-Air plans additional static tests for early FY11.

Large Engine Vulnerability to MANPADS
The goal of this project is to determine the vulnerability of a large turbofan engine to a MANPADS threat as an initial step in understanding the vulnerability of large multi-engine aircraft. JLF-Air is performing this project in partnership with the Department of Homeland Security, Aircraft Systems Program, which is providing matching funds. NASA is also partnering on this project. Two MANPADS will be shot into operating CF6-50 engines to investigate engine-nacelle fires, uncontained engine debris, and the ability to maintain controlled

flight and safely land with damaged engines and airframes. The CF6-50 is representative of engines found on the A300, B747, and KC-10 aircraft and will be tested using realistic power settings, airflow, MANPADS impact velocity, detonation conditions, and shotlines. NASA will conduct a combination of wind tunnel tests and simulations to estimate the effects of damage on aircraft safety of flight. JLF-Air FY10 efforts focused on fabrication of the engine test stand and getting the CF6-50 engines operational. This work will result in a better understanding of the role of engine vulnerability on overall aircraft vulnerability.

MANPADS Comparative Analysis

This project compared the physical and performance characteristics of newer, widely proliferated MANPADS to identify a standard LFT&E test article that could be used to represent later generation missiles for future live fire tests. This hybrid missile would be used in lieu of the typically hard to obtain actual threat weapons. The standardized configuration will lead to higher fidelity characterization and improved live fire testing by better representation of MANPADS across programs.

Dry Bay Fire Vulnerability

This project is evaluating the use of passive fire extinguishing technologies to reduce aircraft vulnerability to fires in dry bays. In FY10, twelve test events were successfully completed, demonstrating potential solutions for the wing leading edge dry bays in the Joint Cargo Aircraft. In FY11, testing will examine solutions for the wing trailing edge dry bays.

Combat Incident Emerging Threat Investigation

A recent combat incident in Afghanistan raised concerns about a potential new threat to helicopters. In this incident, a CH-47 helicopter was damaged in a manner uncharacteristic of any previous aircraft incident, and the JCAT requested JLF-Air help to provide threat characterization data to support their assessment. Having data from controlled live fire tests to compare to the damage was a high priority for JCAT.

JLF-Air conducted two shots to collect initial damage effects data against surrogate airframes using static detonation of the "legacy" threat and dynamic impacts with the postulated "new" threat. Shotlines, based upon information provided by JCAT, addressed basic suspected damage results.

Comparable tests will be executed in FY11 with both static and dynamic warhead impacts against actual CH-47D Chinook airframes. The data collected will be provided to the JCAT, JASP vulnerability reduction community, the National Ground Intelligence Center, and threat modeling communities.

Ground Systems Programs

The goal of the Joint Live Fire Ground Systems Program (JLF-Ground), previously known as the Armor/Anti-Armor program, is to fully characterize current threat weapons and munitions, providing critical empirical data to Joint Improvised Explosive Defeat Organization (JIEDDO) and JTCG/ME. The program also addresses combat personnel protection and survivability from threat weapons. The program funds projects to improve the understanding of weapons effects during operations in urban environments.

Ballistic Clay Development for Use as Body Armor Test Backing Material

In an effort to better characterize and reduce uncertainties in body armor testing, a joint effort between DOT&E, the Services, academia, and industry is underway to produce a consistent, well-documented clay formulation designed specifically for ballistic testing of body armor at room temperature. The project intends to introduce the new ballistic clay into personal protection equipment (PPE) testing in FY12. Results are being shared with Government and commercial stakeholders.

X-ray Fragment Characterization System Testing & Optimized Fragment Recovery Media Study

In FY09, JLF-Ground began an effort to improve DoD's capabilities in performing arena testing and warhead assessments. The FY10 effort focuses on two areas. The first assesses the capability of high-power X-ray systems to significantly automate portions of the process by providing higher quality data while reducing cost and time requirements. The second assesses new materials for capturing fragments to provide better velocity assessments while simultaneously reducing cost. Initial results indicate the potential of using X-ray systems, but analysis of results is still underway to determine the accuracy of such systems.

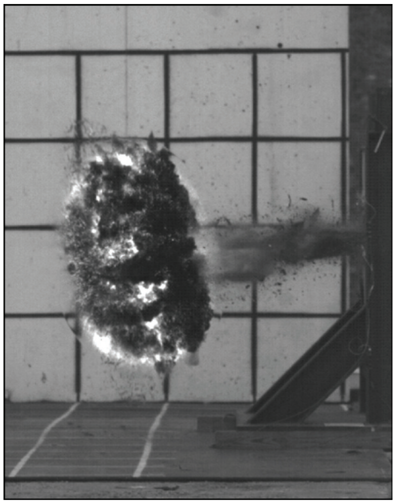
Surface-Laid Improved Explosive Device (IED) Characterization

JLF-Ground is conducting additional characterization tests of the OF-540 artillery round in a theater representative surface-laid configuration, specifically measuring at a higher distance above the ground. The data obtained from this testing will be used to further characterize surface-laid IEDs to be used in M&S of

IED engagements against taller ground vehicles. Testing will be continued in FY11.

Shoulder-Fired Munition Wall Damage Characterization Tests

This project performed tests of tandem warheads against three strengths of triple brick walls. The tests investigated the influence of wall target strength on the performance of precursor/bash-through designs for shoulder-fired munitions under development. Data obtained from the tests will allow improvement in lethality/vulnerability assessments of munitions and the development of a computational tool that will model both the precursor and follow-through warhead effects on the target. Data from these tests will also give operational commanders better information on weapon effectiveness against targets in theater by including a wide variation of brick strengths in the target set.

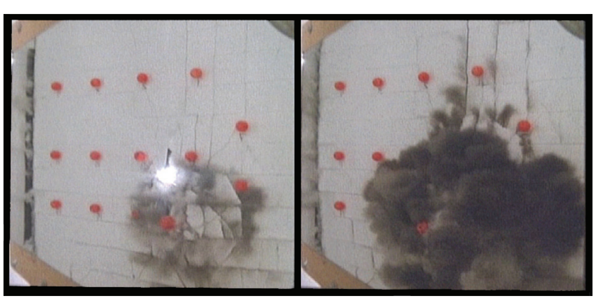


High-Explosive/Fragmentation Mortar Round Characterization

This project funds tests characterizing blast overpressure and fragmentation produced by the O-832 High Explosive/Fragmentation (HE/FRAG) series mortar round that insurgents use in theater. The data collected will provide threat information to be used to support analysis of troop vulnerability to the round, as well as countering its effectiveness.

Venting Effects on Quasi-Static Pressure

Conduct of Military Operations in Urban Terrain (MOUT) requires that operators estimate the damage to typical urban structures caused by weapons. This is vital for both the estimation of risk to Soldiers as well as estimating the effectiveness of munitions in urban combat. In this project, tests were performed to characterize airblast propagation and structural response from detonations within special target structures. The U.S. Army Research Laboratory (ARL) investigated the effect of window and doorway position on internal quasi-static pressures. Additionally, the Air Force Research Laboratory, with the Defense Threat Reduction Agency, conducted specialized tests of airblast propagation through failing walls. Data from these experiments are being provided to modelers to produce improved predictive methods for MOUT scenarios.



Improving HEI Lethality and Vulnerability Products for Tri-Service Applications

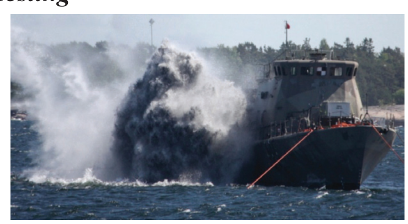
This project conducted tests to characterize the fuze and warhead characteristics of the 23 by 152 mm high explosive incendiary (HEI) projectile. ARL collected data from threat rounds impacting aluminum and steel target coupons representing typical aircraft skin and conventional plate armor, respectively. The data will be used to provide lethality assessments for weapons users based on accurate penetration and detonation of HEI projectiles against ground mobile targets and aircraft with added ballistic protection.

Sea Systems Program

The Joint Live Fire Sea Systems Program (JLF-Sea) made significant progress in FY10 towards improving the capability to assess the survivability of submarines and surface ships. These projects benefit ship and submarine acquisition programs as well as the fleet of fielded U.S. Naval vessels.

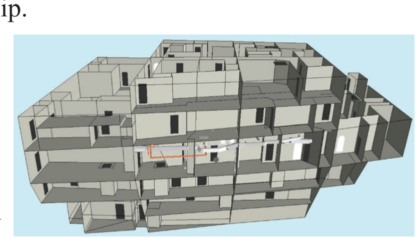
Finnish Fast Attack Craft Testing

FY10 was the second year of a multi-year, trilateral, (United States, Finland, and Germany), cooperative effort to perform damage testing against two aluminum, decommissioned Finnish fast attack craft. The Finnish Navy provided the ships and has conducted testing on their test range in the Baltic Sea. The German and U.S. Navies provided instrumentation, test planning, M&S, and analysis. The objective is to understand the behavior of aluminum structures subjected to various weapon effects. In FY10, underwater explosion testing and air explosion testing was conducted including shaped charge weapons. The ongoing validation of analytical tools for these applications is a primary objective. These tests will help in understanding the weapons effects against aluminum ships, and will augment the LFT&E programs for Joint High Speed Vessel and the Littoral Combat Ship.



Network Fire Model Enhancements

This project provided funds to further develop the U.S. Naval Research Laboratory (NRL) Fire and

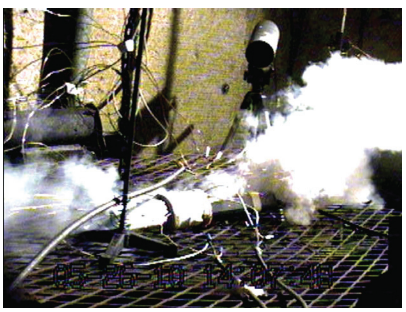


Smoke Simulator (FSSIM) model. The model can be used by naval engineers to develop ship designs that limit the spread of fire and smoke. NRL added features to allow the user to modify compartment fuel loadings to assist in understanding changes to a ship's general arrangement, and to allow the incorporation of non-traditional Navy ship structural materials, such as aluminum, into FSSIM models, leading to improved evaluations of ship survivability.

Submarine Susceptibility to Mines

This project will improve the Navy's ability to assess the susceptibility and vulnerability of submarines to threat mines. In September 2010, small-scale testing was conducted to acquire validation data to assess the underwater explosion resistance of a submarine pressure hull to a bulk charge detonation under the keel of the submarine. Remaining efforts will focus on analysis and construction of relevant test scenarios for vulnerability evaluation. These tests will help validate M&S tools, which can be used to understand the effects of mine blasts on submarines.

Lithium Battery Vulnerability



This project is characterizing the reaction of lithium and lithium-ion batteries to misuse in handling and environmental conditions. Testing was used to identify the type of reaction, burning characteristics, and heat release rate associated with exposing the batteries to dropping, heat, and fire. The results are being used as inputs to the design and development of a prototype battery condition monitoring and protection system. These tests will provide more accurate assessments of the vulnerabilities of ships and submarines that carry and use lithium or lithium-ion batteries.

Diesel Submarine Underwater Explosion Testing

The U.S. and German Navies initiated a project agreement in 2009 to continue development and validation of simulation tools for assessing ship survivability to various explosive threats. The current agreement involves the testing of a decommissioned U206 submarine in the Baltic Sea. JLF provided funding to add a test of a submarine resting on the sea floor – a typically hard to detect position. This effectively leverages a joint U.S./German investment of nearly $17 Million and provides data to increase the fidelity of models and the accuracy of survivability assessments for a situation for which little data are currently available.

