FY 2011
Annual Report

In my report to you last year, I discussed four initiatives that I am undertaking as Director, Operational Test and Evaluation: field new capability rapidly; engage early to improve requirements; integrate developmental, live fire, and operational testing; and substantially improve suitability before initial operational test and evaluation (IOT&E). In this Introduction, I report on the progress made implementing these initiatives, discussing several success stories as well as areas requiring additional effort. I will first discuss key issues causing program delays in defense acquisition and the marginal cost of operational testing. I will also include a discussion of operational test and evaluation (OT&E) interest areas, as well as a summary of my monitoring and reporting activities on OT&E.

Additionally, I have included a new discussion in the Activity and Oversight chapter of this annual report containing my assessment of significant issues observed in operational testing of systems under my oversight in 2010-2011. These issues, in my view, should have been discovered and resolved prior to the commencement of operational testing. This new section also provides my identification of significant issues observed in early testing of systems during 2010-2011 that, if not corrected, could adversely affect my assessment of those systems' effectiveness, suitability, and survivability during IOT&E.

PROGRAM DELAYS

In response to continuing comments by the acquisition community that testing drives undue requirements, excessive cost, and added schedule into programs, I conducted a systematic review of recent major acquisition programs that experienced delays. I examined these programs to determine the causes and lengths of program delays, and the marginal cost of operational test and evaluation. The Under Secretary of Defense (Acquisition, Technology, and Logistics) (USD(AT&L)) had also chartered a team to assess the acquisition community's concerns regarding testing. The results of both studies indicated that testing and test requirements do not cause major program delays or drive undue costs. Dr. Carter and I signed a joint memorandum addressing these issues as well as other problems that were identified in the two studies, summarized below.

The USD(AT&L) study team found that tensions are often evident between programs and the test community and for the most part these are normal and healthy; however, there is room for improvement in these relationships and interactions. Four potential mitigations were identified:

- Stronger mechanisms for a more rapid adaptation to emerging facts
- A requirements process that produces well-defined and testable requirements
- Alignment of acquisition and test strategies (i.e., programs lack the budgetary and contract flexibility necessary to accommodate discovery)
- Open communications between programs and testers, early and often, with constructive involvement of senior leaders

Causes of program delays

My review examined 67 major programs that experienced significant delays and/or a Nunn-McCurdy breach. Thirty-six of these programs experienced a Nunn-McCurdy breach and six of these programs were ultimately canceled. (Two of the 36 Nunn-McCurdy programs experienced no delays to their schedule.) We identified five categories of problems that resulted in delays:

- Manufacturing and development (to include quality control, software development, and integration issues)
- Programmatic (scheduling or funding problems)
- Poor performance in developmental testing (DT)
- Poor performance in operational testing (OT)
- Difficulties conducting the test (such as range availability, test instrumentation problems, and other test execution problems)

Of the 67 programs, we found that 56 programs (or 84 percent) had performance problems in testing (either DT, OT, or both) while only eight programs (or 12 percent) had issues conducting the tests that led

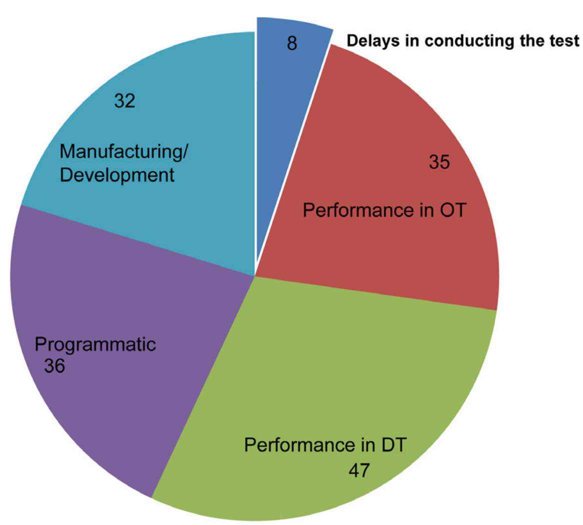

FIGURE 1.
REASONS BEHIND PROGRAM DELAYS

to delays. Only one program had delays solely attributed to the test: the Army's Force XXI Battle Command Brigade and Below (FBCB2) operational test was delayed for one year because the test unit designated by the Army was deployed. However, the delay of the IOT&E for the FBCB2 did not affect the deployment of the satellite communications version of the system. The IOT&E was conducted later on the original terrestrial communications system, which had been previously shown to have poor performance in early operational tests. Figure 1 shows the distribution of the types of delays that occurred in the 67 programs evaluated. There were 158 instances of delays for the 67 programs in five categories (many of the programs had more than one reason for delays). Clearly, programs are most often delayed because of the results of testing, not the testing itself.

Length of delays

The length of delays for the programs examined varied from none (for two of the Nunn-McCurdy programs) to 15 years. Thirty-seven programs were delayed greater than 3 years. The delays were measured against the most recent previously published schedule; so, in a sense the total delay experienced is likely to be even longer relative to the original planned schedule. Six of the programs were eventually cancelled, and one had its Milestone B approval rescinded.

Cost of Operational Testing

The DOT&E and USD(AT&L) studies noted that the marginal cost of operational testing is a small portion of a programs' overall budget; however, the costs can be a large percentage of the budget in the year(s) in which testing occurs. Because the operational testing occurs at the end of the development process, programs typically have fewer degrees of freedom (and resources) left to resolve problems conducting such tests or correcting the problems they too often reveal. Therefore, it is important for planning for OT to commence early, so that the necessary resources can be allocated at the programs' outset.

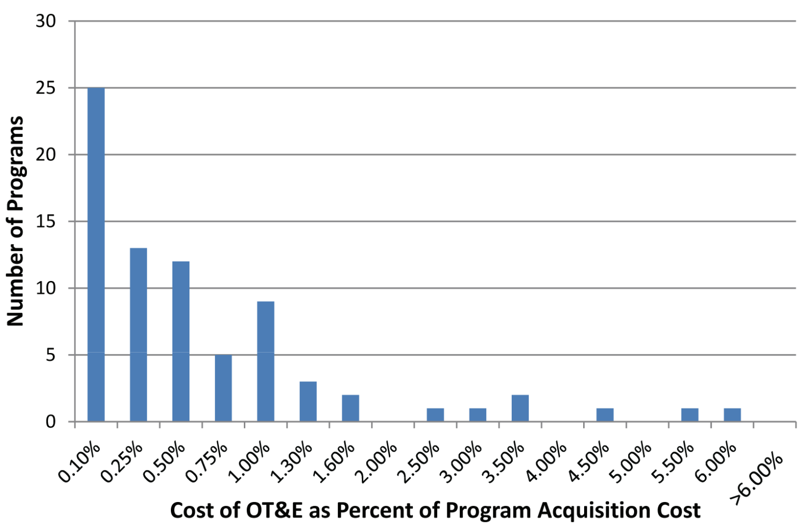

FIGURE 2.
MARGINAL COST OF OT&E RELATIVE TO PROGRAM ACQUISITION COST

We evaluated marginal cost of operational test and evaluation to programs as a percentage of total acquisition cost. A review of 78 recent programs in the Army, Air Force, and Navy showed that the average marginal cost of OT&E is approximately 0.65 percent of the total acquisition cost. Few programs that we reviewed (7 out of 78) required more than 1.5 percent of program acquisition costs for OT&E. For those programs with above average OT&E costs, a relatively low program acquisition cost was the dominant cause of larger proportional OT&E cost (e.g., Modular Aircrew Helmet with $8.4 Million acquisition costs, AIM-120C Electronic Protection Improvement Program with $87 Million acquisition costs, and the Hard Target Void Sensing Fuze with $147 Million acquisition costs). Expense of test articles and their expendability was another major driver. Figure 2 shows the distribution of the marginal cost of OT for the 78 programs we examined.

In addition to the DOT&E and USD(AT&L) studies, the Decker-Wagner report commissioned last year by the Secretary of the Army, addressed the Army's failure rate of initiating and then cancelling new development programs. The study found that between 1990 and 2010, the Army terminated 22 Major Defense Acquisition Programs (MDAPs), and that 15 of those terminations occurred since 2001. Further, excluding the Future Combat System (FCS), the Army spent more than $1 Billion per year since 1996 on programs that were eventually cancelled before completion. The study cited many reasons for the failed programs including unconstrained requirements, weak trade studies, and erosion of the requirements and acquisition workforce. However, none of the reasons cited included test and evaluation (T&E). In fact, in my opinion, earlier and more robust T&E would have revealed problems and solutions earlier when they would have been less costly to fix or allowed decision makers to cancel or restructure programs and avoid wasting billions of dollars.

PROGRESS ON DOT&E INITIATIVES

1. Field new capability rapidly.

Providing new and better equipment to our fighting forces as quickly as possible remains a top priority for the Department. Each Service operational test agency has developed methods for rapidly evaluating systems fulfilling urgent operational needs, including combining testing with the training of the first unit to be equipped and conducting quick reaction assessments. Examples of rapid acquisition programs that underwent tailored, yet rigorous live fire and operational testing this year include upgrades to the Mine Resistant Ambush Protected family of vehicles, the Stryker Double-V Hull, the MQ-9 Reaper Unmanned Aircraft System, the MQ-1C Gray Eagle Unmanned Aircraft System, the Mk 54 and Mk 48 torpedoes, and the Enhanced AN/TPQ-36 (EQ-36) Radar System.

One consequence of rapid fielding is that systems can be committed to combat operations before IOT&E and full-rate production. Under that circumstance, Congress requires DOT&E to submit Early Fielding Reports. In FY11, DOT&E delivered four such reports: the MQ-8B Vertical Take-off and Landing Unmanned Aerial Vehicle (Fire Scout), Navy Multiband Terminal, Precision Lethality Mk 82 Bomb, and the Mk 48 Torpedo. These Early Fielding Reports were also provided to the Services to support their fielding decisions and to the combatant commanders to make our joint forces aware of the capability these systems do and do not provide.

The Joint Test and Evaluation (JT&E) program, established in 1972, continues to provide rapid, non-material 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), revised operational architectures, and training packages. In addition to seven joint tests in FY11, the JT&E program conducted 14 quick reaction tests and one special project. A detailed discussion of these activities is provided in the JT&E chapter of this report.

2. Engage early to improve requirements.

The Weapon System Acquisition Reform Act of 2009 recognized that “unrealistic performance expectations” and “immature technologies” are among the root causes of trouble in defense programs. In addition, the USD(AT&L) study referenced above concluded that “the requirements process is broken;” that requirements are not well conceived; too many Key Performance Parameters complicated consideration of cost-design tradeoffs; the requirements process is slow, cumbersome, and not flexible enough to change with discovery; and finally, that it suffers from inadequate definition of anticipated operational environments and associated mission-oriented operational test requirements. The Decker-Wagner study referenced above also cited unconstrained requirements, weak trade studies, and erosion of the workforce as causes for many of the Army’s failed acquisition programs. To this end, DOT&E has four dedicated staff members working within the Department’s requirements-setting process, the Joint Capabilities Integration Development System (JCIDS). This year they participated on a Joint Staff task force to re-structure the JCIDS process, recommending implementation of a number of changes. One example of needed change is that the rationale for requirements be rigorously stated and justified on the basis of accomplishing missions in combat rather than on the basis of technical specifications. Throughout our participation in the task force, we have consistently emphasized the need to have measurable and testable requirements related clearly to mission accomplishment that will allow the test and evaluation community to provide timely and relevant information to decision makers. DOT&E now provides advice on the testability and relevance of proposed requirements through participation on Joint Capabilities Boards and is formally designated as an advisor to the Joint Requirements Oversight Council.

3. Integrate developmental, live fire, and operational testing.

Dedicated operational testing will always be required to provide relevant, credible evidence with inferential weight to decision makers about the operational benefits of acquiring a new weapon system. That testing must be rigorous and efficient; thus, to the extent possible, it should be integrated with developmental and live-fire testing in order to make early and full use of all the data available.

The National Research Council Panel on Statistical Methods for T&E of Defense Systems has stated many times since 1998 that current practices in the Department do not take full advantage of the benefits available from the use of state-of-the-art statistical methodology, including experimental design techniques. Thus, our testing is not as efficient as it should be. To remedy this shortcoming, my office is working with other stakeholders to develop a roadmap institutionalizing the use of scientific design and rigor in test and evaluation. The stakeholders involved include Deputy Assistant Secretary of Defense (Developmental Test and Evaluation) (DASD(DT&E)), the Service operational test agencies, and the Service T&E executives. The roadmap being developed is a multi-prong, phased effort that encompasses guidance and policy; education, training, and software tools; case studies highlighting lessons learned; and pilot projects applying scientific design tools to solve current problems in constructing tests and evaluating their results. This year we also completed a study of the military and civilian workforce demographics of the operational test agencies and the personnel within the acquisition workforce designated as T&E career field in order to learn what types of training and education are necessary for the workforce to implement these advanced experimental design and analysis techniques. The first phase of the roadmap comprises case studies drawn from each of the Service operational test agencies providing examples and best practices for experimental designs. We are developing a website that displays these case studies and lessons learned from T&E using experimental design and analysis. Moreover, we have recently completed a guide to producing a rigorous and comprehensive Test and Evaluation Master Plan (TEMP). The guide has specific instructions, examples, and guidance on topics of interest that DOT&E requires in a rigorous TEMP. This guide will be hosted on the DOT&E website with a link from the Defense Acquisition University website.

We are now beginning the next phase of the roadmap. We are working directly with each of the Service operational test agencies to identify pilot acquisition programs in which challenging problems in test design and analysis have been discovered. For these programs, we will provide statistical and experimental design expertise to develop solutions to those challenging problems. We will solicit early involvement from the developmental test and evaluation (DT&E) community so that the experimental design can encompass all phases of testing, thereby providing rigorous and efficient integrated testing.

We have established research relationships with academic institutions that have excelled in the fields of statistics, experimental design, T&E, and systems engineering. Together with the Test Resource Management Center, we are funding a three-year research consortium comprising the Air Force Institute of Technology, Naval Postgraduate School, Arizona State University, and Virginia Tech. Graduate research is being conducted on difficult statistical problems in T&E. The research also provides published work on the use of design of experiments in DoD T&E and an academic pool of analysts familiar with T&E to augment the current workforce.

A recent example of using statistical methodology and combining operational and live fire testing is with the Enhanced Combat Helmet (ECH) test program. The Marine Corps will conduct a Full-Up System Level (FUSL) test of the ECH in FY12. The purpose of this test is to provide data to support an evaluation of the vulnerability of the ECH to realistic artillery shell fragments. The test incorporates an array of ECH test articles in an operational layout to evaluate their protection in a realistic environment. The Marine Corps will use the results of this test, along with other ballistic and non-ballistic test results, to inform its procurement decisions. The ECH FUSL will provide valuable lessons for conducting future FUSL tests of combat helmets.

4. Substantially improve suitability before IOT&E.

Our fighting forces need systems that are effective when needed, not just effective when available. Weapon system reliability is a key factor in suitability; it is a primary driver of the operations and support costs of the system; and poor reliability burdens on our combat forces with unscheduled maintenance, excessive logistics burden, and down time. The timeline in Figure 3 below shows the steps the Department has taken to improve reliability, starting with a DOT&E initiative in 2006 to improve the suitability of fielded systems. Following our initiative, the Joint Staff issued a Directive making material availability a key performance parameter, the Army Acquisition Executive issued policy requiring early incorporation of Reliability, Availability, and Maintainability (RAM) planning into their regulations and required new programs to include reliability growth and testing, and we re-instated the Reliability Improvement Working Group. The Defense Science Board on Developmental Test and Evaluation in 2008 found that the use of reliability growth in development had been discontinued by the Department over 15 years ago, and that the solution to the resulting trend of producing unreliable systems would be to ensure that programs are formulated and funded to execute a viable systems engineering strategy that includes a robust reliability growth plan from inception.