SPECIAL INTEREST PROGRAMS

Active Protection Systems (APS)

In response to FY08 legislation, DOT&E continues to direct testing of active protection systems with the potential of protecting wheeled tactical vehicles. Presently six foreign and domestic manufacturers (two foreign, two domestic, and two combined foreign/domestic) are participating in this program. Testing will continue through 2QFY11. Upon completion, DOT&E will provide reports to Congress and acquisition leadership. This effort will determine the capabilities of current active protection system technology and guide future acquisition decisions related to land, air, and sea RPG protection.

Personnel Protection Equipment

DOT&E continued oversight of testing personnel protection equipment. DOT&E provided its report to Congress in July 2010 on the results of the Army's extended ballistic testing of hard body armor plates conducted by the Army Test & Evaluation Command from February through October 2009. This report closed the action generated by House Armed Services Committee hearings June 2007 requiring DoD to "perform additional comprehensive first article ballistic testing" of body armor systems. The purpose of this extended testing was to rigorously characterize the performance of plates that had previously passed First Article Test and been accepted by the government. The testing also provided empirical data to improve body armor test protocol.

DOT&E, in partnership with the Services and the U.S. Special Operations Command (USSOCOM), developed a new testing protocol for ceramic ballistic plates. It ensures the body armor provided to Service members meets ballistic protection requirements and provides uniform protection on the battlefield. Based on data obtained during the Army's extended testing, this protocol established a DoD-wide standard for testing body armor ballistic inserts. The protocol relies on rigorous statistical measures of performance.

The National Academy of Sciences' Committee to Review the Testing of Body Armor Materials for Use by the U.S. Army continued its independent review of tests conducted at Aberdeen Test Center that were the subject of a 2009 Government Accountability Office review. DOT&E, the Army Test & Evaluation Command, USSOCOM, and other interested organizations supported multiple data-gathering meetings by providing briefings, demonstrations, and range orientations to the members of the study committee. The Committee provided two interim reports. The first report, delivered in January 2010, provided recommendations on the use of the laser measuring instruments and clay backing material used in body armor testing. The second report, delivered in May 2010, provided recommendations for improving the ballistic clay used in hard body armor testing to determine possible replacements for clay in testing, and to implement statistically-based protocols. DOT&E provided these interim reports to Congress. DOT&E sponsored a program review issue that obtained the additional funding required for the Army to implement these recommendations, as well as other recommendations made by the National Institute of Standards and Technology to improve measurement accuracy during testing.

Enhanced Combat Helmet

The U.S. Marine Corps and Army conducted developmental testing of the Enhanced Combat Helmet during 2010. This program seeks to increase ballistic protection for Service members while maintaining weight equivalent to the Army's currently fielded Advanced Combat Helmet. Successful helmet designs will undergo more rigorous testing in FY11 prior to fielding, while any new designs will start developmental testing. DOT&E, working with the Services and the USSOCOM, is also preparing a DoD-wide standard for testing of military combat helmets.

Information Assurance and Interoperability

Information Assurance and Interoperability

Information Assurance (IA) and Interoperability (IOP)

In FY10, the assessing organizations performed IA and IOP assessments during 21 Combatant Command (COCOM) and Service exercises; eight assessments involved units preparing to deploy – or already deployed – to Iraq or Afghanistan.

The IA posture observed during FY10 exercise assessments is not sufficient to prevent an advanced adversary from adversely affecting the missions that were being exercised. Improvements in certain areas of network defense were observed, but Red Teams generally overcame defenses during exercises by increasing their level of effort. The cyber threat portrayed during assessed exercises was consistently below that expected from a nation-state. The level of cyber-threat portrayal in future exercises is expected to increase significantly in response to a memorandum signed by the Chairman, Joint Chiefs of Staff in September 2010. This memorandum augments Secretary of Defense Guidance to the Development of the Force, which stated "All DoD Components shall reduce the risk of degraded or failed missions by regularly exercising the capability to fight through cyber or kinetic attacks that degrade the Global Information Grid."

The FY10 IOP assessments found that interoperability issues encountered by the training audience typically hindered, rather than prevented, mission accomplishment; this is due primarily to operators who developed and executed workarounds. Even though missions were generally accomplished, the workarounds usually increased operator workload, and often resulted in degraded efficiency of completing tasks.

In FY11 DOT&E will continue to emphasize and report results of improved portrayal of cyber threats, assessment of operational impact from cyber activity and interoperability shortfalls, and utility of extending assessment opportunities to times outside of exercise execution periods.

PARTNERSHIPS AND COORDINATION

DOT&E remained partnered with the Joint Staff and Assistant Secretary of Defense for Networks, Information, and Integration (ASD (NII)) in the oversight and coordination of the Information Assurance and Interoperability Assessment Program.

DOT&E continued the partnership with the Joint Forces Command (JFCOM) Joint System Integration and Interoperability Laboratory that is intended to enhance assessments conducted by both organizations during training exercises through coordinated sharing of information and expertise. The partnership was involved in three FY10 assessment venues (Austere Challenge, Terminal Fury, and Angel Thunder).

DOT&E has coordinated closely with the intelligence community, National Security Agency, and the Service information warfare centers to improve the characterization of the representative cyber threat and its portrayal during exercises. The Defense Intelligence Agency (DIA) has made significant progress in the definition of advanced and emerging methods of cyber attack. DIA assessments will be instrumental in the identification of the Red Team assets needed to portray the cyber threats used in all exercises where IA assessments will be performed. DOT&E also coordinated with the JFCOM Opposing Force cell to achieve more realistic cyber play during the numerous COCOM exercises they support each fiscal year.

A Memorandum of Understanding with U.S. Cyber Command is also in final staffing that will create a Cyber Assessment Synchronization Working Group. This group is working to synchronize planning, execution, and reporting activities among exercises. Enhanced training and certification for Blue and Red Teams will contribute to more threat-representative cyber play and assessments, as will a newly created Cyber Command exercise support cell.

DOT&E has initiated a partnership with the Naval Postgraduate School to improve and expand the capabilities of network test tools and analysis methods. This partnership includes the design and development of network test tools, instrumentation, and methods; analysis of compliance and performance findings to postulate cause/effect models for use in simulation; and mapping of direct operational effects arising from network performance issues.

Additionally, DOT&E has partnered with the Defense Information Systems Agency to improve and expand the level of assistance available to assessed organizations. This partnership will focus on improved training resources, community feedback, and operator training tools to help remediate vulnerabilities and shortfalls identified during assessments.

FY10 ASSESSMENT ACTIVITIES

In FY10, Information Assurance (IA) and Interoperability (IOP) assessments were performed during 13 COCOM and eight Service exercises. There were also three sets of assessments performed during current operations, with two sets performed in the CENTCOM theater. Six of the Service assessments involved units preparing to deploy to Iraq or Afghanistan (see Table 1).

DOT&E continued the practice of providing formal memoranda of specific system/process findings to cognizant Service and Agency senior leadership. Finding Memoranda detail specific IA and IOP issues identified during assessments that have the potential to significantly degrade operations and either warrant immediate or long-term response. Findings may include system-to-system issues, process/procedure issues, or cross-DoD issues (such as universal use of commercial products).

DOT&E published four Finding Memoranda in FY10 regarding:
- Use of Microsoft Active Directory in DoD
- Use of joint cyber intelligence fusion practices
- Need for additional configuration guidance for certain commercial products
- Interoperability issues with aviation readiness systems

DOT&E is currently preparing an additional seven Finding Memoranda based on assessment conducted during FY10 that address the following issues:
- System upgrade incompatibilities
- Centralized network management
- Allied system interoperability
- Joint system interoperability
- Use of commercial softwares within DoD

ASSESSMENT

Interoperability

The FY10 IOP assessments found that interoperability issues encountered by the training audience typically hindered, rather than prevented, mission accomplishment; this is due primarily to operators who developed and executed effective workarounds. Even though missions were generally accomplished, the workarounds usually increased operator workload, and often resulted in degraded efficiency of completing tasks.

Of the eleven Finding Memoranda prepared based on assessments performed in FY10, four are related to interoperability findings, including system-to-system exchanges between DoD software, as well as ally-to-ally exchanges between coalition partners. In each case, staffing with the cognizant program offices indicates that these issues are being addressed with priority.

Overall, the FY10 interoperability findings may be categorized in three general areas:
1. IOP problems with coalition partners due to system incompatibility that prevented automated information exchanges.
2. IOP problems due to the existence of multiple systems with similar functionality; the increased number of interfaces adds complexity, and causes a higher likelihood of information exchange problems.
3. IOP problems due to personnel who lack adequate training to effectively operate critical information technology.

Information Assurance

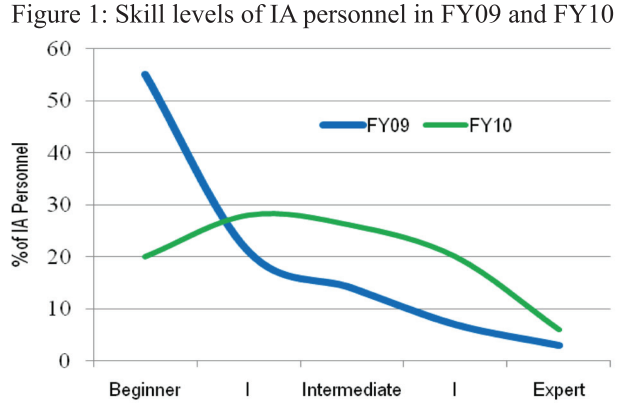
Information assurance assessments continued to highlight the relationships between cyber security and other areas such as physical security and operations security. Despite the finding that overall physical preparation and safeguards have improved over the last 3-5 years, the assessments found that a compromise in any one of these areas generally results in compromises in the other areas.

The assessments confirmed improvements in the ability to protect networks from penetration. All Red Teams reported increasing difficulty in penetrating network defenses, but results show that with sufficient time, Red Teams typically managed to penetrate networks and systems. In several cases, Red Teams were successfully blocked from employing certain attacks due to specific preparations or precautions on the part of network defenders. While this rarely resulted in complete denial of Red Team intrusion attempts, it did increase the level of difficulty for the Red Teams.

The ability of network defenders to detect and react to intrusions remained poor. There has been some preliminary evidence of increased detections noted since the roll-out of the enterprise Host-Based Security System.

Compliance measures and scanning results indicated improvement since FY09, and over the longer period of FY05-FY10, in areas including enclave boundary protection, continuity of operations, incident management, and personnel training. Patch management and policies for wireless devices remain areas of concern where improvement has been modest. Experience levels and formal training levels for network defenders have increased. As shown in Figure 1, the aggregate skill levels of network personnel assessed in several FY09 and FY10 venues indicate an increase in "intermediate" and "expert" skills across the Department and fewer "beginner" level operators.

Figure 1: Skill levels of IA personnel in FY09 and FY10



Assessments have documented a steady improvement in the following areas:

- Compliance testing and system auditing
- Host-based intrusion detection systems
- Processes for network access
- Vulnerability management practices
- Incident response activities

Implementation of the Federal Desktop Standard for DoD computers has increased uniformity and simplified configuration of these assets.

Exercise authorities in several COCOMs have supported greater cyber-threat play in scenarios, and having Red Teams work more closely with the exercise opposition force. Although this is a positive trend, exercise leadership more often than not restricted Red Team activity from disrupting operations to ensure that training objectives were met.

The overall assessment is that information assurance remains a significant operational concern across the Department of Defense. Red Teams were able to overcome even the improved areas of network and systems defense during exercises, although they admittedly had to work harder to do so. The operational concern is further highlighted by noting that the cyber threat portrayed during assessed exercises was consistently below that expected for a nation-state.