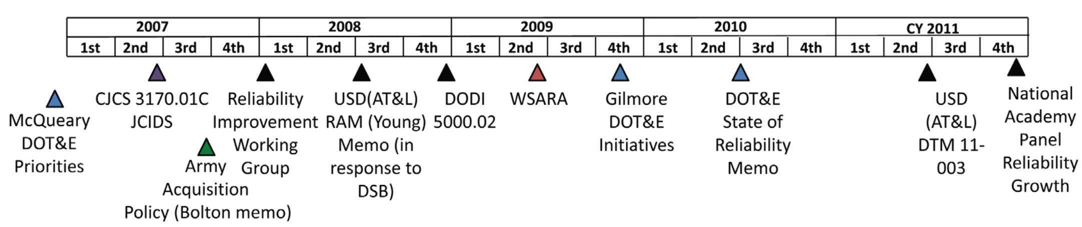

FIGURE 3.
TIMELINE OF EVENTS WITHIN DOD TO IMPROVE RELIABILITY

A system can be reliable but not suitable because of safety, human factors, training, or a combination of other factors. Conversely, a system could be unreliable but still be suitable because failures were easily repaired, there was redundancy in the system, or the reliability requirement was excessive. Figure 4 shows the cumulative scores for effectiveness, suitability, and reliability for systems on which we reported to Congress from 2006 to 2011 (a total of 52 reports). I scored each of the 52 reports to Congress as "reliable" or "not reliable" based on whether they met their reliability threshold; 36 out of 52 systems were found to be suitable while only 26 out of the 52 systems met their reliability threshold. Notably, none of these 52 systems were ultimately cancelled.

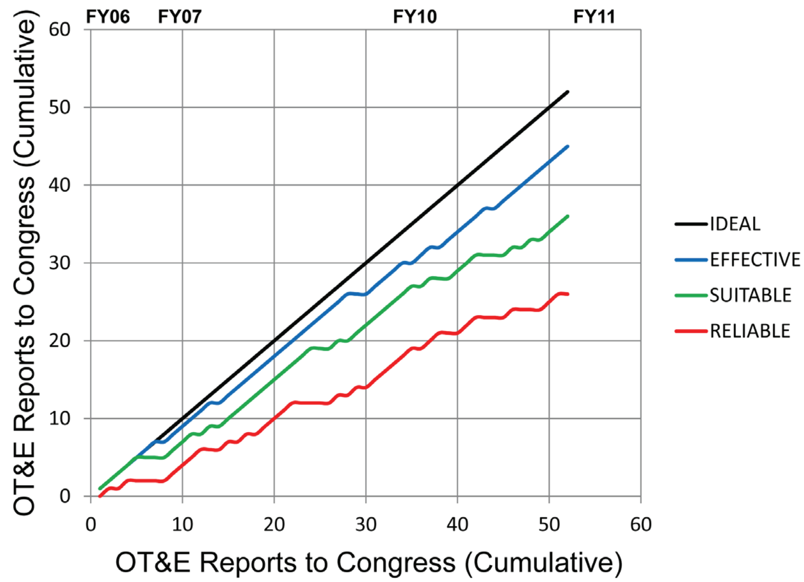

FIGURE 4.
CURRENT TRENDS IN RELIABILITY

Reliability Program Standard

In 1998, the DoD cancelled Mil-Std-785B, "Reliability Program for Systems and Equipment Development and Production." This standard was originally written in 1969 and last updated in 1980; however, industry continues to follow the -785B methodology, which, unfortunately, takes a more reactive than proactive approach to achieving reliability goals. In this standard, approximately 30 percent of the system reliability comes from the design while the remaining 70 percent is to be achieved through growth implemented during test phases. In 2008, the Defense Science Board stated that the DoD needed a standard that defense contractors can use to prepare proposals. A new voluntary reliability standard was developed by subject matter experts drawn from industry, DoD, academia, and the Services; the ANSI/GEIA-STD-0009. This standard was designated by the Deputy Assistant Secretary of Defense (Systems Engineering) (DASD(SE)) the Reliability Program Standard for Systems Design, Development, and Manufacturing to make it easy for program managers to incorporate the best practices in requests for proposals and contracts. The standard promotes four objectives:

- Understand customer/user requirements and constraints
- Design for Reliability (DfR) and re-design for reliability
- Produce reliable systems
- Monitor and assess user's experienced reliability

Thus, the standard emphasizes the need to design reliability into a system at the component level from the outset, rather than test for reliability after components have been designed and integrated to determine if retro-fixes are needed. Specific programs that have used the Design for Reliability standard include the Small Diameter Bomb II, the Stryker Nuclear, Biological, and Chemical Reconnaissance Vehicle, and the Ground Combat Vehicle. Those systems' contractors, Raytheon Missile Systems and General Dynamics Land Systems, were both active participants in the development of the ANSI/GEIA-STD-0009 (along with numerous other contractor participants).

Reliability Growth in TEMPs

We conducted a survey of 151 programs with approved Test and Evaluation Master Plans (TEMPs). Of those 151 programs, 90 percent of programs with TEMPS approved since 2008 plan to collect and report reliability data. A comparison of programs that completed a TEMP before and after June 2008 (when the Office of the Secretary of Defense (OSD) began initiatives to improve reliability) indicates improvement in several areas. Since 2008, programs are more likely to:

- Have an approved System Engineering Plan
- Incorporate reliability as an element of test strategy
- Document reliability growth strategy in the TEMP and include reliability growth curves in TEMPs
- Establish reliability-based milestone or OT entrance criteria
- Collect and report reliability data

However, as shown in Figure 4 above, no significant improvement has yet been demonstrated indicating systems are meeting their reliability thresholds; moreover:

- There is no evidence of programs using reliability metrics to ensure growth is on track.
- Systems continue to enter OT without demonstrating required reliability.
- 50 percent of programs with time scheduled to implement corrective actions met reliability thresholds compared to only 22 percent for programs without corrective action periods.

Significant Actions since 2008 Defense Science Board Study on Developmental Test and Evaluation

In response to both the Defense Science Board study (2008) and the Weapons System Acquisition Reform Act (2009), the Department took a number of actions within OSD, which in turn provided impetus for the Services to take action. In particular, within OSD,

The Systems Engineering Forum was established with DOT&E and USD(AT&L) Systems Engineering and the Service System Engineering Executives. The forum includes monthly updates from each Service on reliability improvement action items.

DOT&E has sponsored Reliability Growth Training conducted most recently by the Army Evaluation Command (AEC) and Army Materiel Systems Analysis Activity (AMSAA)). The courses offer multiple venues throughout the year and are attended by DOT&E staff, DASD(DT&E) staff, and Service personnel with responsibilities for reliability and maintainability, as well as test and evaluation.

The Reliability Senior Steering Group was established in response to the DOT&E letter to USD(AT&L) in late 2009 concerning continued poor reliability performance during initial operational testing. Senior DoD Leaders and Service Acquisition Executives compose three working groups. The primary product of this effort was the Directive Type Memorandum (DTM 11-03) on Reliability Analysis, Planning, Tracking, and Reporting, which was signed by USD(AT&L) in March 2011.

The Deputy Assistant Secretary Defense (System Engineering) now has a dedicated position for Reliability and Maintainability Engineering. The incumbent provides recommendations and advice, and chairs the Service Reliability and Maintainability Engineering Leads quarterly working group.

Specific Service Actions on Reliability Growth

Figure 5 below shows the fraction of systems meeting reliability thresholds for programs on DOT&E oversight between 2006 and 2011 (the same programs depicted in Figure 4 now broken out by Service.)

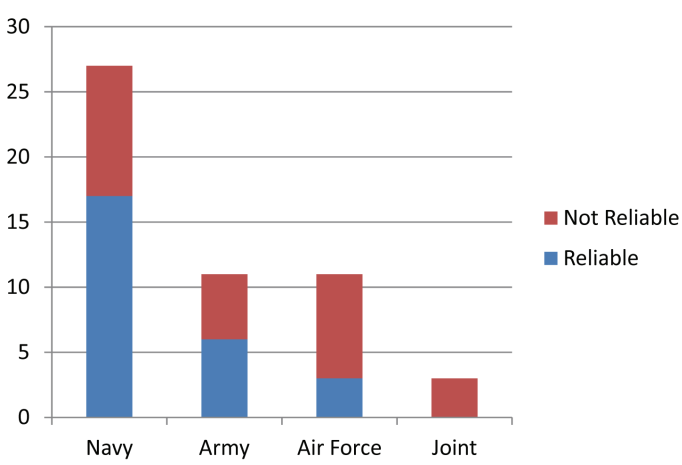

FIGURE 5.
FRACTION OF PROGRAMS MEETING RELIABILITY THRESHOLDS AT IOT&E, BY SERVICE (FROM DOT&E REPORTS TO CONGRESS 2006 – 2011)

Army. The Army Acquisition Executive issued specific policy including: that a Reliability Growth Planning Curve will be included in Engineering and Manufacturing Development (EMD) contracts; that new development programs are to execute Design for Reliability before Milestone B; and that an early reliability test threshold must be established for EMD. Additionally the Army established their Center for Reliability growth with the AEC and AMSAA, which provides training for the Army, OSD, and other Services.

As shown in Figure 5, 55 percent (6/11) of the Army programs that I reported on met their reliability thresholds. The aviation (CH-47 and UH-72) and trucks and artillery (GMLRS) performed well while networks and unmanned systems did not do well.

Navy. The Navy established a Director, Reliability and Maintainability Engineering position within the Deputy Assistant Secretary of the Navy (Research, Development, Test and Evaluation) (DASN(RDT&E)) and reliability and maintainability working groups were established at the Department of the Navy (DoN) and System Command levels. It established a network-based Integrated Reliability Software Suite for all use throughout the Service. Additionally, the Naval Air Systems Command (NAVAIR) Reliability and Engineering organization, which comprises over 200 engineers and technicians, has not been downsized during the last 15 years. The other Navy System Commands: Naval Sea Systems Command (NAVSEA), Space and Naval Warfare Systems Command (SPAWAR), and Marine Corps Systems Command (MARCORSYSCOM) are rebuilding their competencies in reliability and maintainability.

As shown in Figure 5, 63 percent (17/27) of the Navy systems that I reported on met their reliability thresholds. The majority of the reliable systems were aircraft or aircraft-related systems developed in NAVAIR, such as the H-1 upgrades to the AH-1W and UH-1N helicopters, as well as the MH-60R and MH-60S helicopters. Other reliable systems were submarines and related systems such as the USS *Virginia*, USS *Ohio*, and the TB-34 towed array. Ships and software-intensive systems were the types of systems that did not meet reliability thresholds, such as LPD-17, T-AKE *Lewis and Clark* Class of Auxiliary Dry Cargo Ships, and the APG-79 Active Electronically Scanned Array (AESA) radar and the Multi-functional Information Distribution System (MIDS) Joint Tactical Radio System (JTRS) for the F/A-18E/F Super Hornet aircraft. While the last two systems are aircraft related, their software intensive nature was problematic for reliability.

Air Force. The Air Force Material Command is sponsoring short courses in reliability at multiple venues for their acquisition and test personnel. Air Force instructions for System Engineering Plans and procedures now include the guidance for analysis and classification of potential failure modes. A Risk Identification, Integration, and "ilities" (R3I) guidebook has been published.

As shown in Figure 5, only 27 percent (3/11) of the Air Force systems that DOT&E reported on met their reliability threshold. The three systems that performed reliably were the B-2 Radar Modernization Program, Space Based Surveillance System, and the C-5 Reliability Improvement and Re-Engining Program. Other programs such as Small Diameter Bomb, Global Broadcast Service, Joint Mission Planning System, MQ-9 Reaper, Miniature Air-Launched Decoy, C-27J Joint Cargo Aircraft, and Global Hawk demonstrated poor reliability.

DOT&E Continuing Actions to Improve Suitability

- With USD(AT&L), DOT&E sponsored a National Academy of Sciences Workshop on Reliability Growth Methodology. The workshop met twice this year in March and September. Members from each of the Services presented to the panel their Service-specific actions taken to improve reliability as well as obstacles to the implementation of reliability growth methods in their systems. A report from the panel is expected in 2012.
- DOT&E continues to sponsor reliability growth training for its staff and all of DoD.
- DOT&E continues to provide in-house training to its staff to engage early in the system development and test planning process to ensure realistic reliability thresholds are established along with a test program that can support evaluating those thresholds.

Policy Supporting DOT&E Initiatives

Underlying my four initiatives is the need for rigorous, robust, and objective test and evaluation. Currently, I am actively engaged in updating the DODI 5000.02 "Operation of the Defense Acquisition System," to include requiring the use of state-of-the-art statistical methodologies, including experimental design and analysis techniques in TEMPs and test plans. The Defense Acquisition Guide, the T&E Management Guide, and T&E in Contracting Guide have been or are being updated to reflect emphasis on experimental design techniques and analysis. The DODI 5000.02 updates include changes that address rapid acquisition and the agile acquisition of information technology systems. I have provided a substantive description of how simultaneously rigorous and agile T&E of cyber systems can be conducted as part of the Department's Congressional report on Cyber Acquisitions. The updates to the Department policy and guidance draw in part on my FY11 guidance memoranda on the timeliness of OT&E plans, the use of production-representative test articles for IOT&E, and the use of design of experiments in OT&E.

OTHER INTEREST AREAS

Cyber Testing. In February 2011, the Chairman of the Joint Chiefs issued an Executive Order (EXORD) directing that all major exercises include realistic cyber-adversary elements as a training objective to ensure critical missions can be accomplished in cyber-contested environments. Although the EXORD focuses on assessments of fielded capabilities, this philosophy applies equally well to acquisition programs, and DOT&E is committed to ensuring that representative cyber environments are included in our combatant command and Service exercise assessments, as well as in the IOT&E of weapons programs. With these goals in mind, I met with the Deputy Secretary of Defense and proposed significant enhancements to Department cyber assessment capabilities. By the end of FY14, the Department should have in place the capabilities and processes to perform selected evaluations of offensive and defensive cyber-warfighting capabilities in representative cyber-threat environments. This will allow us to assess how well our fighting forces can defend against or fight through the most serious cyber attacks, as well as perform defensive and appropriate response. In order to apply these enhanced capabilities across all major exercises and acquisition programs, the Department will need to identify additional resources to expand the capacity and capabilities of the Red Teams who portray advanced cyber adversaries. This would include funding the cyber-ranges and modeling and simulation capabilities that provide operationally realistic environments for those activities inappropriate for live networks, as well as assessment teams to develop rigorous plans to ensure the cyber adversary is accurately portrayed, and assess the effects of representative cyber adversary activities.

Electronic Warfare Testing. The 2010 Tri-Service Electronic Warfare Test Capability Study, in which DOT&E participated, identified several critical AESA radar jamming capability upgrades needed for the facilities and open-air ranges currently used to evaluate U.S. weapon systems such as the F-35 and the Navy's Next Generation Jammer. These critical upgrades include:

- Next generation electronic warfare environment generator at indoor facilities and on open-air ranges to represent advanced high-fidelity threat emitter digital processing capabilities
- The capability to measure and characterize advanced U.S. jammers' multi-beam steering accuracy and power distribution at the target location at indoor facilities and on open-air ranges
- Next-generation threat surface-to-air-missile models and simulators for use in hardware-in-the-loop facilities and at open-air ranges
- A transportable urban threat representative communications environment that can be used to both stimulate U.S. communication jammers and evaluate jamming effectiveness on open-air ranges

OSD and the Navy are partially addressing the upgrades to indoor facilities, but additional investment will be needed to fund the open-air portions, as well as development of next-generation surface-to-air-missile threat simulators.