Status of Prior Year Recommendations

A recurring recommendation from prior fiscal years (FY07-FY08) was for exercise authorities to incorporate more threat-representative network attacks to stress detection capabilities, network Continuity of Operations, and network recovery plans; and that a Joint Staff recommendation would be helpful. On September 28, 2010, the Chairman of the Joint Chiefs of Staff issued such a memorandum; this memorandum will provide significant support to the execution of rigorous assessments of IA and IOP in representative cyber-threat environments.

FY11 PLANNED ASSESSMENTS AND GOALS

DOT&E has proposals for assessing 22 COCOM and Service exercises in FY11, with the goal of performing at least one interoperability and one information assurance assessment at each COCOM and Service during the fiscal year (see Table 2). Seven of the proposed assessments involve units preparing to deploy (or already deployed) to Iraq and Afghanistan. The FY11 assessment program will focus on the following:

- Improving portrayal of advanced cyber threats during assessments to include providing Red Teams longer time to conduct network reconnaissance, integrating Red Team activities into the exercise scenario, and increasing red team collaboration with the (simulated) opposing force.
- Assessing the ability of network defenders to detect and react to penetrations and intrusions.
- Assessing operational effects and mission impacts from cyber activities.
- Performing assessments at times other than during the conduct of training exercises.

TABLE 1. INFORMATION ASSURANCE AND INTEROPERABILITY EXERCISE EVENTS IN FY10

EXERCISE AUTHORITY	EXERCISE	ASSESSMENT AGENCIES
AFRICOM	CJTF Horn of Africa 10	ATEC
	Direct Reporting Unit - Naval Forces Africa	ATEC
CENTCOM	AOR Visit (Air Operations Center for Iraq)	ATEC
	AOR Visit (Qatar)	ATEC
EUCOM	Austere Challenge 10	ATEC
JFCOM	Empire Challenge 10	JITC
NORAD/NORTHCOM	Ardent Sentry 10	688 IOW
PACOM	Terminal Fury 10	OPTEVFOR, MCOTEA, JITC
SOUTHCOM	JTF GITMO	ATEC
	Panamax 10	ATEC
STRATCOM	Global Lightning/Bulwark Defender 10	JITC, MCOTEA
	Global Thunder 10	JITC, MCOTEA
TRANSCOM	Turbo Distribution 10	JITC, MCOTEA
USFK	Key Resolve 10	ATEC, MCOTEA
USA	Unified Endeavor 09-03-VI	ATEC
	Unified Endeavor 10-1	ATEC
	Unified Endeavor 11-1-I	ATEC
	Unified Endeavor 11-1-III	ATEC
USN	Planned Exercise Delayed to FY11	OPTEVFOR
USAF	Black Demon 10	688 IOW, MCOTEA
	Angel Thunder 10	JITC
USMC	II MEF COMMEX	MCOTEA
	III MEF (in Key Resolve)	MCOTEA
Other	Coalition Warrior Interoperability Demonstration 2010	JITC

AFRICOM – African Command
AOR – Area of Responsibility
ATEC – Army Test and Evaluation Command
CENTCOM – Central Command
CJTF – Combined Joint Task Force
COMMEX – Communications Exercise
EUCOM – European Command
GITMO – Guantanamo Bay
IOW – Information Operations Wing
JFCOM – Joint Forces Command
JITC – Joint Interoperability Test Command
JTF – Joint Task Force
MCOTEA – Marine Corps Operational Test and Evaluation Activity
MEF – Marine Expeditionary Force
NORAD – North American Defense Command
NORTHCOM – Northern Command
OPTEVFOR – Operational Test and Evaluation Force
PACOM – Pacific Command
SOUTHCOM –Southern Command
STRATCOM – Strategic Command
TRANSCOM – Transportation Command
USFK – United States Forces Korea
USA – United States Army
USN – United States Navy
USAF – United States Air Force
USMC – United States Marine Corps

TABLE 2. INFORMATION ASSURANCE AND INTEROPERABILITY EXERCISE EVENTS PROPOSED FOR FY11

EXERCISE AUTHORITY	EXERCISE	ASSESSMENT AGENCIES
AFRICOM	Judicious Response 2011-2	ATEC
	Direct Reporting Unit Assessment	ATEC
CENTCOM	AOR Site Assessment #1	ATEC
	AOR Site Assessment #2	ATEC
EUCOM	Austere Challenge 2011	ATEC
JFCOM	Angel Thunder 2011	JITC
NORAD/NORTHCOM	Vigilant Shield 2011	688 IOW
	Ardent Sentry 2011	688 IOW
PACOM	Terminal Fury 2011	COTF
	Keen Edge 2011	COTF
SOCOM	Emerald Warrior 2011	ATEC
SOUTHCOM	Integrated Advance 2011	ATEC
	Trade Winds 2011	ATEC
STRATCOM	Bulwark Defender 2011	JITC
TRANSCOM	Assessment During Operations	JITC
USFK	Key Resolve 2011	ATEC, MCOTEA
USA	Unified Endeavor 11-1-IV	ATEC
	Unified Endeavor 11-2	ATEC
	Unified Endeavor 11-3	ATEC
	Unified Endeavor 11-1-VI	ATEC
USN	JTFEX 11-1	COTF
	JTFEX 11-4	COTF
USAF	Black Demon 2011	688 IOW
	Dragon 2011/Red Flag 11-3	688 IOW
USMC	Unified Endeavor 11-2 (II MEF)	MCOTEA

AFRICOM – African Command
AOR – Area of Responsibility
ATEC – Army Test and Evaluation Command
CENTCOM – Central Command
COTF – Commander, Operational Test and Evaluation Force
EUCOM – European Command
IOW – Information Operations Wing
JFCOM – Joint Forces Command
JITC – Joint Interoperability Test Command
JTFEX – Joint Task Force Exercise
MCOTEA – Marine Corps Operational Test and Evaluation Activity
MEF – Marine Expeditionary Force
NORAD – North American Defense Command
NORTHCOM – Northern Command
PACOM – Pacific Command
SOCOM – Special Operations Command
SOUTHCOM –Southern Command
STRATCOM – Strategic Command
TRANSCOM – Transportation Command
USFK – United States Forces Korea
USA – United States Army
USN – United States Navy
USAF – United States Air Force
USMC – United States Marine Corps

Test & Evaluation Resources

Test & Evaluation Resources

Test and Evaluation Resources

The Director is required under Title 10, U.S. Code to assess the adequacy of planning for, and execution of, operational and live fire testing conducted on systems under oversight. The ranges, test sites, and assets used in testing are important elements in assessing the adequacy of operational and live fire testing. DOT&E monitors DoD and Service-level strategic plans, involvement in investment programs, and budget decisions to ensure T&E capabilities necessary for realistic T&E are supported. DOT&E collaborates with the Defense Test Resources Management Center (TRMC) to help address critical T&E resource needs through its Central T&E Investment Program (CTEIP) and the T&E Science and Technology (S&T) program. DOT&E also conducts studies of resource needs and potential solutions through the Threat Systems program. This section outlines key interest areas from FY10.

TARGETS

Anti-Ship Ballistic Missile Targets

In order to adequately test Navy ship self-defense systems, DoD must develop threat-representative anti-ship ballistic missile targets that emulate a major threat to aircraft carriers and large deck ships. The Missile Defense Agency, with input from the Navy, is planning and budgeting for development of a target to meet this test need for exo-atmospheric engagements. This $90 Million developmental program includes $30 Million non-recurring engineering and production of two target vehicles for SM-3 testing. It does not include flight test costs. The complete program cost is estimated to be $230 Million. Reentry and terminal phase targets required for multiple Fleet Air Defense system test programs will necessitate a follow-on development program for a more complex target. It is estimated that the cost of such a follow-on target will be at least twice that of the exo-atmospheric target now in development.

Aerial Targets

There is a need for threat-representative full-scale aerial targets that emulate fifth-generation fighter characteristics in order to adequately test U.S. fighter aircraft, air defense combat systems, and missiles. Recent test flights of the Russian PAK-FA reinforce this assessment. The current Air Force program to drone QF-16s does not provide the requisite suite of fifth-generation threat characteristics to support end-to-end testing. DOT&E has conducted several studies to examine the feasibility and affordability of developing a fifth-generation threat fighter target that would be complementary to the QF-16 and address its shortfalls. A prototype program using best practices of general aviation has been proposed that would demonstrate the feasibility of manufacturing an affordable threat-representative target. Development and demonstration of this target, as well as production of six targets, is estimated to cost about $90 Million.

Multi-Stage Supersonic Targets

Adequate operational testing of Navy surface ship air defense systems requires a multi-stage supersonic target that emulates anti-ship cruise missiles with threat level capabilities. The Navy has a $120 Million program to develop a threat level target, including production for one year. Follow-on production has not been programmed.

Rotary Wing Targets

In the summer of 2010, two of the three remaining QUH-1 rotary wing targets were destroyed during Navy ship self-defense system testing. The remaining QUH-1 is not operational. At least five Army and Navy programs require these targets to complete operational testing. Over the past two years, DOT&E has worked with the Services to define performance requirements and develop acquisition documentation necessary for a demonstration contract. In FY11, a capability demonstration of up to three candidate systems is planned. A radar signature characterization will be conducted on the candidate selected from this demonstration. However, the Army, which serves as lead for rotary wing targets, has not programmed procurement funding. Consequently, rotary wing targets will not be available to support future operational test requirements. Adequate rotary wing target capability to support operational testing is estimated to cost $21 Million for procurement and operations and maintenance over a five-year period.

Submarine Targets

The effectiveness of U.S. anti-submarine aircraft, surface combatant ships, and submarines must be evaluated against modern diesel submarine threats. The U.S. does not have diesel submarines, so testing using either a foreign diesel or a threat surrogate is needed. Although the Navy trains regularly against foreign diesel submarines, availability for their use in testing is infrequent. DOT&E assesses that all current threat surrogate options are inadequate. This resulted in the Virginia class submarine being fielded with its effectiveness against diesel submarines unresolved. Similarly, the end-game effectiveness of U.S. torpedoes against threat submarines must be evaluated. Undersea weapons that must hit the target are not currently evaluated on manned submarine targets due to safety issues. DOT&E is monitoring two Navy initiatives that may provide some target capabilities for both of the foregoing test requirements. The first initiative is a $10 Million effort that will provide a surrogate diesel submarine training target. The second effort is a $3 Million initiative that will provide five set-to-hit targets for torpedo end game performance testing. After these initiatives have been demonstrated in FY11, DOT&E will assess their potential for use in operational testing.

TEST RANGES AND FACILITIES

Cyber Assessment and Joint Information Operations Range

The capacity to assess realistically advanced cyber warfighting capabilities must increase to keep pace with heightened demand for those capabilities, advancing technologies, and the growing cyber threat. The Joint Information Operations Range offers a closed multi-level security environment supporting the spectrum of non-kinetic activities. However, it lacks the ability to routinely and consistently portray operationally realistic, threat-representative cyber environments. Test resource enhancements are needed to enable assessment of defenses against cyber attacks and the ability to continue network operations in spite of such attacks. Funding of $106 Million is needed to upgrade the range to provide threat environments, traffic generators, instrumentation, visualization, event control assets, and infrastructure with which to support more test events with greater network loading and the increased fidelity requirements associated with more threat-representative test events. Additional funding of $32 Million would provide for enhanced Defense Intelligence Agency threat assessments, Red Team portrayal of advanced cyber adversaries, cyber assessment plans and reports, persistent environments, and more advanced cyber test and training methodologies.