Network Integration Evaluation. The Army plans to conduct the Network Integration Evaluation (NIE) twice a year at Fort Bliss, Texas, and White Sands Missile Range, New Mexico, in order to provide a venue for operational testing of Army acquisition programs with a particular focus on the integrated testing of programs related to tactical communications networks supporting command and control. The exercises are also intended to provide an operationally realistic environment to evaluate new emerging capabilities that are not formal acquisition programs. The Army has established a leadership and governance triad comprising the Brigade Modernization Command, the Army Test and Evaluation Command, and the Training and Doctrine Command (TRADOC). A detailed assessment of the first NIE is provided in this report.

Helicopter Survivability Task Force. The Joint Aircraft Survivability Program (JASP), under DOT&E guidance, continued to work with the Office of the Assistant Secretary of Defense for Research and Engineering on the Helicopter Survivability Task Force (HSTF). This multi-disciplinary team is tasked with rapidly fielding techniques and technology to improve the survivability of helicopters in theater. JASP expertise in survivability technologies supported two specific vulnerability reduction technologies identified by the HSTF: passive fire protection for the V-22 and multi-hit transparent armor for MH-47G and UH-60 helicopters. Furthermore, the Joint Countermeasures Test and Evaluation Working Group (JCMT&E WG) that DOT&E co-chairs with the DASD(DT&E) continued to expand international cooperation in test and evaluation. Of note are the advances in common U.S./United Kingdom tactics development, improved understanding of hostile fire indication phenomenology, and Man-Portable Air Defense vulnerabilities through the use of the just concluded U.S./United Kingdom Aircraft Survival Equipment T&E Project Arrangement.

Combat Damage Assessment. I continued to support the Joint Combat Assessment Team (JCAT) in continuing its operation in Afghanistan with full-time deployments in Regional Commands – South, Southwest, and East. JCAT supported Iraq and other areas of the world remotely or by rapid deployment from Afghanistan or the Continental U.S. JCAT inspects damaged and destroyed aircraft, acquires maintenance records, and conducts interviews with aircrew and intelligence personnel to develop an accurate and comprehensive assessment of each aircraft combat damage event. They provide weapons, tactics, and logistics consultation to personnel and comprehensive briefings to commanders in charge of daily air operations. These efforts inform battlefield commanders, allowing them to adjust operational tactics, techniques, and procedures based on accurate threat assessments. Their efforts were instrumental in the investigation of the CH-47D (with 38 people onboard) that was shot down in Afghanistan on August 6, 2011.

Active Protection Systems. In response to FY08 legislation, DOT&E completed testing in August 2011 of seven foreign and domestic (two foreign, three domestic, and two combined foreign/domestic) active protection systems with the potential of protecting tactical vehicles. I will provide reports to Congress and acquisition leadership in 2QFY12. This effort will determine the capabilities of current active protection system technology and guide future acquisition decisions.

Personnel Protection Equipment. DOT&E continued oversight of personnel protection equipment testing. The Services and U.S. Special Operations Command are implementing the DoD testing protocol for hard body armor inserts published last year. The Defense Logistics Agency has incorporated the testing protocol into new contracts for sustainment stocks of hard armor inserts. The Army has incorporated the key concepts of statistical confidence and test design into its requirements for future protective systems it will develop. In partnership with the Services and the U.S. Special Operations Command, my staff developed a new combat helmet testing protocol. It ensures combat helmets provided to Service members meet ballistic protection requirements and provide uniform protection on the battlefield. I plan to work with the Services and the U.S. Special Operations Command to prepare a DoD-wide standard for testing of soft armor vests.

Joint Trauma Analysis and Prevention of Injury in Combat. In response to the DOT&E Mine Resistant Ambush Protected (MRAP) report of March 2010, former Secretary Gates tasked DOT&E to coordinate increasing the availability of data coming from the Joint Trauma Analysis and Prevention of Injury in Combat (JTAPIC) Program, as well as the Armed Forces Medical Examiner's Office. So far, DOT&E has hosted four Senior Reviews with participants from the JTAPIC Program Office and all of the JTAPIC partners, including Army intelligence, medical and materiel analysts, Navy medical researchers, and Marine Corps intelligence analysts. Additionally, the Army Surgeon General initiated the execution of two working-level Lean Six Sigma exercises with the goal of increasing the quality and volume of analytical outputs by improving internal operating processes. The improvements already made in these processes have increased the quality of the data shared among the partners, clarified the role of each partner as well as the JTAPIC Program Office, improved customer awareness of JTAPIC and its capabilities, and established common procedures that have streamlined data sharing and analytical processes among partners residing in various commands and Services.

Warrior Injury Assessment Manikin. In August 2010, I sponsored an Army-led, five-year research and development program to increase the Department's understanding of the cause and nature of injuries incurred in underbody blast combat events and develop appropriate instrumentation to assess such injuries in testing. This program, known as the Warrior Injury Assessment Manikin (WIAMan), utilizes expertise across multiple commands and disciplines within the Army to generate a medical research plan from which data will be transitioned to the materiel and T&E communities. These data will feed the design of a biofidelic prototype anthropomorphic test device (ATD) designed to evaluate occupant protection during large under-vehicle blast events, which have become the predominant threat to ground combat vehicles. Current test and evaluation techniques address occupant injuries using automotive crash test dummies and their associated injury criteria, all designed and developed for low-speed civilian car crashes. Development of a military-specific ATD for use in under-vehicle blast testing will better inform users, materiel developers, analysts, and evaluators about the levels of protection afforded by military vehicles to their occupants, and will enable more survivable vehicles to be fielded.

Stryker Double-V Hull. To support the deployment of Stryker Double-V Hull (DVH) vehicles to Afghanistan, the Army developed and began executing a robust multi-phase Stryker DVH Operational and Live Fire Test and Evaluation Program. Test and evaluation to date has confirmed that DVH systems significantly improve IED protection relative to the Stryker vehicles originally available to units in Afghanistan, meeting – and in some cases exceeding – MRAP All Terrain Vehicle (M-ATV) requirements. Stryker DVH additionally demonstrated in test that it retained operational characteristics required for operations in Afghanistan and provides increased vehicle reliability. The Stryker DVH test and evaluation program proved to be a success, and more survivable equipment is now available to the Soldier. The Army continues to conduct operational and live fire test and evaluation of multiple Stryker configurations modified with the DVH.

OT&E MISSION ACCOMPLISHMENTS, FISCAL YEAR 2011

During this fiscal year, my office monitored 311 Major Defense Acquisition Programs (MDAPs) and special interest programs. We approved 51 Test and Evaluation Master Plans, 6 Test and Evaluation Strategies, 79 Operational Test and Evaluation Plans, 6 Live Fire Test and Evaluation Strategies/Management Plans, and 4 Live Fire Test Plans.

Our reporting to both Congress and the Defense and Service Acquisition Executives has continued to increase over the past two years. This year, we delivered 31 reports, including our annual report on Ballistic Missile Defense Systems; in both FY10 and FY09 we delivered 14 reports. We also provided 10 Operational Assessments to the Acquisition Executives and 12 Major Automated Information System (MAIS) reports.

During FY11, DOT&E delivered 13 Beyond Low-Rate Initial Production Reports (BLRIPS) (three of which were combined OT&E and Live Fire Reports), 3 Follow-on Test and Evaluation Reports, 2 Live Fire Test and Evaluation reports, 8 special reports, and 4 Early Fielding Reports to the Secretary of Defense and Congress (see Table 1).

TABLE 1. DOT&E REPORTS TO CONGRESS DURING FISCAL YEAR 2011

PROGRAM	DATE
BEYOND LOW-RATE INITIAL PRODUCTION (BLRIP) REPORTS	
C-5 Reliability Enhancement and Re-Engining Program (RERP) (Combined OT&E/LFT&E)	October 2010
Suite of Integrated Radio Frequency Countermeasures (SIRFC)	October 2010
Excalibur Increment 1A-2 (Combined OT&E/LFT&E)	October 2010
TB-34 Next Generation Fat-Line Towed Array	November 2010
Warfighter Information Network – Tactical (WIN-T)	February 2011
Multi-functional Information Distribution System (MIDS) Joint Tactical Radio System (JTRS)	April 2011
Miniature Air-Launched Decoy (MALD)	April 2011
Improved (Chemical Agent) Point Detection System – Lifecycle Replacement (IPDS-LR)	April 2011
C-27J Joint Cargo Aircraft (JCA) (Combined OT&E/LFT&E)	May 2011
Low Cost Conformal Array (LCCA)	May 2011
RQ-4B Global Hawk Block 30	May 2011
Space-Based Space Surveillance (SBSS) Block 10	June 2011
Integrated Defensive Electronic Countermeasures (IDECM) Block 3 Electronic Countermeasures Suite	June 2011
EARLY FIELDING REPORTS	
Mk 48 Mod 6 Advanced Common Torpedo (ACOT) and Mk 48 Mod 7 Common Broadband Advanced Sonar System (CBASS) Torpedo with the Advanced Processor Build 4 (APB 4) Software	March 2011
Navy Multiband Terminal (NMT)	April 2011
MQ-8B Vertical Take-off and Landing Unmanned Aerial Vehicle (VTUAV)	June 2011
Precision Lethality Mark 82 (PL Mk 82) Bomb	September 2011
SPECIAL REPORTS	
M855A1 Lead-Free, 5.56 mm Cartridge	October 2010
Military Combat Helmet Standard for Ballistic Testing	December 2010
High Mobility Multi-purpose Wheeled Vehicle (HMMWV) Expanded Capacity Vehicle (ECV) Family of Vehicles (FoV)	February 2011
Ship Self-Defense Operational Mission Capability	March 2011
Special Operations Force (SOF) Mine Resistant Ambush Protected – All Terrain Vehicle (M-ATV)	May 2011
Mine Resistant Ambush Protected (MRAP) Force Protection Industries (FPI) Cougar A1 and A2 Independent Suspension Systems (ISS)	June 2011
Stryker Double-V Hull (DVH) Infantry Carrier Vehicle (ICV)	August 2011
Patriot Post-Deployment Build (PDB)-6.5 System	September 2011
LFT&E REPORTS	
Medium Tactical Vehicle Replacement (MTVR) Family of Vehicles (FoV)	July 2011
Mine Resistant Ambush Protected (MRAP) All Terrain Vehicle (M-ATV) Underbody Improvement Kit (UIK)	September 2011
FOT&E REPORTS	
MH-60R Multi-Mission Helicopter and MH-60S Combat Support Helicopter	November 2010
AN/BQQ-10 Acoustic Rapid Commercial Off-the-Shelf (A-RCI) Sonar System Advanced Processor Build 2007 (APB-07) and AN/BYG-1 Combat Control System APB-07	July 2011
Joint Biological Point Detection System (JBPDS) Phase II Whole System Live Agent	August 2011
ANNUAL REPORTS	
Ballistic Missile Defense Systems (BMDS)	February 2011

TABLE 2. DOT&E OPERATIONAL ASSESSMENT REPORTS DURING FISCAL YEAR 2011

PROGRAM	DATE
Early Infantry Brigade Combat Team (E-IBCT) Increment 1	December 2010
Mobile Landing Platform (MLP) (Early Operational Assessment)	January 2011
Shadow Tactical Unmanned Aircraft System (TUAS)	February 2011
M4E1 Joint Chemical Agent Detector (JCAD)	March 2011
Nett Warrior	April 2011
Joint Tactical Radio System (JTRS) Handheld, Manpack, and Small Form Fit (HMS) Rifleman Radio	May 2011
Ship-to-Shore Connector (Early Operational Assessment)	June 2011
Battlefield Airborne Communications Node (BACN) RQ-4B Global Hawk Block 20 Joint Urgent Operational Need (JUON)	July 2011
F-15E Radar Modernization Program (RMP)	July 2011
Miniature Air-Launched Decoy – Jammer (MALD-J)	August 2011

TABLE 3. DOT&E MAJOR AUTOMATED INFORMATION SYSTEM (MAIS) REPORTS DURING FISCAL YEAR 2011

PROGRAM	DATE
Global Combat Support System – Marine Corps (GCSS-MC)/Logistics Chain Management (LCM) Block 1, Release 1.1	October 2010
Navy Enterprise Resource Planning (Navy ERP) Release 1.1	January 2011
EProcurement Release 1.1	February 2011
Operational Utility Evaluation of the Combat Information Transport System Vulnerability Life Cycle Management System Spiral 1.5	May 2011
Operational Utility Evaluation of the Combat Information Transport System Air Force Intranet Increment I	May 2011
Global Combat Support System – Army (GCSS-A) Release 1.1	May 2011
Global Command and Control System – Maritime Increment Two Release 4.1 (GCCS-M v4.1) Force-Level	June 2011
Financial Information Resource System (FIRST) Force Structure Data Management (FSDM) Version 2.2	July 2011
Global Command and Control System – Maritime Increment 2 Version 4.1 (GCCS-M v4.l) Unit-Level (UL)	July 2011
Defense Security Assistance Management System (DSAMS) Training Module (TM) Block 4	September 2011
Global Command and Control System – Joint (GCCS-J) Joint Operation Planning and Execution System (JOPES) Version (v) 4.2.1	September 2011
Common Aviation Command and Control System (CAC2S) Increment 1, Phase 1	September 2011

CONCLUSION

We continue to make progress implementing all my initiatives and providing decision makers with analytically sound, objective information. I remain committed to assuring the Defense Department's operational and live fire tests are robust, 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 2011.

J. Michael Gilmore
Director

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DOT&E Activity and Oversight

DOT&E Activity and Oversight

Activity Summary

DOT&E activity for FY11 involved oversight of 311 programs, including 45 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 FY11 included approval of 51 Test and Evaluation Master Plans (TEMPs) and 6 Test and Evaluation Strategies, disapproval of 1 TEMP (MH-60S Multi-Mission Combat Support Helicopter), approval of 79 Operational Test Plans, and approval of 4 Live Fire Test Plans and 6 Live Fire Test and Evaluation (LFT&E) Strategies/Management Plans.

In FY11, DOT&E prepared 13 Beyond Low-Rate Initial Production Reports, 4 Early Fielding Reports, 8 special reports for the Secretary of Defense and Congress, 2 LFT&E reports, and 3 FOT&E reports, as well as the Ballistic Missile Defense Programs Annual Report.

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

During FY11, 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 onsite participation in, and observation of, tests and test-related activities remain the most effective tools. In addition to onsite participation and local travel within the National Capital Region, approximately 747 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.

TEST AND EVALUATION MASTER PLANS / STRATEGIES APPROVED

Acoustic Rapid Commercial Off-the-Shelf Insertion (A-RCI) Advanced Processor Build (APB) 2009, Rev C

Advanced Extremely High Frequency (AEHF)

Air Intercept Missile – 9X (AIM-9X)

AN/AAR-47(V) Missile Warning Set Software Qualification Test

AN/AQS-20A Sonar, Mine Detecting Set

AN/BYG-1 Fire Control System Advanced Processor Build

Anniston Chemical Agent Disposal Facility

Army Integrated Air and Missile Defense

B-2 Defensive Management System (DMS)

B-2 Extremely High Frequency (EHF)

C-130J Block 7.0 and 8.1

C-5 Avionics Modernization Program (AMP)

C-5 Reliability Enhancement and Re-Engining Program (RERP)

Cobra Judy Replacement

Common Aviation Command and Control System (CAC2S)

Common Infrared Countermeasures (CIRCM)

Consolidated Afloat Networks and Enterprise Services

Direct Attack Moving Target Capability (DAMTC) Laser Joint Direct Attack Munition (LJDAM) GBU-54

Distributed Common Ground System – Navy (DCGS-N) Increment 1 Block 1.2, Rev A

DoD Public Key Infrastructure (PKI) Increment 2, Milestone C

Early Infantry Brigade Combat Team (E-IBCT)

Enhanced Medium Altitude Reconnaissance and Surveillance System (EMARSS)

EProcurement

Expeditionary Combat Support System (ECSS) Increment 1, Milestone B

F-15E Radar Modernization Program (RMP), v2.2

Family of Medium Tactical Vehicles (FMTV)

Force XXI Battle Command Brigade & Below (FBCB2) Joint Capabilities Release (JCR) & Friendly Force Tracking (FFT) Program v21.5

Global Combat Support System – Army (GCSS-A)

Ground Combat Vehicle

Individual Carbine

Infrared Search & Tracking System

Joint & Allied Threat Awareness System (JATAS)

Joint Biological Detection System (JBSDS) Increment 2

Joint Biological Tactical Detection System (JBTDS)

Joint Mission Planning System – Expeditionary (JMPS-E)

Joint Mission Planning System – Maritime (JMPS-M) FA-18 EA-18 Mission Planning Environment (MPE) v2-3

Joint Stand-off Weapon (JSOW) C-1

Joint Tactical Radio System (JTRS) Network Enterprise Domain (NED), Increment 1

KC-X

Kiowa Warrior Cockpit Sensor Upgrade (KW CASUP)

Large Aircraft Infrared Countermeasures (LAIRCM)

M997A3

Mine Resistant Ambush Protected (MRAP) Vehicle, Rev 3

Miniature Air-Launched Decoy – Jammer (MALD-J)

Mission Planning System Annex G for Increment 4 Representative Platform – E-8 Joint Surveillance Target Attack Radar System (Joint STARS)

Mobile Landing Platform (MLP)

Mobile User Objective System (MUOS) Follow-on Buy (FOB)

Navy Multiband Terminal

Nett Warrior

Ohio Replacement

Patriot

Small Diameter Bomb (SDB) II

Spider XM7

Surface-Launched Advanced Medium Range Air-to-Air Missile (SLAMRAAM) Milestone B Update

Tomahawk Weapon System (TWS), Rev F

UH-60M Black Hawk, Update

Zumwalt Class Destroyer

OPERATIONAL TEST PLANS APPROVED

Advanced Extremely High Frequency Navy Multiband Terminal Satellite Program (NMT) Test Plan

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

AIM-9X Air-to-Air Missile Upgrade Block II OA Test Plan

AN/AAR-47 Missile/Laser Warning Set [with Hostile Fire Indicator Variant on CH-53E Helicopter] FOT&E Test Plan

AN/AAR-47 V2 Upgrade Missile/Laser Warning Receiver [with Hostile Fire Indicator Operator Interface Modification Variant on the AH-1W Helicopter] Test Plan

B-2 (classified program) OA Test Plan

B-2 Advanced Extremely High Frequency (AEHF) Satellite Communications (SATCOM) and Computer Capability Increment 1 OA Test Plan

Ballistic Missile Defense System (BMDS) Terminal High-Altitude Area Defense (THAAD) 12 IOT&E Test Plan

C-5 Aircraft Avionics Modernization Program (AMP) Force Development Test Plan

C-17A Globemaster III Advanced Cargo Aircraft Program Force Development Test Plan

C-130J Hercules Cargo Aircraft Program [Situation Keeping Equipment (SKE)] FOT&E Test Plan

Common Aviation Command and Control System (CAC2S) Increment 1, Phase 1 IOT&E Test Plan

CVN 78 *Gerald R. Ford* Class Nuclear Aircraft Carrier Test Plan Timeline

Defense Security Assistance Management System (DSAMS) Block 3 IOT&E Test Plan

Distributed Common Ground System – Army (DCGS-A) Test Plan

EA-18G Test Plan

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

EProcurement Release 1.1 OA Test Plan

F-15E Radar Modernization Program (RMP) OA Test Plan

F-22 Increment 3.1 FOT&E Test Plan and Test Plan Change

Family of Medium Tactical Vehicle (FMTV) Test Plan

Financial Information Resource System (FIRST) IOT&E Test Plan

Force XXI Battle Command Brigade and Below Joint Capabilities Release 1.3 (FBCB2 JCR) LUT Test Plan

Global Combat Support System – Army IOT&E Test Plan

Global Combat Support System – Joint (GCSS-J) IOT&E Test Plan

Global Command and Control System – Joint (GCCS-J) Test Plan

Global Command and Control System – Maritime (GCCS-M) (Force Level and Full Unit Level) IOT&E Test Plans

Global Hawk (RQ-4B) Block 30 – High-Altitude Long-Endurance Unmanned Aircraft System Test Plan

Global Positioning System (GPS) Selective Availability/ Anti-Spoofing Module (SAASM) Test Plan

Integrated Defensive Electronic Countermeasures (IDECM) Block 3 Test Concept Plan

Joint Air-to-Surface Standoff Missile – Extended Range (JASSM-ER) IOT&E Test Plan

Joint Chemical Agent Detector (JCAD) First Article Test Plan

Joint Direct Attack Munition (JDAM) ([Direct Attack Moving Target Capability (DAMTC) Laser Joint Direct Attack Munition (LJDAM) GBU-54] Test Plan

Joint Mine Resistant Ambush Protected Vehicles (MRAP) [Special Operations Forces (SOF) MRAP All Terrain Vehicle (M-ATV)] Test Plan

Joint Mine Resistant Ambush Protected Vehicles [Independent Suspension System (ISS)] LUT Test Plan

Joint Mine Resistant Ambush Protected Vehicles (MaxxPro Dash Ambulance) LUT Test Plan

Joint Mission Planning Systems (JMPS) [E-8 Joint Surveillance Target Attack Radar System (Joint STARS)] Test Plan

Joint Mission Planning Systems – Expeditionary (JMPS-E) Increment 1 IOT&E Test Plan

Joint Mission Planning Systems (JMPS) Supplements for E-3 and RC-135 Force Development Test Plan

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

Key Management Infrastructure (KMI) Increment 2 Spiral 1 OA Test Plan

Large Aircraft Infrared Countermeasures Program (LAIRCM) Phase II IOT&E Test Plan

Lewis and Clark Class of Auxiliary Dry Cargo Ships (T-AKE) FOT&E Test Plan and Test Plan Change Pages

Maritime Prepositioning Force (Future) Mobile Landing Platform (MLP) OA Test Plan

MH-60R Multi-Mission Helicopter Upgrade Test Plan

MH-60S Multi-Mission Combat Support Helicopter FOT&E Test Plan

MH-60S Multi-Mission Combat Support Helicopter [Block 2A Airborne Mine Countermeasures System] and AN/AQS-20A Minehunting Sonar OA Test Plan

Miniature Air-Launched Decoy (MALD) Way-ahead IOT&E

Mk 48 Torpedo Mods [Mod 6 Advanced Common Torpedo (ACOT) and Mod 7] Common Broadband Advanced Sonar System (CBASS) Torpedo Test Plan

MQ-9 Reaper Unmanned Aircraft System Increment 1 Block 5 Test Plan

Multi-functional Information Distribution System (MIDS) Joint Tactical Radio System (JTRS) Annex L, E-8C Joint Surveillance Target Attack Radar System (Joint STARS) Communications and Networking Upgrade (CNU) Phase 1 Test Plan

Nett Warrior LUT Test Plan

Network Integration Kit (NIK) LUT Test Plan

Osprey MV-22 Joint Advanced Vertical Lift Aircraft [Block B (OT-IIIG)] FOT&E Test Plan

Public Key Infrastructure (PKI) Increment 2 IOT&E Test Plan

Ship-to-Shore Connector (SSC) Test Plan

Small Tactical Unmanned Aerial System (STUAS) Tier II OA Test Plan

Spider XM7 Network Command Munition LUT and Force Development Test Plans

SSN 774 *Virginia* Class Submarine FOT&E Test Plan

SSN 774 *Virginia* Class Submarine/AN/BYG-1 Fire Control (Weapon Control & TMA)/Acoustic Rapid Commercial Off-the-Shelf Insertion for SONAR FOT&E Test Plan

SSN 774 *Virginia* Class Submarine/AN/BYG-1 Fire Control (Weapon Control & TMA)/Acoustic Rapid Commercial Off-the-Shelf Insertion for SONAR/CNO Project No. 0371-03 FOT&E Test Plan

SSN 774 *Virginia* Class Submarine/Acoustic Rapid Commercial Off-the-Shelf Insertion for SONAR/BYG-1 Fire Control (Weapon Control & TMA) Test Plan

Standard Missile-6 (SM-6) IOT&E Test Plan

Stryker M1126 Infantry Carrier Vehicle including Double-V Hull variant (ICVV-S) [Operational Event Phase 1] Test Plan

Stryker M1126 Infantry Carrier Vehicle including Double-V Hull variant [Driver's Protection Kit (DPK)] Test Plan

Stryker M1126 Infantry Carrier Vehicle including Double-V Hull variant (ICVV-S) [Operational Event Phase 2] Test Plan

Stryker M1126 Infantry Carrier Vehicle including Double-V Hull variant (ICVV-S) Test Plan

Stryker M1128 Mobile Gun System Validation Test Plan

Surface-Launched Advanced Medium-Range Air-to-Air Missile (SLAMRAAM) Test Plan

Tomahawk Weapon System (TWS) FOT&E Test Plan

LIVE FIRE TEST AND EVALUATION STRATEGIES, TEST PLANS, AND MANAGEMENT PLANS

Stryker M1130 Commander's Vehicle including the Double-V Hull Variant [Phase 3] LFT&E Test Plan Addendum

Stryker M1132 Engineer Squad Vehicle Including the Double-V Hull Variant [Phase 3] LFT&E Test Plan

Stryker Double-V Hull (DVH) [Phase 0 (baseline) and Infantry Carrier Vehicle (ICVV)] LFT&E Test Plan

Stryker Double-V Hull [Phase II (ICVV)] LFT&E Test Plan and Addendum

Family of Light Armored Vehicles (FoLAV) LFT&E Strategy

Joint High Speed Vessel (JHSV) LFT&E Management Plan

Kiowa Warior (KW) Cockpit and Sensor Upgrade Program (CASUP) LFT&E Strategy

Littoral Combat Ship (LCS) LFT&E Management Plan

Mobile Landing Platform LFT&E Management Plan

Ship-to-Shore Connector (SSC) LFT&E Management Plan

FY11 REPORTS TO CONGRESS	
PROGRAM	**DATE**
BEYOND LOW-RATE INITIAL PRODUCTION (BLRIP) REPORTS	
C-5 Reliability Enhancement and Re-Engining Program (RERP)	October 2010
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Excalibur Increment 1A-2	October 2010
TB-34 Next Generation Fat-Line Towed Array	November 2010
Warfighter Information Network – Tactical (WIN-T)	February 2011
Multi-functional Information Distribution System Joint Tactical Radio System (MIDS JTRS)	April 2011
Miniature Air-Launched Decoy (MALD)	April 2011
Improved (Chemical Agent) Point Detection System – Lifecycle Replacement (IPDS-LR)	April 2011
C-27J Joint Cargo Aircraft (JCA)	May 2011
Low Cost Conformal Array (LCCA)	May 2011
RQ-4B Global Hawk Block 30	May 2011
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Mine Resistant Ambush Protected (MRAP) Force Protection Industries (FPI) Cougar A1 and A2 Independent Suspension Systems (ISS)	June 2011
Stryker Double-V Hull (DVH) Infantry Carrier Vehicle (ICV)	August 2011
Patriot Post-Deployment Build (PDB)-6.5 System	September 2011
LFT&E REPORTS	
Medium Tactical Vehicle Replacement (MTVR) Family of Vehicles (FoV)	July 2011
Mine Resistant Ambush Protected (MRAP) All Terrain Vehicle (M-ATV) Underbody Improvement Kit (UIK)	September 2011
FOT&E REPORTS	
MH-60R Multi-Mission Helicopter and MH-60S Combat Support Helicopter	November 2010
AN/BQQ-10 Acoustic Rapid Commercial Off-the-Shelf (A-RCI) Sonar System Advanced Processor Build 2007 (APB-07) and AN/BYG-1 Combat Control System APB-07	July 2011
Joint Biological Point Detection System (JBPDS) Phase II Whole System Live Agent	August 2011
ANNUAL REPORTS	
Ballistic Missile Defense Systems (BMDS)	February 2011

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 (U.S.C.), Selected Acquisition Reports (SARs). The law (Section 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 311 acquisition programs during FY11.

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 (Section 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 U.S.C. 139. DoD regulation uses the term "covered system" to include all categories of systems or programs identified in 10 U.S.C. 2366 as requiring LFT&E. In addition, systems or programs that do not have acquisition points referenced in 10 U.S.C. 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 Title 10 U.S.C. 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 118 LFT&E acquisition programs during FY11.

Programs Under DOT&E Oversight
Fiscal Year 2011
(As taken from the September 2011 DOT&E Oversight List)

DoD PROGRAMS

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

Armed Forces Health Longitudinal Technology Application (AHLTA)

Ballistic Missile Defense System Program (BMDS)

Ballistic Missile Technical Collection (BMTC)

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

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

Defense Enterprise Accounting and Management System – Transportation Command (DEAMS – TRANSCOM)

Defense Readiness Reporting System – Strategic

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 and Control System – Joint (GCCS-J)

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 (GCCS-J, GCCS-A, GCCS-M, TBMCS-FL, DCAPES, GCCS-AF, USMC JTCW, USMC TCO)]

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

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

Joint Tactical Radio System Network Enterprise Domain (JTRS NED)

Joint Tactical Radio System Ground Mobile Radio (JTRS GMR)

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

Joint Warning and Reporting Network (JWARN)

Key Management Infrastructure (KMI)

Multi-functional Information Distribution System (MIDS) [Includes all current and planned integrations of MIDS JTRS into USAF and USN aircraft: F/A-18 E/F, E-2D, E-8, RC-135, EC-130 (All applicable series designations)]

Public Key Infrastructure (PKI) Increment 2

Soldier Radio Waveform (SRW) Network Manager

Teleport, Generation III

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

Wideband Networking Waveform (WNW) Network Manager

ARMY PROGRAMS

25 mm Individual Semi-Automatic Airburst System (ISAAS)

Abrams Tank Modernization (M1E3)

Abrams Tank Upgrade (M1A1 SA/M1A2 SEP)

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)

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 and Missile Defense (AIAMD)

Army Vertical Unmanned Aircraft System

Biometrics Enabling Capability (BEC)

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

Bradley Fighting Vehicle System Upgrade

Bradley Tank Modernization (M2A3 V2)

ARMY PROGRAMS (continued)

Cartridge, 7.62 mm, M80A1
CH-47F – Cargo Helicopter
Common Infrared Countermeasures (CIRCM)
Distributed Common Ground System – Army (DCGS-A)
Enhanced AN/TPQ-36 Radar System (EQ-36)
Enhanced Medium Altitude Recon Surveillance System (EMARSS)
Excalibur – Family of Precision, 155 mm Projectiles
Force XXI Battle Command Brigade and Below Program (FBCB2)
Force XXI Battle Command Brigade and Below Program Joint Capabilities Release (FBCB2 JCR)
Family of Medium Tactical Vehicles (FMTV)
General Fund Enterprise Business System (GFEBS)
Global Combat Support System Army (GCSS-A)
Gray Eagle Unmanned Aircraft System (Formally ERMP UAS)
Ground Combat Vehicle (GCV)
Guided Multiple Launch Rocket System Alternate Warhead (GMLRS AW)
Guided Multiple Launch Rocket System (GMLRS) – Dual Purpose Improved Conventional Munitions (DPICM)
Guided Multiple Launch Rocket System – Unitary (GMLRS Unitary)
Hellfire Romeo
High Mobility Artillery Rocket System (HIMARS)
High Mobility Multi-purpose Wheeled Vehicle (HMMWV)
Hostile Fire Detection System
Identification Friend-or-Foe Mark XIIA Mode 5 (All development and integration programs)
Individual Carbine
Integrated Personnel and Pay System – Army (Army IPPS)
Interceptor Body Armor
Joint Air-to-Ground Missile (JAGM)
Javelin Antitank Missile System - Medium
Joint Assault Bridge
Joint Battle Command Platform (JBC-P)
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 Upgrade
Land Warrior – Integrated Soldier Fighting System for Infantrymen
Logistics Modernization Program (LMP)
Long Endurance Multi-Intelligence Vehicle (LEMV)
Light Utility Helicopter (LUH)
M1200 Knight Targeting Under Armor (TUA)
M829E4
Nett Warrior (formerly Ground Soldier System)
One-System Remote Video Terminal
Paladin/FASSV Integrated Management (PIM)
Patriot Advanced Capability 3 (Missile only)
Patriot/Medium Extended Air Defense System (PATRIOT/MEADS)
Shadow Tactical Unmanned Aircraft System
Small Unmanned Aircraft System (Raven UAS)
Spider XM7 Network Command Munition
Stryker M1126 Infantry Carrier Vehicle (Including Double-V Hull variant)
Stryker M1127 Reconnaissance Vehicle
Stryker M1128 Mobile Gun System
Stryker M1129 Mortar Carrier (Including the Double-V Hull variant)
Stryker M1130 Commander's Vehicle (Including the Double-V Hull variant)
Stryker M1131 Fire Support Vehicle (Including the Double-V Hull variant)
Stryker M1132 Engineer Squad Vehicle (Including the Double-V Hull variant)
Stryker M1133 Medical Evacuation Vehicle (Including the Double-V Hull variant)
Stryker M1134 Anti-Tank Guided Missile (ATGM) Vehicle (Including the Double-V Hull variant)
Stryker M1135 NBC Reconnaissance Vehicle (NBCRV) (Including the Double-V Hull variant)
Stryker Modernization Program
Surface-Launched AMRAAM (SLAMRAAM)
Tactical Edge Network – Extension
Warfighter Information Network – Tactical (WIN-T) Increments 1, 2, 3, and 4
XM1156 Precision Guidance Kit (PGK)
XM395 Accelerated Precision Mortar Initiative (APMI)