Rotary Wing Survivability Testing

Rotary wing aircraft crews face significant danger from small arms fire and rocket-propelled grenades. The Helicopter Survivability Task Force identified deficiencies including situational awareness and threat detection. DOT&E has taken the lead to coordinate testing in the development of Hostile Fire Indication (HFI) technologies. A test handbook, standards and procedures, portable test instrumentation packages, and a data repository of signatures and prior test results have been developed. HFI systems cannot currently be tested during formation flight, nor can they be tested against moving threats. Open-air testing for current and future systems is a priority and requires ongoing funding to enable end-to-end testing of aircraft survivability equipment. Funding of $14 Million would provide a second HFI test tower for formation flight testing and a rotary wing target program for open-air testing.

Instrumentation

Smaller test articles and a trend toward low observable platforms require stand-alone miniaturized instrumentation capable of sub-meter accuracy. In August 2010, the Air Force awarded a $140 Million contract to develop the next increment of the Common Range Integrated Instrumentation System. However, packaging concerns remain for installing instrumentation in test articles that have limited space and weight allocations. Time-space-position information (TSPI) systems required to support advanced weapon systems testing must possess accuracies at least one order of magnitude greater than the systems under test.

Real Time Casualty Assessment (RTCA) is a critical function for determining the fidelity of weapons system engagements. An affordable, sustainable, transparent high-fidelity RTCA is required to provide feedback on weapons and systems effectiveness in test evolutions. Two legacy RTCA programs were terminated due to performance deficiencies and rising cost. Subsequently, the Army has pursued a hybrid approach comprising an interim capability to meet RTCA requirements during test events to be conducted in FY11. This will be followed by an objective capability in 2017. The Test Capability Requirements Document (TCRD) for the 2017 capability was completed in FY10. Capabilities Development Documents are being prepared that will specify the funding required to achieve the required RTCA capability.

Target Control Systems

The Services continue to operate and maintain a variety of different target control systems with little interoperability among them. The result is an inability to use targets across the test ranges. DOT&E has addressed this issue through the tri-Service Target Control Study Group, which has developed open protocols for use in target control systems. Both the Army and Navy plan to upgrade or replace ageing target control systems starting in FY12-13.

Urban Environment Testing

Urban combat has become increasingly important for ground forces. Test environments require more extensive and precise instrumentation than that used at training sites. An urban test environment capability has been funded at $95 Million to date with the Army as Executive Agent. An Urban Environment Test Capability Study was completed in 2010. Development of a TCRD, planning documents, cost analysis, and planning implementation are underway. The TCRD will be completed in 2010 and the remainder of the planning documents in 2011. These documents will specify the acquisition cost of an operationally realistic urban test environment.

Joint Test & Evaluation Program

Joint Test
& Evaluation
Program

Joint Test and Evaluation Program

The Joint Test and Evaluation (JT&E) Program develops solutions to joint operational problems through enhanced tactics, techniques, and procedures (TTPs) and measures the associated improvements based on rigorous analysis and operational evaluation. The JT&E Program's objective is to provide rapid solutions to operational issues identified by the joint military community. The program is complimentary to, but not part of, the acquisition process. Projects annotated with an asterisk (*) closed in FY10.

The program managed seven joint tests in FY10 that focused on the needs of operational forces:
- Joint Air Defense Operations-Homeland (JADO-H)
- Joint Civil Information Management (J-CIM)
- Joint Data Integration (JDI)
- Joint Electronic Protection for Air Combat (JEPAC)*
- Joint Integration of Maritime Domain Awareness for Homeland Defense (JIMDA)
- Joint Jamming Assessment and Mitigation (JJAM)
- Joint Non-Kinetic Effects Integration (JNKEI)*

The JT&E Program instituted a quick reaction test (QRT) capability in 2003 to respond to the pressing needs of today's deployed forces.

The program managed 12 QRTs in FY10:
- Foreign Humanitarian Assistance/Disaster Relief (FHA/DR)
- Host Based Security System (HBSS)
- Joint Defense Support to Civil Authorities (JDSCA)*
- Joint Entry Control Point/Escalation of Force Project (JEEP)*
- Joint Early Warning Operator (JEWO)*
- Joint Mapping the Human Terrain (JMAP-HT)*
- Joint Maritime Evaluation of Transit Escort (J-METE)
- Joint Modular Protection System (JMPS)
- Joint Passive Electronic Radio Frequency Emission Classification and Tracking (J-PERFECT)
- Joint Rapid Attack Process (J-RAP)*
- Joint Systems Prioritization and Restoration (JSPAR)*
- Joint Unmanned Aircraft System Full-Motion Video Integration for Command and Control (JUFIC)*

The program executes special projects, as directed by DOT&E, that address issues DoD-wide.

The program managed two special projects in FY10:
- Hostile Fire Indicator (HFI)*
- Joint Test and Evaluation Methodology-Transition (JTEM-T)

JOINT TESTS

JOINT AIR DEFENSE OPERATIONS-HOMELAND (JADO-H)

Sponsor/Charter Date: North American Aerospace Defense (NORAD) and U.S. Northern Command (USNORTHCOM)/ August 2007

Purpose: To develop joint tactics, techniques, and procedures (TTPs) and planning processes for deployable integrated air defense systems (D-IADS)

Products/Benefits: Standardized planning to counter emerging air threats to the homeland. Collaborative tools will include:
- D-IADS process modeling that provides a view of the entire planning process
- Checklists for critical steps in the planning process
- An exercise planning guide
- A commanders' planning handbook

JOINT CIVIL INFORMATION MANAGEMENT (J-CIM)

Sponsor/Charter Date: U.S. Special Operations Command (USSOCOM)/August 2008

Purpose: To research and develop processes and joint TTPs to standardize the collection, consolidation, and sharing of civil information among DoD, other U.S. Government agencies, host nations, coalition forces, and non-governmental organizations to support the joint force commander's operational planning efforts.

Products/Benefits: A J-CIM user's guide that will:
- Improve sharing of unclassified information
- Standardize collection, consolidation, and sharing of civil information
- Identify senior leader and staff requirements for the integration of civil data to support planning, operations, and assessments in support of non-lethal operations
- Enable commanders, senior leaders, and other stabilization and development partners to better share, identify, prioritize, and apportion civil affairs resources

JOINT DATA INTEGRATION (JDI)

Sponsor/Charter Date: U.S. Joint Forces Command (USJFCOM) and Joint Task Force (JTF) 519/August 2008

Purpose: To develop joint TTPs for Global Command and Control System – Joint (GCCS-J) operators, track data managers, and system administrators to provide the joint task force and combatant commanders with an effective common tactical picture.

Products/Benefits: Data Management Handbook with Quick Reference Guides for Developing and Sharing the Common Tactical Picture. This product provides new command and control data management procedures that improve the quality of the common tactical picture used by joint task force and component commanders to support force employment decisions. Other benefits:

- Improved policies and procedures for implementation emphasizing common tactical picture management
- U.S. Pacific Command (USPACOM), U.S. European Command (USEUCOM), and U.S. Southern Command (USSOUTHCOM) established and now routinely use the Joint Data Network Operations Cell (JDNO) at JTF headquarters
- U.S. Strategic Command (USSTRATCOM) reported a marked overall improvement in USPACOM and USEUCOM theater inputs to Global Common Operating Picture (COP) after JDI recommendations were adopted within their commands.

Leadership Feedback:

"Our COP management...has seen significant improvement, providing a great shared situational awareness tool. The Joint Data Network Operations Concept is being incorporated at our JTF capable service components and the Headquarters is coordinating a plus-up in its personnel to support the Theater COP."

Maj Gen Harold Moulton (USEUCOM J3) to Maj Gen David Edgington (USJFCOM J02)

"In short, the net result of the JFCOM – JTF-519 partnership is a reliable GCCS picture. This has become an 'expectation' and an 'assumption' and operational decisions within the JTF JOC [Joint Operations Center] are supported directly from our 'near real time' picture. Through the efforts of your team our Joint C2 [command and control] system matured beyond just being a concept; it is an 'operational necessity' for both the JTF and Pacific Fleet. "

RDML Thomas Shannon (U.S. Pacific Fleet N3) to Maj Gen David Edgington (USJFCOM J02)

"JDI personnel provided assistance to the 2nd Fleet JDNO Cell who enabled the JTF/MNF [Multinational Force] to properly manage dynamic track data over the GCCS-J network. JDI also provided a team to evaluate USSOUTHCOM's manning and TTPs for presenting a COP at the Combatant Command Headquarters. The team clearly identified shortfalls in the J33 that we are now correcting through hiring actions and SOP [Standard Operating Procedure] updates."

RDML Steve Ratti (USSOUTHCOM J3) to RDML Dan Davenport (USJFCOM J02)

JOINT ELECTRONIC PROTECTION FOR AIR COMBAT (JEPAC)

(Completed September 2010)

Sponsor/Charter Date: Air Force/August 2007

Purpose: To develop, test, and evaluate joint TTPs to enhance air combat capability in the presence of Advanced electronic attack (AdvEA) waveforms

Products/Benefits:

- Joint counter-AdvEA TTPs
- Significantly increased awareness of AdvEA technologies and threat
- Comprehensive kill-chain execution testing in operationally realistic AdvEA environment
- Enhanced AdvEA representations within the virtual and constructive environments
- Robust live joint training environment with unprecedented levels of opposition forces utilizing AdvEA
- Reaffirmed electronic protection capabilities gaps and developed workarounds
- Technical data and findings shared with complementary organizations
- Documentation and data to support upgrade of Service air warfare school syllabi
- Establishment of a permanent program of record to conduct electromagnetic spectrum vulnerability assessments and joint operational testing and evaluation of current and emerging technologies and TTPs

JOINT INTEGRATION OF MARITIME DOMAIN AWARENESS FOR HOMELAND DEFENSE (JIMDA)

Sponsor/Charter Date: NORAD and USNORTHCOM/ August 2009

Purpose: To develop TTPs that synchronize maritime domain information for key decision makers across operations centers for homeland defense with comprehensive coordination across the maritime domain awareness community.

Products/Benefits:

- Integrated maritime domain awareness processes, procedures, and checklists
- Maritime Information Handbook
- Maritime central access portal

JOINT JAMMING ASSESSMENT AND MITIGATION (JJAM)

Sponsor/Charter Date: Air Force/August 2009

Purpose: To develop joint TTPs that mitigate the effects of adversary purposeful interference to satellite communications (SATCOM). JJAM will formulate, refine, and improve the methods and processes that allow operational forces to effectively conduct operations when satellite communications are degraded.

Products/Benefits:

- Multi-Service TTPs, handbooks, and operator checklists
- Seamless and effective command and control through mitigation of purposeful interference to SATCOM
- Heightened awareness of the threat and consequences of SATCOM purposeful interference
- Shortened SATCOM purposeful interference mitigation timelines
- Real-time access for operational forces to SATCOM mitigation improvements and refinements
- Incorporation of SATCOM mitigation procedures into joint exercises
- Enhanced operations in a SATCOM degraded environment
- Recommendations on needed changes to joint publications, USSTRATCOM instructions, and user checklists

JOINT NON-KINETIC EFFECTS INTEGRATION (JNKEI)
(Completed September 2010)

Sponsor/Charter Date: USSTRATCOM/August 2007

Purpose: To develop joint TTPs to assist joint planners in integrating the non-kinetic effects of electronic attack, computer network attack, and offensive space control capabilities into operational planning.