NAVY PROGRAMS

Acoustic Rapid Commercial Off-the-Shelf (COTS) Insertion for SONAR

Active Electronically Scanned Array (AESA)

Advanced Airborne Sensor

Advanced Extremely High Frequency (AEHF) Navy Multiband Terminal (NMT) Satellite Program

Aegis Modernization

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

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/BVY-1 Integrated Submarine Imaging System

AN/SQQ-89A(V) Integrated USW Combat Systems Suite

Broad Area Maritime Surveillance Unmanned Aircraft System (BAMS UAS)

BYG-1 Fire Control (Weapon Control and TMA)

CH-53K Heavy Lift Replacement Program

Close-In Weapon System (CIWS) (Including SEARAM)

Cobra Judy Replacement – Ship-based radar system

Common Aviation Command and Control System (CAC2S)

Consolidated Afloat Network Enterprise Services (CANES)

Cooperative Engagement Capability (CEC)

Countermeasure Anti-Torpedo

CV-22 Osprey Joint Advanced Vertical Lift Aircraft

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 Countermeasures Program (DoN-LAIRCM)

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 (ECH)

Evolved Sea Sparrow Missile (ESSM)

Evolved Sea Sparrow Missile (ESSM) 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)

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

Infrared Search and Track System

Integrated Defensive Electronic Countermeasures (IDECM) (All Blocks)

Joint and Allied Threat Awareness System (JATAS)

Joint Expeditionary Fires

Joint High Speed Vessel (JHSV)

Joint Mine Resistant Ambush Protected (MRAP) Vehicles Family of Vehicles (Including SOCOM vehicles)

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 with Harvest Hawk

LHA-6 *America* Class Amphibious Assault Ship (Includes all supporting PARMs)

LHD-8 Amphibious Assault Ship

Light Armored Vehicle

Littoral Combat Ship (LCS) - includes all supporting PARMs, and 57 mm, 30 mm, and missile lethality

Littoral Combat Ship Mission Modules

Logistics Vehicle System Replacement

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

Marine Personnel Carrier

Maritime Prepositioning Force (Future) Mobile Landing Platform

Medium Tactical Vehicle Replacement Program (USMC) (MTVR)

MH-60R Multi-Mission Helicopter Upgrade

MH-60S Multi-Mission Combat Support Helicopter

Mk 48 CBASS Torpedo

NAVY PROGRAMS (continued)

Mk 48 Torpedo Mods

Mk 54 Torpedo/Mk 54 VLA/Mk 54 Upgrades Including High Altitude ASW Weapon Delivery (HAWK)

Mobile User Objective System (MUOS)

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

Navy Enterprise Resource Planning (ERP)

Navy Unmanned Carrier Launched Airborne Surveillance and Strike System (NAVY UCLASS)

Next Generation Cruiser (CG(X))

Next Generation Enterprise Network (NGEN)

Next Generation Jammer (NGJ)

Offensive Anti-Surface Warfare

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

Organic Airborne and Surface Influence Sweep (OASIS)

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

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

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 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)

Surface Ship Torpedo Defensive Capability (Includes upgrades to AN/SQS-89 and NIXIE systems as well as the Countermeasure Anti-Torpedo and Torpedo Warning System acquisition programs)

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 (T-AKE) (Includes all supporting PARMs)

Torpedo Warning System (Previously included with Surface Ship Torpedo Defense System) (Including all sensors and decision tools)

Trident II Missile – Sea-Launched Ballistic Missile (SLBM)

UH-1Y

Unmanned Surface Sweep System (US3)

Unmanned Undersea Vehicle Program

Vertical Take-Off and Land Tactical Unmanned Air Vehicle (VTUAV) (Fire Scout)

VXX - Presidential Helicopter Fleet Replacement Program

AIR FORCE PROGRAMS

20 mm PGU-28/B Replacement Combat Round

Advanced Extremely High Frequency (AEHF) Satellite Program

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

Advanced Pilot Trainer

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

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

Airborne Signals Intelligence Payload (ASIP) Family of Sensors

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

ALR-69A Radar Warning Receiver

B-2 Defensive Management System Modernization (DMS)

B-2 Advanced Extremely High Frequency (EHF) Satellite Communications (SATCOM) and Computer Capability Increments 1 and 2

B-61 Mod 12 Life Extension Program

Battle Control System – Fixed (BCS-F) 3.1 and 3.2

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

AIR FORCE PROGRAMS (continued)

C-27J Joint Cargo Aircraft (JCA)

C-130 Aircraft Avionics Modernization Program (AMP)

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

C-130J Hercules Cargo Aircraft Program

CITS AFNet Migration Urgent Operational Need

Cobra Judy Replacement Mission Planning Tool

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)

Conventional Prompt Global Strike

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

Defense Weather Satellite System (DWSS)

Deliberate and Crisis Action Planning and Execution Segments (DCAPES)

Expeditionary Combat Support System (ECSS)

Enhanced Polar System (EPS)

F-15E Radar Modernization Program

F-22 Raptor Advanced Tactical Fighter

F-35 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)

Full-Scale Aerial Target

Global Broadcast Service (GBS)

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

Global Hawk (RQ-4B) High-Altitude Long-Endurance Unmanned Aircraft System Blocks 30 and 40

Global Positioning Satellite Next Generation Control Segment (GPS OCX)

Global Positioning Satellite III (GPS-IIIA)

HC/MC-130 Recapitalization

HH-60 Recapitalization [Formerly known as Combat Search and Rescue Replacement (CSAR-X)]

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

Joint Direct Attack Munition (JDAM)

Joint Aerial Layer Network

Joint Space Operations Center Mission System (JMS)

Joint Surveillance Target Attack Radar System (JSTARS) Communications and Networking Upgrade (CNU) Phase I – MIDS JTRS Integration

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

KC-46A Tanker Replacement Program

Large Aircraft Infrared Countermeasures Program (LAIRCM)

Long-Range Stand-Off (LRSO) Weapon

Massive Ordnance Penetrator (MOP)

Military GPS User Equipment (GPS MGUE)

Miniature Air-Launched Decoy (MALD)

Miniature Air-Launched Decoy – Jammer (MALD-J)

Mission Planning System (MPS) Increment 4 (E-8/E-3, F-22, A-10)

Mission Planning System (MPS) Increments 1-3 [Including the Joint Mission Planning System (JMPS) (RC-135)]

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)

MV-22 Osprey – Joint Advanced Vertical Lift Aircraft

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

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

Space-Based Space Surveillance Block 10 (SBSS B10)

Space-Based Space Surveillance Block 10 (SBSS B10) Follow-on

Small Diameter Bomb (SDB) Increments 1 and 2

Space Fence (SF)

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

Vulnerability Life-Cycle Management System (VLMS) 1.5

Wideband Global SATCOM (WGS) Program

Problem Discovery Affecting Operational Test and Evaluation

Developmental testing and evaluation serves as a means for detection and identification of problems in program software and hardware. It provides programs the opportunity to correct those problems prior to commencement of production and operational test and evaluation. As such, the developmental test and evaluation phase must be rigorous and realistic to provide an accurate validation of system performance and to identify a program's readiness for operational testing.

In order to provide an accurate assessment of operational effectiveness, suitability, and survivability, it is paramount for operational test and evaluation to be of a production-representative system working in an operationally-realistic environment. The operational test should not be a time for problem discovery, nor should it be a time for resolution of lingering problems left over from developmental test and evaluation.

The Congress expressed concern that significant problems with weapons acquisition programs are discovered during operational test and evaluation that should have been detected during developmental test and evaluation and corrected during subsequent development. I am including this new section of my annual report with my assessment of significant issues observed in operational testing of systems under my oversight in 2010-2011 that in my view should have been discovered and resolved prior to the commencement of operational testing. This section also provides my assessment of significant issues observed in early testing of systems during 2010-2011, that if not corrected could adversely affect my evaluation of those systems' effectiveness, suitability, and survivability during their initial operational test and evaluation (IOT&E).

Since the implementation of the Weapon Systems Acquisition Reform Act (WSARA) of 2009, I have received seven formal Assessments of Operational Test Readiness (AOTRs) from the Deputy Assistant Secretary of Defense, Developmental Test and Evaluation (DASD(DT&E) which provide detailed assessments of Key Performance Parameters and make specific recommendations to the Services regarding readiness to enter into IOT&E. In four of those AOTRs (C-5 Reliability Enhancement and Re-Engining Program, Global Hawk Blocks 20 and 30, Standard Missile-6, and the Joint Tactical Radio System Handheld, Manpack, and Small Form Fit Rifleman Radio, the DASD(DT&E) recommended that the program not proceed to IOT&E, and in all four cases, the Services elected to proceed into IOT&E. The trend is that major discrepancies are being discovered and raised to the Service leadership, but decisions to enter IOT&E are not being affected by these AOTRs.

The tables below list systems for which we observed and evaluated operational testing during FY10 and FY11. Some of the systems had significant issues discovered during the IOT&E that should have been discovered in developmental testing; other systems had issues observed during early testing that if not corrected, could adversely affect my assessment of operational effectiveness, suitability, and survivability during IOT&E (to be conducted within the next two years) and should be resolved prior to that testing.

SIGNIFICANT DISCOVERIES IN IOT&E	
AGM-88E Advanced Anti-Radiation Guided Missile (AARGM)	LPD-17 *San Antonio* Class Amphibious Transport Dock
C-130J	Multi-functional Information Distribution System (MIDS) Joint Tactical Radio System (JTRS)
Common Aviation Command and Control System (CAC2S)	Navy Multiband Terminal (NMT)
CV-22 Osprey	Nett Warrior
Department of the Navy Large Aircraft Infrared Countermeasures (DoN LAIRCM)	Space-Based Space Surveillance (SBSS)
Early Infantry Brigade Combat Team (E-IBCT)	Standard Missile-6
Financial Information Resource System (FIRST)	Stryker Nuclear, Biological, and Chemical Reconnaissance Vehicle (NBCRV)
Force XXI Battle Command Brigade and Below (FBCB2) Joint Capabilities Release (JCR)	Vertical Launch Anti-Submarine Rocket (VLA) Mk 54
Joint Tactical Radio System (JTRS) Ground Mobile Radio (GMR)	

DISCOVERIES IN EARLY TESTING THAT SHOULD BE CORRECTED PRIOR TO IOT&E	
Aegis Ballistic Missile Defense (BMD)	Miniature Air-Launched Decoy – Jammer (MALD-J)
AIM-120 Advanced Medium-Range Air-to-Air Missile (AMRAAM)	Mk 48 Advanced Capability Mod 7 Common Broadband Advanced Sonar System (CBASS) Torpedo
Apache Block 3 (AB3)	Mk 54 Lightweight Torpedo
Defense Enterprise Accounting and Management System (DEAMS)	MQ-1C Gray Eagle Unmanned Aircraft System (UAS)
E-2D Advanced Hawkeye	MQ-9 Reaper Unmanned Aircraft System (UAS)
Enhanced AN/TPQ-36 Radar System (EQ-36)	P-8A Poseidon
EProcurement	RQ-4B Global Hawk Block 30
Joint High Speed Vessel (JHSV)	Spider XM7 Network Command Munition
Joint Tactical Radio System (JTRS) Handheld, Manpack, and Small Form Fit (HMS)	Surveillance Towed Array Sensor System (SURTASS) and Compact Low Frequency Active (CLFA)
Joint Tactical Radio System (JTRS) Network Enterprise Domain (NED)	Vertical Take-Off and Landing Unmanned Aerial Vehicle (VTUAV) Fire Scout
Littoral Combat Ship (LCS) Mission Modules	Warfighter Information Network – Tactical (WIN-T) Increment 2
LHA-6 (formerly LHA(R)) New Amphibious Assault Ship	

PROBLEMS DISCOVERED DURING OPERATIONAL TEST AND EVALUATION THAT SHOULD HAVE BEEN DISCOVERED DURING DEVELOPMENTAL TEST AND EVALUATION

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

The AARGM began IOT&E in June 2010, but the Navy stopped the test in September 2010 after eight anomalies occurred during 12 captive carry flights. Of the eight anomalies, six operational mission failures included:

- Three separate "weapon fail" indications from the built-in test (BIT) equipment (this presents a caution on the cockpit display that the weapon will not work), a BIT indication for a communications failure between the aircraft and the weapon, a BIT indication for a guidance control section failure, and finally, the BIT system did not detect a malfunction in which an anti-radiation homing failure occurred; it was noted because of an absence of displayed track files while flying on an instrumented range with known radar systems emitting radio frequency energy.

Of the eight anomalies, two additional discrepancies included:

- The misidentification of an unambiguous target emitter
- One instance during post-flight inspection where the pilot received an electrical shock from the weapon

C-130J

The C-130J is in production with periodic Block Upgrades to correct deficiencies and to provide capability enhancements.

- Reliability problems with the Station Keeping Equipment prevented the achievement of the required formation flight success rate. Consequently, the C-130J is still not certified for formation flight in instrument meteorological conditions and is therefore only partially mission capable for the airdrop mission.

Common Aviation Command and Control System (CAC2S)

The Marine Corps conducted IOT&E of the CAC2S Phase 1 this year. The testing revealed the following deficiencies:

- The inability to receive data via Joint Range Extension Application Protocol A and B and provide an accurate and timely air picture from these sources.
- The inability to interface with Theater Battle Management Core System as designed and access web-based applications via the system hyperlink functionality.
- The inability of net time server to synchronize time with the GPS through the CAC2S Defense Advanced GPS Receiver.

CV-22 Osprey

The Air Force conducted the CV-22 IOT&E in three phases from September 2007 through April 2008. Intended capabilities added by electronic warfare and communications equipment unique to the CV variant of the V-22 have not reached their full potential and limit mission accomplishment.

- Poor reliability and performance shortfalls of the Directional Infrared Countermeasures system, the Suite of Integrated Radio Frequency Countermeasures system, and the multi-mission advanced tactical terminal 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.

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

DOT&E submitted a Beyond Low-Rate Production Report to Congress in December 2009 on the DoN LAIRCM as installed on the CH-53E helicopter. This report highlighted a critical classified performance shortfall.

- Critical system performance shortfalls in certain environments and terrain because of software errors.
- The results from the Navy verification of correction of deficiencies testing using a CH-46E aircraft indicated the correction to the major DoN LAIRCM deficiency identified in the CH-53E IOT&E was effective.