Products/Benefits:
- Improved integration of non-kinetic capabilities during operational planning that expand the range of possible courses of action for joint force commanders
- Information exchange requirements based on the JNKEI TTPs and incorporated into the Integrated Strategic Planning and Analysis Network (ISPAN) and Virtual Integrated Support for the Information Operations Environment (VisIOn) collaborative tools
- Input provided to Joint Publication (JP) 5-0, Joint Operational Planning; Joint Test Publication 3-12, Cyberspace Operations; JP 3-13, Information Operations; and JP 3-60, Joint Targeting
- JNKEI TTPs provided to Joint Information Operations Planning Course (Joint Forces Staff College), Joint Targeting School (USJFCOM), and Advanced Integrated Warfighter Weapons Instructor Course (U.S. Air Force Weapon School)
- JNKEI TTPs provided to USEUCOM; USPACOM; U.S. Force, Korea; and USSTRATCOM to enhance existing standard operating procedures

QUICK REACTION TESTS

FOREIGN HUMANITARIAN ASSISTANCE/DISASTER RELIEF (FHA/DR)

Sponsor/Charter Date: USSOUTHCOM/July 2010

Purpose: To develop, assess, and validate concepts of operations and TTPs for operational and tactical forces tasked to provide humanitarian assistance to partner nations subsequent to a natural disaster abroad.

Products/Benefits: A FHA/DR handbook containing concepts of operation and TTPs that enable Title 10 forces of all Services to effectively integrate disaster response efforts with the Department of State, the U.S. Agency for International Development, the United Nations, and non-governmental organizations, enhancing speed, effectiveness, and unity of effort.

HOST BASED SECURITY SYSTEM (HBSS)

Sponsor/Charter Date: USSTRATCOM and Defense Information Systems Agency/January 2010

Purpose: To develop, assess, and validate standard enterprise HBSS configurations and TTPs that will give DoD joint network defenders the ability to effectively implement and use the HBSS for prevention, detection, diagnosis, and response to cyber attacks, as well as maintain situational awareness in the cyber domain.

Products/Benefits: A handbook composed of proven standard HBSS enterprise configurations and TTPs that USSTRATCOM's Cyber Command can use to direct DoD network defenders to ensure critical mission operations in the face of a cyber attack.

JOINT DEFENSE SUPPORT TO CIVIL AUTHORITIES (JDSCA)
(Completed July 2010)

Sponsor/Charter Date: USNORTHCOM/July 2009

Purpose: To develop, assess, and validate concepts of operations and TTPs for tactical level units providing operational support to U.S. civil authorities subsequent to a natural disaster.

Products/Benefits: The Defense Support to Civil Authorities Handbook, containing a Tactical Commander and Staff Tool Kit and a Liaison Officer Tool Kit, equips military forces of all Services to effectively integrate disaster responses with local, state, tribal, and federal emergency managers, and enhances unity of effort with civil authorities.

JOINT ENTRY CONTROL POINT/ESCALATION OF FORCE PROJECT (JEEP)
(Completed January 2010)

Sponsor/Charter Date: U.S. Central Command (USCENTCOM)/December 2008

Purpose: To develop concepts of operations and TTPs to train troops adequately on escalation of force at entry control points.

Products/Benefits: A handbook that improves training and execution of timely and relevant responses to enemy attacks directed against an installation while minimizing civilian casualties.

JOINT EARLY WARNING OPERATOR (JEWO)
(Completed February 2010)

Sponsor/Charter Date: USCENTCOM/December 2008

Purpose: To assess USCENTCOM's ballistic missile warning network and document the existing warning architecture, current platforms involved in the warning mission, and current methods of information collection, processing, reporting, and dissemination.

Products/Benefits: A handbook for allied and joint forces in USCENTCOM's area of responsibility to improve their capabilities to detect, track, and report enemy ballistic missiles.

JOINT MAPPING THE HUMAN TERRAIN (JMAP-HT)
(Completed May 2010)

Sponsor/Charter Date: USCENTCOM/September 2009

Purpose: To develop, validate, and field JMAP-HT concepts of operations and TTPs for immediate deployment to Civil Affairs and Human Terrain units supporting U.S. forces in the Horn of Africa and Operation Enduring Freedom in Afghanistan.

Products/Benefits: A handbook that enables effective civil information sharing among staffs at the operational and tactical levels.

JOINT MARITIME EVALUATION OF TRANSIT ESCORTS (J-METE)

Sponsor/Charter Date: U.S. Transportation Command and U.S. Coast Guard Forces Command/January 2010

Purpose: To develop and test the concepts of operations and TTPs for the employment of joint Service support, personnel, and equipment that will assist in reducing the threat from asymmetric underwater attacks to high value ships while transiting critical ports, restricted waterways, and chokepoints in the continental United States.

Products/Benefits:
- A J-METE handbook outlining the TTPs to detect and interdict asymmetric underwater threats for ships in transit
- Concepts of operations to enhance mission success against asymmetric underwater threats for United States commanders responsible for escorting high value ships transiting militarily significant ports, restricted waterways, and chokepoints

JOINT MODULAR PROTECTION SYSTEM (JMPS)

Sponsor/Charter Date: USCENTCOM/July 2010

Purpose: To develop and validate TTPs for Modular Protective Systems that enhance force protection to forward deployed military personnel.

Products/Benefits: TTPs that improve use of force protection modules for allied and joint forces in USCENTCOM's area of responsibility

JOINT PASSIVE ELECTRONIC RADIO FREQUENCY EMISSION CLASSIFICATION & TRACKING (J-PERFECT)

Sponsor/Charter Date: NORAD and USNORTHCOM/March 2010

Purpose: To develop joint concepts of operations and TTPs for sustained air vigilance operations against strategic aviation threats to the homeland.

Products/Benefits: A standard, globalized concept of operations and TTPs that optimize the execution and employment of multi-Service, combatant command, and national agency capabilities to detect, track, identify, and evaluate air threats to the United States.

JOINT RAPID ATTACK PROCESS (JRAP)

Sponsor/Charter Date: USSTRATCOM/January 2010

Purpose: To investigate, evaluate, and make recommendations to improve cyber mission planning methods used to employ alternative approaches to leverage current capabilities against complex targeting challenges.

Products/Benefits:
- Cyber playbook
- Operational TTPs to improve cyber mission planning, rehearsal, execution, and assessment

JOINT SYSTEMS PRIORITIZATION AND RESTORATION (JSPAR)
(Completed July 2010)

Sponsor/Charter Date: USNORTHCOM/July 2009

Purpose: To develop and validate NORAD, USNORTHCOM, and USPACOM coordinated TTPs for continuity of communications for DoD entities in the state of Alaska.

Products/Benefits:
- Drafted the NORAD and USNORTHCOM Instruction to implement MINIMIZE protocol (an order from a commander that normal message, telephone, and e-mail traffic be reduced drastically so that vital messages are not delayed) for strategic and operational communications between NORAD and USNORTHCOM and its subordinate units
- Delivered a methodology supplementing Defense Information Systems Agency Circular 310-130-4, Defense Users Guide to the Telephone Service Priority System. This work resulted in the prioritization of land-based strategic and operational communications services and circuits among USPACOM, NORAD and USNORTHCOM, Services, and DoD Agencies.

JOINT UNMANNED AIRCRAFT SYSTEM FULL-MOTION VIDEO INTEGRATION FOR COMMAND AND CONTROL (JUFIC)
(Completed February 2010)

Sponsor/Charter Date: Air Force Warfare Center and Joint Unmanned Aircraft Systems Center of Excellence/December 2008

Purpose: To develop TTPs that improve the commander's ability to effectively use unmanned aircraft systems full-motion video for command and control through the fusion of operational graphics, unit locations, and full-motion video.

Products/Benefits:
- TTPs that improve the integration of unmanned aircraft systems' full-motion video within various command and control systems supporting operational and tactical combat operations centers
- Verified set of measures of evaluation and performance for use of unmanned aircraft systems' full-motion video

SPECIAL PROJECTS

JOINT TEST AND EVALUATION METHODOLOGY-TRANSITION (JTEM-T)

Sponsor/Charter Date: DOT&E/May 2009

Purpose: To integrate, implement, and apply the JTEM-developed Capability Test Methodology methods and processes into component and agency test organizations in support of the Testing in a Joint Environment Roadmap, with particular emphasis placed on enhancing and improving current Operational Test Agency (OTA) test processes

Products/Benefits:
- Documented improvements to OTA and other component and agency test and assessment processes that improve and enhance the ability to test system-of-systems in a joint environment
- Functional and reusable mission and task-based measures decomposition process and a complementary analysis framework to facilitate the ability to test in a joint environment

HOSTILE FIRE INDICATOR (HFI) SPECIAL PROJECT
(Completed June 2010)

Sponsor/Charter Date: DOT&E/November 2009

Purpose: To develop TTPs for emerging Hostile Fire Indication (HFI) materiel solutions to help improve rotary wing aircraft survivability against unguided munitions.

Products/Benefits:
- An initial HFI TTP to assist the Services as a starting point in updating their platform-specific TTPs as development, testing, and fielding of HFI is completed
- Recommended the Services consider adding an HFI training capability into existing helicopter simulators used for tactics training in conjunction with HFI fielding
- Assisted the Naval Air Manned Flight Simulator at the Naval Air Station Patuxent River, Maryland, with efforts to obtain an HFI simulation capability

The Center for Countermeasures

The Center for Countermeasures

Center for Countermeasures

The Center for Countermeasures (the Center) is a joint activity that directs, coordinates, supports, and conducts independent countermeasure/counter-countermeasure (CM/CCM) test and evaluation (T&E) activities of U.S. and foreign weapon systems, subsystems, sensors, and related components in support of DOT&E, weapon system developers, and the Services. The Center's testing and analysis directly supports evaluation of the operational effectiveness and suitability of CM/CCM systems.

Specifically, the Center:
- Performs early assessments of CM effectiveness against threat and DoD systems and subsystems.
- Determines performance and limitations of missile warning and survivability equipment used on rotary wing and fixed wing aircraft, as well as the effectiveness of precision-guided weapon systems and subsystems.
- Develops and evaluates CM/CCM techniques and devices.
- Tests and develops new CMs as they are discovered on the modern battlefield in an operationally realistic environment.
- Provides analysis and recommendations on CM/CCM effectiveness to Service Program Offices, DOT&E, and the Service member.
- Supports Service member experimentation, training, and pre-deployment activities

During FY10, 83 percent of the programs that received support were under DOT&E oversight, and 73 percent of the Center's effort was focused on overseas contingency operations (OCO) support. The majority of the OCO activities involved rotary wing survivability events.

The Center participated in operational/developmental tests for rotary and fixed wing aircraft survivability testing, precision-guided weapons, hostile fire indicator data collection, experimentation tests, and pre-deployment/exercise support related to the CM/CCM mission area.

The Center continued to develop test tools for evaluating Infrared Countermeasure (IRCM) systems. The Center tested, analyzed, and reported on more than 29 DoD systems or subsystems.

The following activities are representative of those conducted by the Center during the past year.

FIXED AND ROTARY WING AIRCRAFT SURVIVABILITY IMPROVEMENTS

Rotary Wing Test Events

Navy: Department of the Navy Large Aircraft Infrared Countermeasure (DoN LAIRCM)
- **Sponsor**: Navy Program Executive Officer, Advanced Tactical Aircraft Protection Systems Program Office (PMA-272)
- **Activity**: The Center provided test assets and crew to perform end-to-end testing of the system at several test locations throughout the year. Platforms participating included CH-53D/E and CH-46E.
- **Benefit**: The assessment of this threat detection and Directed Infrared Countermeasures (DIRCM) system on Navy platforms made use of experience gained testing the Air Force's previously developed DIRCM systems. The testing identified a problem with the system that has been fixed prior to LAIRCM's widespread use.