Early Infantry Brigade Combat Team (E-IBCT)

The Army 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. The E-IBCT Increment 1 comprised: Network Integration Kit mounted on a tactical wheeled vehicle such as High Mobility Multi-purpose Wheeled Vehicle or Mine Resistant Ambush Protected vehicle, Unattended Ground Sensors, Class 1 Unmanned Aerial System Block 0, and Small Unmanned Ground Vehicle (SUGV).

- E-IBCT Increment 1 systems contributed little to mission effectiveness. Blue force combat power was sufficient to accomplish assigned missions with or without employment of the E-IBCT systems. Key performance parameters not met are: Net Ready, SUGV recognition range at night, Material Availability.
- 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.

Financial Information Resource System (FIRST)

The 346th Test Squadron and Air Force Financial Systems Operations conducted the OT&E of the FIRST in the Pentagon from March 28-31, 2011. DOT&E assessed the system to be operationally effective and operationally suitable, but with limitations in the areas of interoperability and information assurance.

- FIRST was able to process flying hours data, but was unable to correctly process inventory data provided by the Reliability and Maintainability Information System, thus hampering planning actions.

Force XXI Battle Command Brigade & Below (FBCB2) Joint Capabilities Release (JCR)

In FY11, the Army and Marine Corps conducted a Limited User Test (LUT) of FBCB2 JCR/Blue Force Tracker 2 (BFT2). The FBCB2 JCR/BFT2 LUT highlighted the following deficiencies:

- Situational awareness "fading," which would freeze display icons for 30 seconds to 5 minutes.
- New Equipment Training was not adequate to train new FBCB2 operators.
- All versions of FBCB2 supported by line-of-sight Enhanced Position Location Reporting System (EPLRS) radios demonstrated poor mission effectiveness and interoperability.
- Less than required reliability.

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

The Army planned a Milestone C Limited User Test of the JTRS GMR in June and July 2011 and later downgraded that test to a Customer Test because of a Nunn-McCurdy breach and continuing performance and reliability problems that could not be fixed prior to the planned operational test.

- During the Customer Test at the Army's Network Integration Evaluation (NIE), commanders attempted to use the JTRS GMR Wideband Networking Waveform (WNW) network, but found the network was not useful due to range limitations and poor reliability.
- The JTRS GMR schedule delays were due to technically immature GMR hardware, software operating environment, and waveform software.
- JTRS GMR was not reliable during the NIE. Reliability was 125 hours Mean Time Between Essential Function Failure versus a 466-hour requirement.
- The Joint WNW network manager is not an effective tool to manage the WNW network, and the Soldiers preferred the commercially-available Simple Network Management Protocol Console software for WNW network management.

LPD-17

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 modeling and simulation in November 2009. The Navy completed two LFT&E events in FY08: the Full Ship Shock Trial was conducted in August and September 2008 and the Total Ship Survivability Trial was conducted in September 2008. DOT&E noted the following deficiencies:

- Poor reliability of critical systems (network, voice communications, engineering control), support systems (cargo ammunition magazine elevators, vehicular ramps, main propulsion diesel engines, electrical distribution system, and steering system), and combat systems (SPQ-9B horizon search radar, the Mk 46 Gun Weapons System (GWS), and the Magnetic Signature Control System) adversely impacted mission capability.
- LPD-17 self-defense systems (Mk 46 GWS, Ship Self-Defense System (SSDS) Mk 2, SPQ-9B, and SPS-48/Cooperative Engagement Capability did not demonstrate adequate capability.
- The ship provided poor command and control capability for embarked troops.
- The conduct of the Full Ship Shock Trial and the Total Ship Survivability Trial on the LPD-17 class ships were adversely affected by reliability issues with the same critical system

identified by IOT&E. These reliability issues resulted in increased cost and schedule delays for the trials.

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

The Navy completed IOT&E of the MIDS JTRS core terminal integrated into the F/A-18E/F in November 2010. The MIDS JTRS IOT&E data indicated performance shortfalls.

- Link 16 messages that provide situational awareness of friendly force positions and intentions were consistently exchanged during only 90 percent of the F/A-18E/F sorties flown, compared to the Key Performance Parameter threshold requirement of 98 percent.
- Link 16 close air support messages were successfully exchanged in only 26 percent of the attempts.
- Poor system reliability during start-up prevented timely mission launch during 16 percent of sorties.
- Post-test causality analysis indicated that manufacturing and quality control problems with ViaSat-produced MIDS JTRS terminals led to new failure modes discovered during IOT&E. Other deficiencies were traced to errors in the Link 16 waveform software code and inadequate aircrew and maintenance personnel training.

Navy Multiband Terminal (NMT)

DOT&E completed an Early Fielding Report in April 2011 when the Navy deployed an operational NMT on the USS *Roosevelt* (DDG 80) prior to IOT&E. The Navy completed integrated testing in June 2011 and operational testing in August 2011.

- The program stopped testing due to schedule pressure prior to completion of the Reliability Growth Test (RGT). The program conducted a composite reliability analysis from a collection of data sources, to include contractor integrated tests, Government independent verification and validation activities, and hours collected from operational fleet that indicated that the reliability could be met. However, in order to meet the schedule, the program did not conduct a thorough failure analysis with corrective action before starting the integrated test and IOT&E. During the RGT, the NMT demonstrated a Mean Time Between Critical Failure (MTBCF) of 892 hours against a 1,400-hour requirement. During the integrated testing, NMT demonstrated an MTBCF of 338 hours. The IOT&E confirmed the NMT is not reliable. While the full failure analysis is ongoing, results from the operational test have revealed that the MTBCF is comparable to that of the integrated test.

Nett Warrior (formerly Ground Soldier System)

The Army conducted the Nett Warrior Limited User Test (LUT) of three competing systems from October 18 – November 5, 2010, at Fort Riley, Kansas. There were two problems observed during the LUT that should have been corrected earlier:

- Unclear voice communications
- Excessive light emissions

Space-Based Space Surveillance (SBSS) Block 10

The Air Force launched the SBSS satellite at the end of FY10. During FY11, the Air Force completed both on-orbit developmental testing and IOT&E.

- During the later stages of integrated testing, a data formatting problem was discovered, which prevented full utilization of SBSS mission data by one user. This problem could have been identified earlier in developmental testing by sharing sample data products with the end users.

Standard Missile 6 (SM-6)

The Navy completed the remaining FY10 missions during developmental and operational flight scenario testing of the SM-6 in January 2011 and completed SM-6 IOT&E flight testing in July 2011. There were two classified performance anomalies in IOT&E that a more rigorous developmental testing program may have discovered earlier. Additionally, two anomalies discovered in developmental testing did not have sufficient corrective action prior to the IOT&E:

- One anomaly discovered in developmental testing (antenna debris) carried forward to IOT&E without corrective action fully implemented on all missiles; there were additional occurrences during IOT&E on this configuration.
- One anomaly discovered in developmental testing (Mk 54 Safe-Arm Device) carried forward into IOT&E and remains under investigation; additional occurrences were experienced during IOT&E. This anomaly could influence the SM-6 lethality.

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

The Army conducted IOT&E phase two at Dugway Proving Ground, Utah, from September 20 – October 1, 2010. In IOT&E phase one, conducted from September to October 2006, the NBCRV experienced numerous operational mission failures. The program undertook a reliability improvement program and made a number of changes to the system configuration tested in IOT&E phase one with the result of significantly improved reliability of the base vehicle.

- Initial testing of the NBCRV, equipped with Stryker Reactive Armor Tile II, indicates the added weight of the armor kit negatively affects NBCRV mobility in steep terrain, such as Afghanistan. During a 3,090-mile NBCRV reliability test with the Stryker Reactive Armor Tile II, the system experienced multiple driveline failures, including three broken differentials and multiple broken axle half-shafts. Driveline failures negatively affect mobility by limiting the speed of travel and the vehicle's ability to traverse steep terrain.

Vertical Launch Anti-Submarine Rocket (VLA) with the Mk 54 Mod 0 Lightweight Hybrid Torpedo

The Navy conducted operational testing of the VLA with an Mk 54 torpedo payload at the Pacific Missile Range Facility in February 2009; DOT&E published a BLRIP in 2010.

- The Mk 54 torpedo experienced excessive depth excursion on entering the water that could cause the torpedo to impact the bottom in shallow water. Testing suggests that the excessive depth excursion problem is linked to VLA rocket delivery method rather than the weapon itself.
- The Mk 54 VLA is not operationally effective in its primary mission environment because the ship's Combat System cannot effectively detect, classify, and target a threat submarine; this deficiency was identified by the Navy in 2007, but the Combat System continued to experience performance problems during the 2009 IOT&E.
- The Navy has not completed sufficient operational testing of the Mk 54 torpedo to verify its effectiveness. The testing completed so far indicates the Mk 54 torpedo may not be effective in attacking the target. (The Mk 54 torpedo is discussed further below.)

PROBLEMS OBSERVED DURING EARLY TESTING THAT IF NOT CORRECTED, COULD ADVERSELY AFFECT MY ASSESSMENT OF OPERATIONAL EFFECTIVENESS, SUITABILITY, AND SURVIVABILITY DURING INITIAL OPERATIONAL TEST AND EVALUATION (CONDUCTED WITHIN THE NEXT TWO YEARS)

Aegis Modernization Program

The Navy conducted operational testing of Aegis Guided Missile Cruisers (CGs 52 58) upgraded with Aegis Warfare System (AWS) Advanced Capability Build 2008 (ACB08) and Aegis Guided Missile Destroyers (DDGs 103-112) upgraded with AWS Baseline 7.1R in FY10 with the exception of air defense and suitability testing, which is expected to complete in 1QFY12.

- Aegis Guided Missile Cruisers upgraded with AWS ACB08 and Aegis Guided Missile Destroyers upgraded with AWS Baseline 7.1R have limited ability to counter high-speed surface threats in littoral waters.

AIM-120 Advanced Medium-Range Air-to-Air Missile (AMRAAM)

The next update to the AIM-120 AMRAAM, the AIM-120D, is currently in developmental testing by both the Air Force and Navy at Eglin AFB, Florida, and China Lake Naval Weapons Station, California. Progression to operational testing has been suspended pending resolution of four key technical deficiencies. The AIM-120D was originally scheduled to begin operational testing in 2008; it is now more than three years behind schedule.

- The four key deficiencies include missile lockup, built-in test (BIT) failures, aircraft integration problems, and poor GPS satellite acquisition.
- DOT&E approvals of the Test and Evaluation Master Plan and test plan are awaiting resolution of the deficiencies that suspended operational testing in 2009. Raytheon has solved the BIT fail problem and has developed a pending solution to the GPS failure problem. Weapons failure and aircraft integration deficiencies remain.

Apache Block 3 (AB3)

In November 2009, the Army conducted the Apache Block III (AB3) Limited User Test (LUT).

- Initial testing of the fire control radar indicated performance comparable to that of the legacy radar in most operating modes. However, the new radar generated excessive false targets in some operating modes.
- During the LUT, the Integrated Helmet and Display Sight System did not fit well and limited the pilots' visibility of the Helmet Display Unit imagery.
- Mission planning tools do not allow creation of a flight plan for the Unmanned Aerial System or multiple frequency settings for the ARC-231 radios.
- During flight testing, pilots discovered that the Modernized Targeting Acquisition Designation Sight voice communication and navigation subsystems video vibrates excessively during certain flight regimes. Subsequent testing revealed that the cause of the vibration was the natural frequency of the Electronics Display and Control overlays with the main rotor frequency.
- Interoperability testing between the AB3 and Gray Eagle unmanned aircraft is ongoing. Ground and flight testing between the Gray Eagle and AB3 programs have identified differences in frame size of the video sensor movement, inverted commands, and differences in the data rate and data format between AB3 and Gray Eagle

Defense Enterprise Accounting and Management System (DEAMS)

The Air Force Operational Test and Evaluation Center (AFOTEC) began, but did not complete, an Early Operational Assessment (EOA) of DEAMS Spiral 2 from August through December 2010 at Scott AFB, Illinois, and at the Defense Finance and Accounting Service in Limestone, Maine. AFOTEC curtailed the EOA when it became apparent that major system deficiencies were present. The data from the incomplete EOA were insufficient to determine readiness for IOT&E, currently scheduled for 1QFY14, and a full evaluation of operational effectiveness, suitability, and mission capability.

- Important interfaces were inoperable. During the EOA, non-functioning interfaces with the Component Billing and Automated Funds Management systems required manual procedures from onsite personnel.
- Required reports were not being produced or were inaccurate or incomplete.
- Since the Air Force released Spiral 2 in May 2010, 2,313 deficiencies have been reported and 1,680 have been closed, leaving a gap of 633 open deficiencies. Although the program has made progress on closing the deficiencies, new ones continue to accrue.

E-2D Advanced Hawkeye
The Navy completed an operational assessment in December 2010 of the E-2D to support a decision to procure the next two lots of low-rate production aircraft.
- DOT&E identified potentially inadequate overland performance of the E-2D radar system as a risk to a successful Theater Air Missile Defense/Anti-Air Warfare mission effectiveness assessment during IOT&E.

Enhanced AN/TPQ-36 Radar System (EQ-36)
The Army is developing and fielding 38 Quick Reaction Capability radars to support an Urgent Materiel Release. Fielding began in 2010 with 10 systems operating in Iraq and Afghanistan. The Army conducted three radar test events at Yuma Proving Ground, Arizona, in October 2010, January 2011, and June 2011. Testing focused on acquiring threat rocket, artillery, and mortar fires, and the radar's integration with the Counter Rocket, Artillery, and Mortar system.
- The live ammunition system demonstration averaged one system abort in less than 30 hours. This demonstrated performance will impact operational suitability without an increased effort to increase the hours between system aborts. The EQ-36 Program of Record requirement is one system abort every 185 hours.

EProcurement
EProcurement extends the functionality of the Defense Logistics Agency Enterprise Business System in three releases. The final release, Release 1.2, is currently in limited deployment and is planned for IOT&E in 2012. The Joint Interoperability Test Command (JITC) conducted an operational assessment (OA) of Release 1.1 in June 2011. JITC conducted validation tests of fixes to deficiencies in Release 1.1 in August and October 2011.
- JITC found 20 critical software defects that have subsequently been fixed. These defects inhibited users from successfully processing purchase requisitions and orders, managing and processing contracts, and managing contract line items. Another 22 moderate software defects remain open and require large amounts of functionality workarounds to use Release 1.1.
- The user community found manual award processing and post-award processing for modifications to be largely inaccurate, incomplete, and unusable.
- Only one-third of the Release 1.1 users rated the human-system interface and other system usability attributes as acceptable during the OA. User dissatisfaction may also have been due, in part, to slow screen refresh times for some operations.
- During the developmental test of Release 1.1, numerous critical system defects were discovered and documented. These defects were reported as fixed just prior to deployment of Release 1.1 into the production environment; however, the OA still found many critical defects, which indicates that defect resolution and developmental testing may not be as robust as they should be.

Joint High Speed Vessel (JHSV)
A Navy-led operational assessment in January 2009 identified multiple areas of risk to the program's achieving operational effectiveness and suitability. The JHSV will likely meet or exceed its threshold requirements; however, missions other than basic transport, as outlined in the Capabilities Development Document and Concept of Operations, may prove to be too challenging unless the program pursues objective requirements in selected areas such as ammunition storage and communications.
- The absence of forced ventilation and air quality monitors in the mission bay jeopardizes the safety of the crew and embarked force during onload and offload of vehicles, particularly in port or at anchor when there is little natural circulation.
- Storage space for embarked force personal equipment is inadequate.
- JHSV will not have the capability to support the Joint Integration Concept to interface with Sea Base units at high sea states. The Navy is developing a ramp for Sea State 3 but interfacing at Sea State 4 is unlikely.
- To support more challenging Army concepts of employment, the JHSV must have more robust communications, capability to land armed helicopters, and store palletized ammunition.
- JHSV requirements do not include any metrics for reliability, availability, and maintainability.