Army: Reduced Optical Signature Emissions Solution
- **Sponsor**: Department of the Army Technology Applications Program Office (TAPO), Systems Integration and Maintenance Office (SIMO) Aircraft Survivability Equipment Cell
- **Activity**: The Center provided test assets and crew to provide immediate feedback on the effectiveness of flares and flare sequences. This data was used to finalize flare sequences on 160th Special Operations Aviation Regiment rotary wing aircraft.
- **Benefit**: The results of this combined effort resulted in verification of the effectiveness of flare sequences both used on aircraft deployed in-theater and under development.

Marine Corps: Target Sight System (TSS)
- **Sponsor**: Air Test and Evaluation Squadron Nine (VX-9), China Lake, California
- **Activity**: The Center deployed a variety of passive and active CMs. This test provided the aircrew with the opportunity to perform detection, recognition, and identification of targets of interest under operationally realistic conditions.
- **Benefit**: This field test determined the strengths and weaknesses of the TSS to assist the Service member in developing training, tactics, and procedures (TTPs) before fielding the TSS on the AH-1Z platform.

Navy: Distributed Aperture Infrared Countermeasure (DAIRCM) Technology
- **Sponsor**: Naval Research Laboratory
- **Activity**: The Center provided test equipment and crews to support end-to-end open-air T&E of rotary wing aircraft equipped with DIRCM.
- **Benefit**: The DAIRCM prototype testing contributed to critical future Infrared Countermeasure (IRCM) protection of Navy rotary wing aircraft.

Army: Laser Afocal IRCM Scan Mirror (LAISM) Pointer-Tracker

- **Sponsor**: U.S. Army Research Development Engineering Command – Communications Electronics Research, Development, and Engineering Center (RDECOM-CERDEC), Fort Monmouth, New Jersey
- **Activity**: The Center provided test assets and crew to simulate missile signatures and collect jam beam radiation from the prototype laser pointer-tracker. This was the initial missile jamming open range test for LAISM.
- **Benefit**: Sponsors used test results to continue development of the LAISM system.

Joint (Navy lead): Joint and Allied Threat Awareness System (JATAS)

- **Sponsor**: Navy Program Executive Officer, Advanced Tactical Aircraft Protection Systems Program Office (PMA-272)
- **Activity**: The Center provided test assets and crew to perform testing of JATAS installed on the H-60 helicopter.
- **Benefit**: JATAS prototype testing will contribute to critical future IRCM and Hostile Fire Indicator (HFI) protection of Service rotary wing aircraft.

Fixed Wing Test Events

Joint (Army Lead): Joint Cargo Aircraft (JCA)

- **Sponsor**: Operational Test Command (OTC), Aviation Test Directorate
- **Activity**: The Center provided equipment and test crews to evaluate the installed missile warning system and flare effectiveness against simulated missile threats.
- **Benefit**: The results of this verified the effectiveness of the missile warning system and flare sequences.

Air Force: LAIRCM Next Generation Phase II C-17A

- **Sponsor**: 654th Aeronautical Systems Squadron, Wright Patterson AFB
- **Activity**: The Center provided test assets and crew to perform in an open-air environment for end-to-end testing of the LAIRCM Next Generation system installed on the C-17A.
- **Benefit**: This testing contributed to critical protection of Air Force heavy lift capability during OCO operations.

Rotary and Fixed Wing Test Events

Army, Air Force, and Navy: Advanced Strategic and Tactical Infrared Expendables

- **Sponsors**: Naval Surface Warfare Center – Crane Division, Department of the Army, Program Executive Office JCA, Air Force Special Operations Command, and Air Mobility Command
- **Activity**: The Center provided test assets and crew to collect test data on 12 different aircraft against reactive captive infrared (IR) missiles. These tests evaluated new CM sequences, variations of current CM sequences using improved flares, or different flares within the sequences.
- **Benefit**: Sponsors are using these test results on flare sequence effectiveness to enhance the protection of various aircraft against IR Man-Portable Air Defense Systems (MANPADS).

PRECISION-GUIDED WEAPONS CM TEST

Army: Joint Air-to-Ground Missile (JAGM) System

- **Sponsor**: U.S. Army Joint Attack Munition System, JAGM Program Office, Redstone Arsenal, Alabama
- **Activity**: The Center planned, coordinated, and executed a mission to provide a realistic CM environment for the JAGM system.
- **Benefit**: The testing supported the technology development phase of the JAGM System. The data collected by the developer during the CM environment will be used to develop robust algorithms for the JAGM system to operate in realistic battlefield environments. JAGM will eventually replace the Hellfire, Tube-launched, Optically-tracked, Wire command data link-guided missile (TOW), and Maverick families of missiles.

PRE-DEPLOYMENT EXERCISE SUPPORT AND TTP DEVELOPMENT

- **Red Flag Nellis Exercise** – Nellis AFB, Nevada
- **Enhanced Mohave Viper** – 29 Palms, California
- **HH-60G Combined Search and Rescue Task Force Operational Test and TTP development** – Part 1 (Nellis AFB, Nevada), Part 2 (Oahu, Hawaii)
- **KC-135 Weapons Instructor Course** – Roswell, New Mexico

Sponsors: Various

Purpose: The Center provided equipment and subject matter expertise to observe aircraft sensor/ASE systems and crew reactions in a simulated threat/CM environment.

Benefit: Presentation of simulated surface-to-air (SAM) missiles and CMs in an operational environment assists the Service member in developing TTPs for use in OCO.

SERVICE MEMBER SURVIVABILITY INITIATIVES

Hostile Fire Indicator (HFI)

- The Center is involved in many HFI efforts, including hosting symposiums and workshops, as well as participating in test programs, T&E standards development, test methodology development, data collection, and several U.S. military and international defense initiatives. The following activities are representative of the Center's HFI efforts:
  - The Center held two HFI symposia and workshops that included current HFI program briefings, break-out coordination sessions, and DoD and International partner information exchange. This CCM-led initiative provides a venue for cross Service discussion on the common issue of Service member protection from hostile fire in theater.
  - CCM supported one combined IRCM and HFI test – JATAS (see above).
  - The Center conducted three data collection efforts: Event 1- Yuma, Arizona; Event 2- White Sands Missile Range, New Mexico; Event 3- Aberdeen, Maryland. The focus of these three events was to collect data on systems deploying Hostile Fire Indicating Systems. The systems could be either a retrofit capability of already fielded missile warning systems or more advanced acoustic HFI systems. The data collected will provide a basis for testing and evaluating more complex future hostile fire indicating systems.
  - The Center continued development of a Hostile Fire Signature (HSIG) Model Project to support HFI T&E and modeling and simulation programs - The HSIG Model project is sponsored by the T&E Threat Resources Activity (TETRA), and will develop a physic-based electro-optical (EO) model that produces a muzzle flash and hard body signatures. The model will support HFI T&E and Modeling and Simulation programs.
  - The Center is developing a HFI Test Methodology Handbook to provide the T&E community with guidance for planning, executing, and reporting HFI tests. This handbook provides background on HFI systems, HF threats, as well as discusses all aspects of testing.

Joint Countermeasures Test and Evaluation Working Group (JCMT&E WG)

The Center has established and is continuing to coordinate on-going ASE T&E requirements definition of COCOM and Service CM requirements, and CM requirements identified in the Aircraft Survivability Equipment Joint Analysis Team Roadmap. The ASE T&E includes passive and active warning systems, expendables, active jammers, man-portable, vehicle-mounted guided surface-to-air missiles, unguided hostile-fire munitions, and similar threat systems. Additionally this group will determine T&E gaps in the ASE CM test and evaluation community across the Services. Currently the Center is coordinating a JCMT&E charter, organization, and operational concept between Director, Developmental Test and Evaluation (DDT&E) and DOT&E.

Rotary Wing Survivability Task Force

In a July 2009 Memo, the Director, Defense Research and Evaluation (DDR&E) created a $200 Million effort to improve helicopter survivability. The Center (as DOT&E's representative), in partnership with the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD (AT&L)), continues to coordinate plans for near and far term solutions to helicopter survivability. The goal of this task force is to identify and rapidly mitigate shortfalls in survivability of rotary wing aircraft.

THREAT SIMULATOR TEST AND EVALUATION TOOLS

The Center has continued to develop tools for test and evaluation of IRCM systems funded by USD(AT&L) Test Resource Management Center, Central Test and Evaluation Investment Program Office. Currently, the Center is working on the following test tools:

- Towed Aerial Plume Simulator (TAPS) is used to resolve shortfalls of emulating spatial/temporal signatures for testing missile warning systems (MWS) and IRCM systems. This tool has the ability to test aircraft at various airspeeds, cover a greater portion of the operational battle space and to test in a realistic IR clutter environment. TAPS was designed to support the operational testing of LAIRCM NexGen.
- Multi-Spectral Sea and Land Test Simulator (MSALTS) is a small mobile missile simulator that can fire while on the move and simulate all current tier-one missile threats. It is designed to provide simulated signatures for the new and more capable missile warning systems such as LAIRCM NexGen, DoN LAIRCM, and JATAS.

Annex – Congressional Reports

Annex – Congressional Reports

Congressional Reports Overview

DOT&E prepared seven Beyond Low-Rate Initial Production Reports (BLRIPs), one Early Fielding Report, and four special reports for the Secretary of Defense and Congress in FY10, as well as the Ballistic Missile Defense Annual Report and a report on the Airborne Laser. This section includes Executive Summaries of two of the BLRIP reports. Summaries for the remaining reports are not included due to classification, as noted in the table below.

PROGRAM	REPORT TYPE	DATE
BLRIP Reports		
Acoustic Rapid Commercial Off-the-Shelf (COTS) Insertion (A-RCI) AN/BQQ-10(V) Sonar System (Classified)	OT&E BLRIP Report	October 2009
Virginia Class Submarine (Classified)	Combined OT&E/LFT&E BLRIP Report	November 2009
Department of the Navy Large Aircraft Infrared Countermeasures (DoN LAIRCM) (Classified)	OT&E BLRIP Report	December 2009
Vertical Launch Anti-Submarine Rocket (ASROC) with the Mk 54 Mod 0 Lightweight Hybrid Torpedo (VLA Mk 54) (Classified)	OT&E BLRIP Report	January 2010
CV-22 Osprey	OT&E BLRIP Report	January 2010
USS *San Antonio* Class (LPD 17) Amphibious Transport Dock Ship (Classified)	Combined OT&E/LFT&E BLRIP Report	June 2010
USMC H-1 Upgrades (AH-1Z)	Combined OT&E/LFT&E BLRIP Report	September 2010
Special Reports		
Assessment of the Mine Resistant Ambush Protected (MRAP) Family of Vehicles (Classified)	Combined OT&E/LFT&E Special Report	March 2010
Operational and Live Fire Report of the M915A5 Truck Tractor, Line Haul (Classified)	Combined OT&E/LFT&E Special Report	May 2010
Live Fire and Operational Test and Evaluation Report on the Mine Resistant Ambush Protected (MRAP) All-Terrain Vehicle (M-ATV) (Classified)	Combined OT&E/LFT&E Special Report	June 2010
DOT&E Independent Assessment of the Army's Phase I and Phase II Follow-On Testing of Hard Body Armor (Classified)	Special Report	July 2010
BMDS Reports		
Airborne Laser (ABL) (Classified)	Missile Defense Report	January 2010
2009 Assessment of the Ballistic Missile Defense Systems (Classified)	Annual Report	February 2010
Early Fielding Reports		
Littoral Combat Ship (LCS) 1 (Classified)	Early Fielding Report	July 2010

CV-22 Osprey

The CV-22 is operationally effective with significant limitations and operationally suitable with limitations for supporting Special Operations missions. The speed and range of the basic V-22 airframe exceed the capabilities of existing Air Force Special Operations Command (AFSOC) aircraft and the recently retired MH-53 Pave Low helicopter, enabling greater mission flexibility and survivability. The intended capabilities added by electronic warfare and communications equipment unique to the CV-22 have not reached their full potential and limit mission accomplishment. This report discusses the ability of AFSOC crews to accomplish assigned missions using the CV-22 as tested without all the intended mission enhancements.

The Initial Operational Test and Evaluation (IOT&E) and Live Fire testing were adequate to reach this conclusion and were executed in accordance with the test plan approved by the Director, Operational Test and Evaluation (DOT&E). This report covers the Air Force CV-22 variant. The DOT&E report on the Marine Corps MV-22 variant was published in September 2005.

System Overview

The V-22 Osprey is a multi-mission, tiltrotor aircraft with Marine Corps and Air Force variants. 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 CV-22 Air Force variant adds Special Operations Forces (SOF)-unique mission equipment such as additional communications radios, a multi-mode radar, a multi-mission advanced tactical terminal (MATT), and an advanced electronic warfare suite. As a result, the CV-22 is heavier by about 1,800 pounds of mission weight plus 2,000 pounds of additional fuel. The CV-22 will replace the MH-53J/M Pave Low helicopter and supplement MC-130 aircraft. The Air Force plans to procure 50 CV-22s.

Because the CV and the MV air vehicles are nearly identical, the aircraft have similar capabilities and deficiencies including aerial refueling characteristics, intense downwash, a limited defensive maneuvering envelope in helicopter mode, lack of an all-aspect defensive gun system, and a significant maintenance burden to maintain operational mission capable rates. While some of these deficiencies are significant, operational workarounds allow the aircraft and crew to accomplish all assigned missions.

The Air Force intends to use the CV-22 high-speed, long-range, all-weather, vertical takeoff and landing capabilities to support SOF. In order to support the diverse array of SOF missions, the CV-22 Osprey must be capable of infiltrating defended hostile or politically denied airspace to deliver Joint Service Special Operations teams via vertical takeoff and landing, airdrop, or alternate insertion/extraction operations in day or night, over land or water. The CV-22 must be able to communicate and operate within the existing command structures of a diverse set of worldwide situations, from peacetime crisis response to covert/clandestine low intensity conflict through support to major conventional warfare. Additionally, access to timely intelligence and coordination with joint and combined forces is essential to SOF mission execution. The CV-22 command, control, communications, and computer support must be global, secure, jointly interoperable, and flexible, such that it can be tailored to a wide range of diverse mission needs.

Test Adequacy

The operational and live fire testing of the CV-22 aircraft was adequate to support an evaluation of CV-22 operational effectiveness, operational suitability, and survivability. There were some limitations in the IOT&E test planning and execution: the test team evaluated the Suite of Integrated Radio Frequency Countermeasure (SIRFC) performance against 10 prioritized radio-frequency emitters and Directed Infrared Countermeasures (DIRCM) performance against five infrared threats; evaluation of GPS-denied operations was minimal; detailed (DIRCM) data were not recorded; and the survey questionnaires were inadequately designed. Both the cold weather and out-of-continental-U.S. deployments were canceled, with DOT&E concurrence.

The Air Force Operational Test and Evaluation Center (AFOTEC) conducted the CV-22 IOT&E test in three phases from September 2007 through April 2008 at three locations:

- The Hurlburt Field and Eglin Air Force Base electronic warfare ranges, Florida
- The Nevada Test and Training Range (NTTR)
- The Electronic Combat Range (ECR), China Lake, California.

The specific threat types and scenarios at NTTR and ECR are described in the classified annex to this report. Four CV-22 Block 10 aircraft participated in the operational test, with the third and fourth arriving in January 2008. The IOT&E missions totaled 284 sorties and 665 flight hours over 25 weeks. The average utilization rate was approximately 38 flight hours per aircraft per month throughout the test. The aircraft were operated and maintained in an operationally realistic manner.

Operational Effectiveness

The CV-22 is operationally effective in performing the range of Special Operations missions called for in the requirements document with significant limitations. The demonstrated speed and range of the aircraft expand the operational ability of AFSOC to support global Special Operations commitments and permit options that are not possible with legacy aircraft. The 220-knot, turboprop-class performance in airplane mode allows for global deployment using long-range air refueling capability. The current lack of strategic (KC-10) aerial refueling capability and high frequency radio requires an MC-130P Combat Talon escort, as did legacy Pave Low helicopter operations. Additionally, the ability of the CV-22 to depart from forward helicopter landing zones and transition to airplane mode for long-range, unrefueled cruise – for insertion of Special Operations teams at previously unreachable distances, or extraction of casualties – is a capability unique to the CV-22.

The maneuverability of the CV-22 in airplane mode, in combination with the intended (but not fully realized) performance of onboard sensors, electronic warfare systems, and situational awareness equipment, gives SOF a new ability to operate in low- to medium-threat environments, and perform Special Operations support beyond the capabilities of current Special Operations helicopters or fixed-wing aircraft.

The Terrain Following/Terrain Avoidance radar and flight control systems enable high speed, low-level flight at night and in poor visibility, increasing mission flexibility and survivability.

Poor reliability and performance shortfalls of the DIRCM system, the SIRFC system, and the MATT as installed on the CV-22 limit mission accomplishment by necessitating avoidance of threats and reliance on visual cueing and manual dispense of chaff and flares if unknown threats are encountered. The program should consider incorporating improvements in the DIRCM system, developed by the Navy Large Aircraft Infrared Countermeasures (LAIRCM) program, which have proven effective in testing on other aircraft. Integration of the MATT with a Blue Force Tracker must be improved. Both MATT and DIRCM were effective on the legacy Pave Low aircraft. The program should work with the Army to identify performance fixes to the SIRFC system.

Failures of the Icing Protection System, the Engine Air Particle Separator (EAPS) system, and the communication suite degraded the ability of the platform to conduct effective covert or clandestine operations. Operational workarounds mitigate most of these deficiencies at the cost of increased workload in flight and during ground maintenance.

Significant downwash from the CV-22's proprotors in hover mode makes fastrope and hoist operations challenging, causes brown-outs in austere landing sites, precludes rappel operations, and makes water operations challenging for even combat swimmers because of intense water turbulence. AFSOC currently restricts the CV-22 from hovering in salt-water environments because of the rapid degradation of engine performance from salt encrustation on the engines. This salt contamination causes a reduction of power available within minutes and necessitates increased maintenance workload following salt-water operations.

The CV-22, as currently configured, is capable of delivering 18 mission-equipped troops 538 nautical miles (500 required) using a 20-foot hover-in-ground-effect at the mission destination; if terminal operations require a hover-out-of-ground-effect, the mission radius drops to approximately 335 nautical miles with operationally realistic power and engine performance safety margins in place. Additionally, if atmospheric conditions require the use of the Icing Protection System, the mission radius drops further. High-altitude landing zone operations further reduce the available mission radius or payload capability.

The CV-22 has an objective requirement for strategic aerial refueling from the KC-10 tanker. This capability is not yet available because of airspeed and refueling system incompatibilities. This strategic tanker capability shortfall requires AFSOC to devote scarce MC-130 aircraft to support each deploying CV-22.

Operational Suitability

The CV-22 is operationally suitable with limitations for supporting Special Operations missions. The system fell short of its required mission capable rate (82 percent) during the IOT&E as a whole (58 percent), but during the final two-thirds of the IOT&E (the deployed portion), the system demonstrated sufficient mission capable rates (74 percent) to support expected combat utilization rates. During operational testing, the CV-22 exceeded most reliability and maintainability thresholds with the exception of the critical failure rate, which was affected primarily by failures of the electronic survivability equipment unique to the CV-22 (SIRFC and DIRCM systems). Deficiencies in both maintainer and aircrew technical publications during IOT&E also degraded suitability, and the Environmental Control System and EAPS performed poorly in desert conditions. Maintaining an acceptable mission capable rate resulted in a significant maintenance burden (24 hours a day, 7 days a week).

Many human factors and safety issues that were identified during MV-22 testing are still present on CV-22 systems. These include fuel, environmental control, heads-up display, lighting, and aft cabin systems.

Survivability

DOT&E assesses survivability of the CV-22 against low- and medium-threats as high during the enroute portions of missions when all defensive electronics are working. Limits on defensive maneuvering and the lack of an all-aspect defensive weapon increase susceptibility to enemy fire during terminal phases in and near landing zones where threats are likely. Survivability of the CV-22 against certain modern fielded threats in the high-threat category is assessed as low because of deficient performance of the electronic combat systems. This is discussed in the classified annex to this report. While deliberate entry by the CV-22 into such high-threat conditions would likely be avoided if possible, inadvertent or necessary exposure could occur in certain urgent, high-priority missions.

Recommendations

The V-22 Joint Program should consider the following recommendations and AFOTEC should verify the corrections of deficiencies during FOT&E:

Operational Effectiveness

- Correct and retest CV-22 SIRFC deficiencies that were also observed in the SIRFC IOT&E as installed in MH-47 and MH-60 helicopters (classified annex). The deficiencies include the inability to detect certain threats, incorrect jamming profiles, misinformation presented to aircrew, delayed jamming, ineffective jamming, and false returns. In addition, pursue system performance against higher-end threats by improving the high-power jammer.
- Resolve DIRCM in-flight self-calibration failures in conjunction with the Large Aircraft Infrared Countermeasures program office; consider fixes already completed on other Air Force aircraft. Identify, fix, and test other DIRCM deficiencies experienced during IOT&E.
- Develop, install, and test a defensive gun system to enhance survivability against close-in threats.
- Conduct testing against GPS jamming.
- Resolve display and control deficiencies with the MATT and improve training and flight manual procedures to facilitate receiving real-time threat updates and survivor/evader information.
- Correct the CV-22 software deficiencies associated with erroneous measurement of outside air temperature used by the flight control computers.
- Resolve deficiencies with the V-22 Mission Planning System, including certification for basic flight performance calculations and automated release points for airdrop.
- Resolve air refueling deficiencies including slow refueling rate and fuel system malfunctions such as low feed tanks and trapped fuel. Pursue a strategic (KC-10) air refueling capability.
- Improve the radio communications suite range and sensitivity. Consider adding a high frequency radio capability to permit independent CV-22 operations in international airspace. Consider certification for area navigation for filing international flight plans.
- Improve Forward Looking Infrared video quality and discrimination to permit precision navigation and operations in confined landing zones in poor visibility conditions.
- Characterize engine degradation of power in salt spray and pursue options to permit AFSOC operations in salt-water environments. Determine whether improved tactics, techniques, and procedures can minimize engine salt encrustation.

Operational Suitability

- Improve the reliability of the Icing Protection System and the EAPS system.
- Evaluate cold-weather operations.
- Improve the aircraft system critical failure rate, which was dominated by SIRFC, DIRCM, and Icing Protection System failures.
- Improve the maintainer and aircrew technical publications.
- Improve internal and external lighting issues including: accessibility of cabin lighting controls, cumbersome rotor tip light controls, searchlight time delays, and night vision goggles heads-up display symbols.
- Add tie-down points and anti-skid decking inside the cabin.
- Optimize the litter configuration for SOF use, including extended medical care during long-distance evacuations.
- Improve the Environmental Control System to allow extended operation in hot environments.