Joint Tactical Radio System (JTRS) Handheld, Manpack, and Small Form Fit (HMS)
The JTRS HMS program provides handheld and two-channel manpack radios supporting Army, Marine Corps, Navy, and Air Force operations. In June 2011, the Army conducted a Manpack Limited User Test (LUT) as a part of the 2011 Network Integration Evaluation (NIE). During the NIE JTRS HMS Manpack LUT, the radio demonstrated the following:
- Poor reliability
- Short range of the Soldier Radio Waveform and Single Channel Ground and Airborne Radio System (SINCGARS) waveforms that significantly constricted the operational area of the cavalry troop
- Inconsistent voice quality
- SINCGARS waveform did not support unit operations and was immature for operational test

Littoral Combat Ship (LCS) Mission Modules
The Littoral Combat Ship is intended to accommodate a variety of individual warfare systems (mission modules) assembled and integrated into interchangeable mission packages. The Navy split the program into two separate acquisition programs – one for seaframes and the other for mission modules.
- Both developmental and operational testing of the AN/AQS-20A Sonar Mine Detecting Set, an Airborne Mine-countermeasures mission module system within the LCS Mine Countermeasures (MCM) mission package, revealed the system is deficient in meeting required

thresholds for False Classification Density (FCD) and Vertical Localization. These deficiencies may preclude the LCS MCM mission package from meeting its required threshold for Area Coverage Rate Sustained (ARCS). If the FCD and Vertical Localization deficiencies are not corrected prior to IOT&E, they may adversely affect the operational effectiveness of the LCS MCM Mission Package.
- Developmental testing of the Airborne Laser Mine Detection System (ALMDS), an Airborne Mine-countermeasures mission module system within the LCS MCM mission package, revealed the system is deficient in meeting the required threshold for FCD. This deficiency will likely preclude the LCS MCM mission package from meeting its required threshold for ARCS. If the ALMDS FCD deficiency is not corrected prior to IOT&E, it will adversely affect the operational effectiveness of the LCS MCM Mission Package.
- LCS is not expected to be survivable (i.e., be capable of continuing to fight after being attacked) in a hostile combat environment.

LHA-6 (formerly LHA(R)) New Amphibious Assault Ship

The Navy conducted an operational assessment of the LHA-6 large-deck amphibious ship from June to August 2008. Experienced fleet operators (Navy and Marine Corps) reviewed ship plans and specifications, data on fielded systems, and previous testing conducted on systems that will be installed on LHA-6. Since that time, no specific operational testing has occurred with the exception of enterprise testing on the Self-Defense Test Ship.
- Due to long-standing and previously identified legacy sensor limitations, LHA-6 may be vulnerable to certain airborne threat flight profiles.
- Based on combat systems testing on other platforms, it is unlikely that LHA-6's Ship Self-Defense System Mk 2-based combat system (including Nulka, SLQ-32, and Evolved Sea Sparrow Missile) will meet the ship's Probability of Raid Annihilation requirement against anti-ship cruise missiles.

Miniature Air Launched Decoy – Jammer (MALD-J)

The Air Force completed IOT&E on MALD (the decoy only variant) in 2011 after additional development test missions were flown to evaluate upgrades resulting from deficiencies found in the 2010 IOT&E. DOT&E conclusions regarding MALD-J suitability---particularly its reliability---depend in part upon data from MALD testing, which will be used by DOT&E to evaluate whether the vehicle reliability problems have been resolved. In the interim, outstanding MALD reliability deficiencies pose some risk to the planned FY12 MALD-J IOT&E due to the vehicle commonality between the two variants.
- During the 2010 IOT&E, the MALD reliability point estimate that combines free-flight and aircraft carriage time was 77 percent, which fell short of the threshold requirement of 93 percent.
- MALD carriage life during the 2010 IOT&E failed to meet the required threshold of a minimum of 60 hours. All MALDs that accumulated over 14 hours of carriage time, and were subsequently launched by the Air Force, failed during free-flight test. This is significant for long-endurance B-52 missions, which are likely to accumulate 14 or more hours of carriage time before operational employment.
- The MALD IOT&E failure in FY10 was most likely a result from long-term vehicle exposure to rain and moisture during aircraft carriage, which caused excessive ice accumulation in the fuel filter and flamed out the motor during open-air free-flight. During the MALD IOT&E retest in August 2011 (following hardware, firmware, and software fixes), one of the vehicles experienced another (unrelated) malfunction after failing to complete the engine start sequence after aircraft release. An Air Force review board concluded the malfunction was likely a result of cold soak of the arming lanyard during long endurance flight. Cold soaking reduces the tensile strength of the wire.
- The August 2011 mission failure during the final event of the MALD IOT&E further validates the DOT&E assessment of poor vehicle material reliability. The testing failed to demonstrate the resolution of deficiencies when MALD is employed in an operationally-realistic manner.

Mk 48 Advanced Capability Mod 7 Common Broadband Advanced Sonar System (CBASS) Torpedo

In FY11, the Navy began operational testing of the Advanced Processor Build 4's (APB4) tactical software for the Mk 48 Advanced Capability (ADCAP) Mod 7 CBASS torpedo and Mk 48 ADCAP Mod 6 Advanced Common Torpedo (ACOT). OT&E is expected to continue through the end of FY12. From January to February 2011, the Navy conducted a Quick Reaction Assessment of the Mk 48 APB4 to evaluate the torpedo's capability against an emerging submarine threat.
- DOT&E assessed that testing to date indicates the Mk 48 APB4 has a limited capability, under certain operational conditions, against the threat identified in the urgent operational need statement; however, the Navy did not have adequate threat surrogates for the evaluation. DOT&E's assessment also reported that the APB4 torpedo did not demonstrate expected improvements over the legacy torpedo, and may degrade current capability in certain warfare scenarios.
- The completed Mk 48 APB4 test events are being assessed for operational realism and validity incrementally as the fleet training and test events are completed. Due to delays in completing the development of the Submarine Launched Countermeasure Emulator (SLACE) mobile countermeasure surrogate, some important operational testing to confirm performance has not begun. DOT&E assesses that Mk 48 APB4 performance against SLACE-like threats is high risk because the program office completed little in-water developmental testing.

Mk 54 Lightweight Torpedo

The Navy's Fifth Fleet issued an Urgent Operational Need Statement (UONS) in March 2010 requesting solutions to address an emerging submarine threat. The Navy identified the Mk 54 Block Upgrade (BUG) software as a solution. In August to September 2011, the fleet fired 22 Mk 54 BUG torpedoes against a Steel Diesel Electric Submarine surrogate target and against U.S. attack submarine targets. Based on preliminary results of this test, the Navy scheduled an additional phase of in-water trials in November 2011 and delayed the planned early fielding until January 2012.

- The Navy did not complete adequate in-water or model and simulation developmental testing of the Mk 54 BUG. As the program office shifted resources to demonstrate that the Mk 54 BUG has a capability against the UONS emerging submarine threat, testing focused on the UONS threat scenarios vice the operational scenarios for which the Mk 54 BUG was originally intended.
- The Navy developed an unmanned Steel Diesel Electric Submarine target. This Steel Diesel Electric Submarine target has different signature characteristics than the UONS emerging threat, thus this surrogate is of limited utility in assessing torpedo operational performance for the UONS. However, completing set-to-hit-terminal homing testing may address some unresolved test scenarios identified in the IOT&E. Mk 54 BUG performance in these previously unresolved test areas will affect the overall effectiveness and suitability of the torpedo against other submarine threats.
- Testing in structured scenarios and relatively benign environments indicates the Mk 54 BUG likely has a limited capability against the Steel Diesel Electric Submarine surrogate target. The Mk 54 BUG performance in other environmental areas and against operationally-realistic target scenarios is unresolved.

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

Deployment of the Gray Eagle Quick Reaction Capability took place prior to completion of IOT&E and the full-rate production decision. The Army conducted a Limited User Test in conjunction with training for unit deployment to Afghanistan from May to June 2010.

- Gray Eagle did not meet reliability requirements for the ground station, the aircraft, and the electro-optical/infrared sensor payload. The poor aircraft reliability was largely due to ARC-231 radio subsystem failures.
- 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.
- 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.
- Manning of the quick reaction capability unit is not adequate to sustain the required operational tempo of 22 flight hours per day.

MQ-9 Reaper Armed Unmanned Aircraft System (UAS)

Responding to urgent operational needs and incorporating associated emerging technologies has affected the MQ-9 UAS ability to meet program of record requirements within a predictable development timeline and stable test and fielding schedule in FY11.

- Deficiencies with fusing, aircraft integration, and cockpit integration identified during the ongoing GBU-38 Joint Direct Attack Munition (JDAM) evaluation indicate that the developmental testing of JDAM integration with the MQ-9 system was insufficient.
- The program faces systemic challenges in prioritizing and maturing software flight programs to meet development and fielding timelines for the Increment One program of record. The projected FOT&E for the final Increment One configuration slipped from FY13 to FY14, and the desired June 2011 Milestone C decision was deferred due to the program's inability to demonstrate sufficient system integration maturity in the FY11 development schedule. Until the program is able to better prioritize and control maturation and development of the Increment One program of record capabilities, future delays in operational testing and fielding of capabilities will continue to occur.

P-8A Poseidon

The P-8 integrated test team is conducting 10 to 14 integrated test flights per week.

- The P-8A currently has an operational flight envelope limit that precludes it from flying at a bank angle greater than 48 degrees when maneuvering. In order to fly operationally realistic tactics during anti-submarine warfare missions, the aircraft will have to fly maneuvers that require a bank angle of 53 degrees. The P-8A full flight envelope should be cleared for flight to conduct operationally-realistic missions and maneuvering flight profiles during the IOT&E.
- Priority 1 and 2 software problems that will affect IOT&E remain open. Although 92 percent of the priority 1 and 2 software problems have been closed, the current closure rate is not sufficient to have all the priority 1 and 2 software problems resolved by the start of IOT&E. Priority 1 software problems prevent a mission-essential capability from being performed. Priority 2 software problems affect mission-essential capabilities, and there is no acceptable workaround for these problems onboard the P-8A. There are 369 priority 1 and 2 software problems as of September 21, 2011. Software problems discovered during the later stages of the integrated testing may not be fixed in the software version that is currently planned for IOT&E, and may require additional software upgrades prior to starting IOT&E to ensure the software is production-representative.

RQ-4B Global Hawk Block 30, High-Altitude, Long-Endurance Unmanned Aerial System

The Air Force conducted RQ-4B Global Hawk Block 30 IOT&E from October 2010 through January 2011. Operational testing for the next incremental Block 30 capability began in July 2011.

- When operating at near-continuous operational tempos, the system provided less than half the required 55 percent Effective-Time-On-Station coverage over a 30-day period.
- The system was not operationally suitable due to low air vehicle reliability, incomplete maintenance technical data, inadequate maintenance training, and ineffective integrated diagnostic systems.
- The Airborne Signals Intelligence Payload provided a limited operational utility, but did not consistently deliver actionable signal intelligence products to operational users, due to technical performance deficiencies and immature training, tactics, techniques, and procedures.
- The system did not meet joint interoperability certification and information assurance requirements.
- In August 2011, the Air Force halted follow-on operational testing due to a serious air vehicle command and control software deficiency. The RQ-4B Global Hawk Block 30 developmental test program previously identified this deficiency, but underestimated its impact during operational missions.

Spider XM7 Network Command Munition

The Army continued corrective actions to address Spider system and training deficiencies following the FOT&E conducted in May 2010. The Army conducted a Spider Limited User Test as part of the Army's Network Integration Evaluation at Fort Bliss, Texas, and White Sands Missile Range, New Mexico, in June 2011.

- Current software development to achieve requirements for munition control unit reliability and reuse are inadequate. Increased efforts are needed to achieve operational suitability.
- Further development focused on identifying ways to reduce the system's complexity and increase its ease of use by Soldiers is needed to achieve operational suitability.

Surveillance Towed Array Sensor System (SURTASS) and Compact Low Frequency Active (CLFA)

The Navy completed an operational assessment of the SURTASS CLFA during FY11.

- The operational assessment identified some classified deficiencies with the CLFA detection algorithms and with some components' software and hardware reliability.

Vertical Take-Off and Landing Unmanned Aerial Vehicle (VTUAV) (Fire Scout)

The program deployed two systems aboard Navy frigates USS *McInerney* in 2010 and USS *Halyburton* in 2011 to conduct Military Utility Assessments. In May 2011, the Navy deployed a land-based VTUAV system to Afghanistan in support of ongoing Army operations. Developmental testing was also conducted during 2011.

- The lack of ability to disseminate VTUAV near-real-time imagery off the host frigate limits VTUAV effectiveness. In the foreseeable future, this problem is a function of the shipboard infrastructure and the Navy's overall command and control system. While not required as part of the program of record, it is an area that the Navy should address to maximize the utility of the VTUAV and other Unmanned Aerial Systems.
- The focus on non-program of record activities between 2010 and 2011, such as the Military Utility Assessments and Afghanistan deployment, slowed developmental testing. The time spent training additional operators and maintainers, modifying air vehicles, integrating non-program of record payloads, and a requirement to provide spare parts to three operating locations, delayed the program's efforts to address deficiencies.
- Challenges with system reliability and the lack of a dependable communications relay capability continue to delay the IOT&E.

Warfighter Information Network – Tactical (WIN-T) Increment 2

The Army conducted a combined WIN-T Increment 2 and Increment 1b Limited User Test at Fort Stewart, Georgia; Fort Lewis, Washington; and Fort Gordon, Georgia, in March 2009. DOT&E assessed the WIN-T Increment 2 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 communication due to network routing
- Network Operations Management
- Information Assurance

DoD Programs

DoD Programs

Defense Security Assistance Management System (DSAMS)

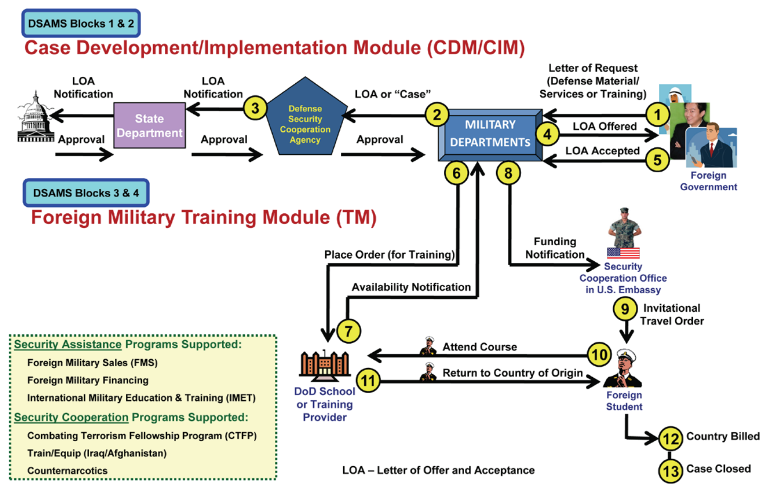
Executive Summary

- The Joint Interoperability Test Command (JITC) conducted the OT&E of the Defense Security Assistance Management System (DSAMS) Training Module (TM) Block 4 from June 7-24, 2011, in accordance with a DOT&E-approved test plan. Additionally, the Defense Information Systems Agency (DISA) Field Security Office conducted a penetration test from June 13-24, 2011, at the Defense Enterprise Computing Center in Oklahoma City (DECC-OKC), Oklahoma.
- DSAMS TM Block 4 is operationally effective and operationally suitable, but with significant limitations in the areas of Federal Financial Management Improvement Act (FFMIA) compliance and information assurance.
- The Air Force Security Assistance Training Squadron (AFSAT) users were able to accomplish their mission tasks at well above the 95 percent success rate (most at 100 percent). However, the system did not attain FFMIA compliance certification. The system and DECC-OKC did not fully employ current technology to protect data and system resources, and to detect and react to intrusions. The program office should take immediate action to rectify these limitations to improve the overall security posture of the system.
- More than 90 percent of surveyed users (52 of 56) rated "ease of use" as satisfactory or better and close to 95 percent of surveyed users (53 of 56) agreed that they could use the system to adequately perform their mission tasks. However, only 65 percent (26 of 40) of the surveyed users rated the user manuals as satisfactory or better and only 69 percent (31 of 45) rated the online help information as satisfactory or better, which did not meet the 90 percent requirement.