USMC H-1 Upgrades (AH-1Z)

The AH-1Z is operationally effective, operationally suitable, and survivable. The IOT&E and live fire testing were adequate and were executed in accordance with the DOT&E-approved test plans.

This document completes reporting by the Director, Operational Test and Evaluation (DOT&E) on the Initial Operational Test and Evaluation (IOT&E) of the United States Marine Corps (USMC) H-1 Upgrades program, which consists of improvements to two variants, the AH-1Z Cobra attack helicopter and the UH-1Y Huey utility helicopter. This report covers the AH-1Z variant tested in IOT&E Phase 3, conducted from March-June 2010. The UH-1Y completed its IOT&E in Phase 2 in May 2008, and DOT&E published its report on the UH-1Y in September 2008.

System Description and Mission

The AH-1Z is an upgrade to the legacy AH-1W helicopter. Along with the UH-1Y, the AH-1Z equips Marine Corps Light Attack Helicopter Squadrons, supporting their missions to provide combat assault helicopter support, attack helicopter fire support, and fire support coordination for aviation and ground forces during amphibious operations and subsequent operations ashore. Light Attack Helicopter squadrons deploy and operate from air-capable ships and forward operating bases ashore in support of combat, contingency, training, and non-combat operations. The AH-1Z must have the ability to operate at night and in adverse weather conditions at extended ranges while maintaining a suppressive weapons capability against surface-to-air threats.

The H-1 Upgrades program consists of the design, development, and integration of a new four-bladed rotor system, a new drive train, a redesigned tail boom and tail rotor assembly, and a new mission avionics suite for the UH-1 and AH-1 helicopters. Replacement of the two-bladed main rotor system with the new four-bladed system is intended to increase payload, endurance, and speed, and improve flight-handling qualities in comparison to the legacy AH-1W helicopter. The upgraded digital cockpit integrates communication, navigation, target acquisition, and weapon employment functions, with the goal of reducing pilot workload and increasing crew situational awareness.

Test Adequacy

The operational and live fire testing of the H-1 Upgrades aircraft were adequate to support an evaluation of the AH-1Z operational effectiveness, operational suitability, and survivability. The minor limitations to testing – short shipboard operating periods and limited use of opposing forces during tactical missions – did not hinder this assessment.

The Navy's Commander, Operational Test and Evaluation Force (COMOPTEVFOR), through Air Test and Evaluation Squadron Nine (VX-9), conducted the H-1 Upgrades Operational Evaluation in three phases. The Navy conducted IOT&E Phase 1 from May 2006 through January 2007, primarily during daylight conditions because of limitations of the Top Owl Helmet-Mounted Sight Display (HMSD) system while flying at night. The second phase of IOT&E, with the Optimized Top Owl HMSD system, included more flying at night. Because of poor weapons system reliability, the Navy terminated AH-1Z testing during Phase 2 (while completing UH-1Y testing) and added a third phase to the IOT&E. VX-9 flew 49 percent (39 of 80) of the IOT&E Phase 3 tactical missions at night. This was sufficient to assess the aircraft's ability to operate at night.

Four AH-1Z low-rate initial production aircraft configured with the Optimized Top Owl HMSD system and with system configuration set 5.3.1 software participated in IOT&E Phase 3. Unlike the IOT&E Phase 1 and Phase 2 aircraft, the IOT&E Phase 3 aircraft were equipped with production models of the Target Sight System.

During all phases of operational testing, VX-9 operated and maintained the aircraft in an operationally realistic manner reflecting fleet operations.

Operational Effectiveness

The AH-1Z is operationally effective. During operational testing, when VX-9 employed the AH-1Z in flights of two or more aircraft, the AH-IZ successfully accomplished 89 percent of its assigned missions, which included Deep Air Support, Close Air Support, Assault Support, Strike Coordination and Reconnaissance, and Forward Air Controller (Airborne).

The AH-1Z provides the Marine Corps with an improvement in attack helicopter capabilities compared to the current AH-1W, with increased speed and range and more than double the payload capability. The AH-1Z also provides expanded range and maneuverability, thereby increasing the aircraft's effectiveness in air combat maneuvering.

Structural limitations of the main rotor blade cuff and yoke result in some restrictions of the maneuvering flight envelope, especially at high gross weights at high altitudes. Because of the relative ease with which the aircrew can cause the aircraft to exceed its G-limits (potentially overstressing the aircraft), aircrew were cautious while performing air combat maneuvering with an attendant loss of situational awareness while one of the two pilots had to constantly monitor the G-meter.

Testing during phase 3 showed improved performance of the Target Sight System (TSS) and the Optimized Top Owl HMSD compared to the systems tested during phases 1 and 2. Incorporation of these systems contributes to the accurate delivery of ordnance equal to or better than that of the AH-1W. The increased detection, recognition, and identification ranges of targets provided by the TSS increases the survivability of the AH-1Z. The TSS laser designation accuracy at maximum ranges when using the color TV sensor is inconsistent, and reduces the range at which the Hellfire missile can be employed with this sensor. Using the forward-looking infrared (FLIR) for laser designation increases accuracy to the maximum employment range of the Hellfire missile.

The Multi-Function Displays with moving map capability, combined with the digital cockpit and the Optimized Top Owl HMSD, increases situational awareness and aircrew confidence in their ability to perform missions while reducing pilot workload in flight (compared to the AH-1W). The communications and navigation capabilities of the AH-1Z met or exceeded requirements, but excessive delays in the transmission of secure voice communications caused pilots to have to employ workarounds leading to the potential pilots will miss important information.

The mission planning system is labor-intensive and not well integrated. These deficiencies resulted in excessive workloads for the pilots. The integrated stores management system required specific keystroke sequences to avoid system crashes. Each system crash requires a system reset and therefore distracts the aircrew and interferes with the aircrew's situational awareness.

Operational Suitability

The AH-1Z is operationally suitable. During operational testing, the AH-1Z exceeded reliability thresholds for mean flight hours between failure and mean flight hours between abort. The AH-1Z's 7.6 maintenance man-hours per flight hour is 43 percent lower than the AH-1W (which is historically 13.3).

Aircraft availability was greater than 95 percent (mission capable rate) and exceeded the required threshold of 85 percent. Maintainers considered the publications adequate and much improved from earlier phases of testing. The limited information available in maintenance publications addressing aircraft structural repairs and repair of the Optimized Top Owl HMDS system necessitated heavy reliance on contractor fleet support personnel in those specific areas. The aircraft's blade fold system has shipboard compatibility deficiencies.

The rotor system is operating with greatly reduced life-cycle times because of structural limitations on its principal components, the yokes and cuffs. The Navy intended these parts to last 10,000 flight hours, i.e., the full expected life of the aircraft, but in operational use they are being replaced after 700 to 1,200 hours. This costs not only the actual replacement dollars (up to $14.8 million over the projected 10,000 flight hours life span of each aircraft), but also the maintenance hours and the aircraft down time. For a combined fleet (UH-1Y and AH-1Z) of 349 aircraft, this could be a considerable life cycle cost to the program. The Navy is working on a main rotor redesign plan scheduled to deliver upgraded rotor heads in 2015. The redesign is expected to address the structural G-limits and increase the lifetimes of the parts. By 2015, the program will have delivered 160 UH-1Y and AH-1Z aircraft that will require premature retrofit as incidents, failures, or inspections require.

While a C-17 can carry three AH-1W aircraft, only one AH-1Z fits within the C-17 cargo hold. Transporting a squadron of AH-1Z aircraft will require three times the number of strategic lift assets than for the AH-1W squadron. This increase in demand for strategic lift aircraft will slow the transport of other high-priority items into theater.

Survivability

DOT&E previously reported on the Live Fire Test and Evaluation of the H-1 Upgrades. The September 2008 report on the UH-1Y contains further details regarding this testing.

Operational and live fire testing indicates that the AH-1Z aircraft is survivable against small arms and automatic weapons fire (up to 12.7 mm) and legacy man-portable air defense systems (MANPADS). A number of features enhance the survivability of the AH-1Z in combat operations by reducing either the susceptibility or the vulnerability of the aircraft compared to the legacy AH-1W.[1] These include the Hover Infrared Suppressor to reduce engine exhaust signature, improved aircraft survivability equipment, ballistic impact-tolerant flight components, redundant hydraulic systems, and built-in fire detection/suppression systems in the fuel cells. Operational testing included few flights against live opposing forces, limiting the ability to evaluate susceptibility. Vulnerability testing indicates that some improvements are needed for flight-critical components, including transmissions, fuel cells, flare dispensers, and fire suppression in the dry bays.

[1] Susceptibility is commonly defined as hit avoidance, while vulnerability is defined as hit tolerance.

Recommendations

Operational Effectiveness

- Increase color TV-to-laser boresight accuracy to allow for employment of precision-guided munitions, such as the Hellfire missile, at maximum ranges.
- Improve G-limit warning systems to reduce pilot-intensive focus on the G-meter during maneuvering flight.
- Improve the design of the legacy rocket pod intervelometer switch that controls the firing sequence of the rockets, or adopt a new launcher. Because of the age and associated wear of this switch, it is difficult for ordnance personnel to verify the rocket pod is in the ARM vice LOAD position.
- Resolve software anomalies with the stores management system to permit any desired sequence of weapon selection.
- Resolve nonintegrated mission planning system issues to reduce excessive pilot workload associated with pre-flight mission planning.
- Resolve excessive time delays that occur when the aircrew are transmitting secure voice communications.
- Address unreliable auto track function of the TSS against moving targets to provide better target tracking of time-critical targets and reduce pilot workload.
- Develop infrared position lights to assist pilots in maintaining visual contact with other aircraft during low light level operations.

Operational Suitability

- Continue efforts to redesign the cuff and yoke to increase structural integrity, service life, and flight envelope. Conduct developmental and operational tests of the aircraft with the redesigned rotor system to verify performance.
- Develop damage assessment criteria and repair procedures to be included in the AH-1Z Structural Repair Manual prior to the aircraft's first deployment.
- Redesign the blade fold racks to reduce their size and weight and increase their durability for shipboard compatibility.
- Develop quick disconnect fittings for the cables connecting the helmet to the aircraft in order to expedite aircrew emergency egress from the aircraft.
- Fully fund and implement all tail rotor water intrusion redesign efforts.
- Conduct an end-to-end shipboard compatibility assessment to include shipboard ordnance storage, transport, loading, and unloading of the greater amount of ordnance the AH-1Z consumes.

Survivability

- Continue the redesign of the main rotor transmission and combining gearbox housings to overcome the deficiency demonstrated during earlier run-dry tests. The main transmission redesign should be tested in a fully loaded condition (i.e. rotor blades and hub installed with hover power applied).
- Redesign the AH-1Z main fuel cells to meet self-sealing requirements.
- Implement a configuration management plan that, when consistent with susceptibility to likely threats, will put only pyrophoric materials such as the MJU-49 flares in the forward flare buckets and the more sensitive pyrotechnic materials like the MJU-32 flares in the aft buckets (located in the tailboom area away from the crew). This would reduce the likelihood of dry bay fire leading to catastrophic damage to the aircraft and possible crew injury or incapacitation due to smoke and fumes.
- Improve the ballistic tolerance of the main rotor pitch change adapter to reduce the likelihood of damage to the clevis and pitch control rod that could cause catastrophic damage to the aircraft.
- Incorporate self-sealing breakaway valves between fuel bladders and lines to prevent post-crash leakage of fuel.
- Add fire detection/extinguishing systems to the dry bays adjacent to fuel cells, the engine compartment, the main transmission, auxiliary power unit dry bays, and oil cooler areas to reduce the likelihood that an uncontained fire could cause catastrophic damage to the aircraft.

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