System

- DSAMS is a Major Automated Information System designed to support the development and implementation of contractual agreements for the U.S. Government to transfer defense equipment, services, and training to international partners via sale, lease, or grant. The system is funded exclusively with Foreign Military Sales administrative funding.
- DSAMS supports the following programs:
  - Security Assistance programs – Foreign Military Sales, Foreign Military Financing, and International Military Education and Training
  - Security Cooperation programs – Combating Terrorism Fellowship Program, Train/Equip (Iraq, Afghanistan), and Counter-narcotics
- DSAMS consists of three separate modules: Case Development, Case Implementation, and Training. The Case Development and Case Implementation modules are used primarily to support the transfer of defense equipment and services. A "case" is a government-to-government contractual agreement for the U.S. Government to transfer defense equipment, services, and training to international partners. The TM builds on the Case Development and Case Implementation modules by executing those cases involving foreign military training.
- The program office completed the Case Development and Case Implementation modules and deployed them in July 1999 and August 2000, respectively. In October 2006, the program office also completed the foreign military TM for the Army, the Navy, and the Coast Guard, but not for the Air Force.
- The DSAMS TM provides the following major functionalities:
  - Case Development – tuition pricing, quota management, grant planning, training development, and training planning
  - Case Implementation – financial authorization, Letter of Offer and Acceptance notification, and site surveys
  - Case Execution – training order placement, training availability notification, financial status reporting, monitoring, and reconciliation
  - Performance – feedback reporting on training performance
  - Reconciliation and Closure – reconciliation, tracking, and archiving

Defense Security Assistance Management System



Mission

DoD Security Assistance and Security Cooperation program managers use DSAMS to develop and implement government-to-government agreements (cases) for the transfer of defense equipment, services, and training to U.S. international partners via sale, lease, or grant; and manage execution of international training.

Major Contractor

Information Gateways – Bingham Farms, Michigan

Activity

- In December 2007, the DoD Inspector General completed a review of the DSAMS TM and recommended that DOT&E place it under oversight and ensure that OT&E is conducted on the Air Force TM (Block 4) when completed.
- JITC conducted the OT&E of DSAMS TM Block 4 from June 7-24, 2011, in accordance with a DOT&E-approved test plan. The OT&E was primarily conducted at the AFSAT, Randolph AFB, San Antonio, Texas. JITC also collected interoperability data at the Defense Security Assistance Development Center in Mechanicsburg, Pennsylvania, and information assurance data at the DECC-OKC.
- The DISA Field Security Office conducted an information assurance penetration test from June 13-24, 2011, at the DECC-OKC.

Assessment

- DSAMS TM Block 4 is operationally effective and operationally suitable, but with significant limitations in both areas.
- AFSAT users were able to accomplish their mission tasks at well above the 95 percent success rate (most at 100 percent). However, the system did not attain FFMIA compliance certification. This shortfall poses no operational impact to end users. However, FFMIA compliance certification is needed to improve financial management of the Defense Security Cooperation Agency.
- During the penetration test, the system and DECC-OKC did not fully employ current technology to protect data and system resources from unauthorized access. The system also did not effectively use technology to detect and react to intrusions. More than 90 percent of surveyed users (52 of 56) rated "ease of use" as satisfactory or better and close to 95 percent of surveyed users (53 of 56) agreed that they could use the system to adequately perform their mission tasks. However, only 65 percent (26 of 40) of the surveyed users rated the user manuals as satisfactory or better and only 69 percent (31 of 45) rated the online help information as satisfactory or better, which did not meet the 90 percent requirement.
- DSAMS failed to comply with Section 508 of the Rehabilitation Act. This limitation has no operational impact at this time since there are no known DSAMS users with physical disabilities that require special accommodation. Future system upgrades will need to comply with this regulation (or document a waiver if the effort would cause undue burden).
- The system achieved better than 99 percent availability, which met the requirement of 95 percent. The system also had less than 12 hours of downtime per quarter, which met the requirement for reliability. However, only about half of the users surveyed (8 of 15) rated the quality of the help desk as satisfactory or better, which did not meet the requirement of 90 percent.

Recommendations

- Status of Previous Recommendations. This is the first annual report for this program.
- FY11 Recommendations. The program office should:
  1. Achieve FFMIA compliance certification.
  2. Resolve the identified information assurance limitations by improving detection and reaction to intrusions and employing Public Key Infrastructure identity certifications and tokens (such as those provided by the Common Access Card).
  3. Consider using a Red Team independent to DISA in future penetration testing.
  4. Seek feedback from users to improve user manuals and online help information.
  5. Enhance the system to meet Section 508 of the Rehabilitation Act requirements (or document a waiver).
  6. Improve the quality of help desk operations.

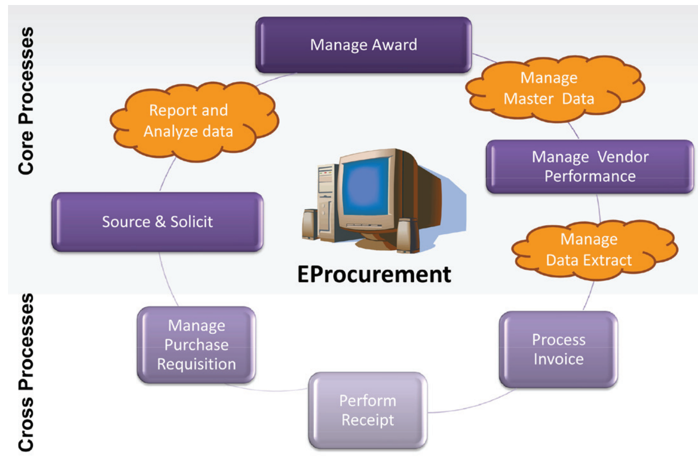
EProcurement

Executive Summary

- EProcurement extends the functionality of the Defense Logistics Agency (DLA) Enterprise Business System in three releases. The final release, Release 1.2, is currently in limited deployment and is planned for IOT&E in 2012.
- The Joint Interoperability Test Command (JITC) conducted an Operational Assessment (OA) of Release 1.1 in June 2011. JITC conducted validation tests of fixes to deficiencies in Release 1.1 in August and October 2011.
- In October 2011, JITC assessed EProcurement as potentially not effective and potentially not suitable. From June to October 2011, JITC found 20 critical software defects in Release 1.1 that inhibited users from successfully processing purchase requisitions and orders, managing and processing contracts, and managing contract line items. All 20 critical software defects have subsequently been validated by JITC to be resolved. JITC also found that 22 moderate software defects remained open and demonstrated the large amounts of functionality workarounds required to use Release 1.1. User comments and ratings indicated that the system was difficult to use. JITC noted that the volume of workarounds underscored the negative user evaluation and indicated that many documents produced in Release 1.1 were not accurate, not complete, or not usable by themselves and required manual editing by users.
- A joint DLA and Defense Information Systems Agency (DISA) Red Team conducted a penetration test at the DISA-operated Ogden Defense Enterprise Computing Center (DECC) in August 2011 and discovered major Information Assurance deficiencies. Since that time, DLA and DISA have taken the necessary actions to mitigate the system from being compromised, which was partially validated by DLA and DISA by October 19, 2011. More comprehensive fixes are being developed and applied. Efficacy of these fixes will be evaluated in IOT&E.

System

- EProcurement is designed to provide enterprise-level procurement capabilities for the DLA to replace legacy procurement systems (Pre-Award Contracting System, Electronic Contract Folder, Procurement Automated Contract Evaluation, and Base Operations Support System).
- Intended functions of EProcurement include purchase requisition management, sourcing and solicitation, award management, and vendor performance management.
- The program office has delivered EProcurement in three releases. Release 1.0 was deployed to approximately 50 users in November 2010; Release 1.1 was deployed to approximately 320 users in May 2011; and Release 1.2, which has all of the required functionality of EProcurement, will be delivered in multiple roll-outs across the DLA Supply Chains.
  - The first roll-out of Release 1.2 was initiated in October 2011 for a new group of approximately 380 aviation procurement specialists and to the Release 1.1 users (for a total of approximately 700 users).
  - The remaining aviation users will receive EProcurement by September 2012.
  - The following roll-out is scheduled for November 2012 to Land and Maritime, followed by DLA Troop Support starting in June 2013.
- The production environment for EProcurement is hosted at the DECC in Ogden, Utah, which is operated and maintained by DISA. EProcurement is one of the programs in the overall DLA Enterprise Business System Infrastructure hosted by the Ogden DECC. The back-up site is located at the DECC in Mechanicsburg, Pennsylvania.



Mission

The DLA users will use EProcurement to procure and provide the full spectrum of consumables, services, and depot-level repairables to the Army, Navy, Air Force, Marine Corps, other federal agencies, and combined and allied forces.

Major Contractor

Accenture – Reston, Virginia

Activity

- JITC conducted an OA of Release 1.1 from May 31 to June 16, 2011, in accordance with a DOT&E-approved OA plan. The OA was conducted at DLA facilities located in New Cumberland, Pennsylvania; Mechanicsburg, Pennsylvania; Battle Creek, Michigan; Fort Belvoir, Virginia; Albany, Georgia; and Kaiserslautern, Germany.
- JITC also conducted validation tests from August 4-19, 2011, and from October 4-7, 2011, to verify the fixes to the deficiencies identified during operational use and developmental testing. Furthermore, JITC observed the developmental testing for Release 1.1 from December 2010 to February 2011 and for Release 1.2 from April to October 2011.
- The DISA Field Security Operations (FSO) and the DLA Information Operations conducted a penetration test from August 15-26, 2011. The FSO team tested the supporting infrastructure on-site at the DECC in Ogden, Utah; and the DLA team tested the security posture of the EProcurement application from the internet and from DLA's internal network.

Assessment

- During the Release 1.1 OA and the follow-on validation tests, JITC found 20 critical software defects. These defects inhibited users from successfully processing purchase requisitions and orders, managing and processing contracts, and managing contract line items.
- The user community found manual award processing and post-award processing for modifications to be largely inaccurate, incomplete, and unusable. Some user dissatisfaction may have derived from the conversion from manual processes to Enterprise Resource Planning-based processes, as the Release 1.1 user population had not been exposed to the Enterprise Business System prior to the Release 1.1 OA. However, 22 Moderate priority incident reports (software defects for which there are workarounds) also remained open and required large amounts of functionality workarounds to use Release 1.1.
- Only one-third of the Release 1.1 users rated the human-system interface and other system usability attributes as acceptable during the OA. User dissatisfaction may also have been due, in part, to slow screen refresh times for some operations. Most operations were timely; the median screen refresh time was 8.8 seconds (versus a threshold requirement of 15 seconds). However, 14 operations took more than 1 minute to complete, and the average screen refresh time was 190 seconds.
- Subsequent to the June OA, the program office took action to address the identified deficiencies. By mid October, the program office had fixed (and JITC had verified) all 20 critical software defects. The program office also implemented optimized software code in early September 2011, which improved the screen refresh times. During the validation test conducted in October 2011, the median screen refresh times met the objective of less than 8 seconds; four operations took more than 1 minute, and the average screen refresh time was about 18 seconds. The program office is continuing to track operations with long refresh times.
- A joint DLA and DISA Red Team conducted penetration testing at the DISA-operated Ogden DECC and discovered significant Information Assurance deficiencies. These deficiencies, if not mitigated, would enable perpetrators to take total control of the system and all systems connected to it. A total of 16 Information Assurance findings related to the system were found. Of the 16 findings, seven were related to the EProcurement application, seven were related to the DISA DECC, and two were shared by DLA and DISA. The program reports that all seven application-specific findings have been remediated. For the remaining findings, DISA has developed a Plan of Action and Milestones (POA&M) to address each of the findings with a phased approach that began in late October 2011. The DLA, in conjunction with DISA, also developed a POA&M to address the shared Information Assurance deficiencies.
- All identified Information Assurance deficiencies are scheduled to be fixed or mitigated by the end of January 2012. JITC will perform a follow-on penetration/exploitation test event to verify that the system and supporting infrastructure are secure.
- During the developmental test of Release 1.1, numerous critical system defects were discovered and documented. These defects were reported as fixed just prior to deployment of Release 1.1 into the production environment; however, the OA still found many critical defects, which indicates that defect resolution and developmental testing may not be as robust as they should be.
- The operational effectiveness and operational suitability of EProcurement will be determined after the completion of the IOT&E of Release 1.2 in 2012.

Recommendations

- Status of Previous Recommendations. This is the first annual report for this program.
- FY11 Recommendations. The program office should:
  1. Improve developmental testing and the developmental test environment to enhance its operational realism so that critical system defects are discovered in developmental testing.
  2. Improve the feedback mechanisms between the deployed system and developmental testing so as to incorporate discovered system deficiencies into subsequent developmental testing.
  3. Develop and implement a plan to use automated testing to diminish the ongoing regression testing burden.
  4. Define and implement an incremental test and roll-out plan to further reduce program risk.
  5. Verify the efficiency of the DLA's POA&M for Information Assurance during the IOT&E in 2012.

F-35 Joint Strike Fighter (JSF)

Executive Summary

- The high level of concurrency of production, development, and test created several challenges for the program and the Services:
  - Preparing to begin flight training at the integrated training center with immature aircraft
  - Developing and resourcing structural modification plans for early production aircraft to meet service life and operational requirements
  - Developing and resourcing configuration upgrade plans to achieve final Block 3 capability
- The flight rate in flight sciences testing for all variants in 2011 matched or exceeded the new, restructured flight test plan for 2011. Measurements of progress based on test points accomplished indicate mixed results for flight sciences of the three variants: both the F-35B Short Take-Off/Vertical-Landing (STOVL) variant and the F-35A Conventional Take-Off and Landing (CTOL) variant are behind schedule (9 and 11 percent, respectively), and the F-35C Carrier Variant (CV) is 32 percent ahead.
- Very limited mission systems software flight testing took place in 2011. Additionally, concurrency between development and testing of mission systems blocks of capability is growing and this growth in concurrency increases risk. Development, integration, and flight testing of the most complex elements of mission systems lie ahead.
- In October 2011, the program successfully conducted initial amphibious ship trials with STOVL aircraft in accordance with the new, restructured plan for 2011; however, significant work and flight tests remain to verify and incorporate modifications to STOVL aircraft required to correct known STOVL deficiencies and prepare the system for operational use.

- Although it is early in the program, current reliability and maintainability data indicate more attention is needed in these areas to achieve an operationally suitable system.
- The program completed full-up system-level (FUSL) testing of the first flight test aircraft, as required under the LFT&E plan. Test results confirmed the ability of the airplane to isolate ballistic damage to targeted components, validating the robustness of both the flight control and electrical power systems. Nonetheless, live fire tests and analyses showed the fuel tank inerting system is incapable of providing protection from threat-induced fuel tank explosions during some critical segments of combat missions when the aircraft is most likely to be hit. The program is redesigning the system. Upon completion, the redesigned system will be evaluated to determine if it provides the required protection.

Actual versus Planned Test Flights and Points through November 2011

		ALL VARIANTS ALL TESTING		STOVL ONLY FLIGHT SCIENCES		CTOL ONLY FLIGHT SCIENCES		CV ONLY FLIGHT SCIENCES		MISSION SYSTEMS (MS)			OTHER MS TEST ACTIVITY
		Flights	Points	Flights	Points	Flights	Points	Flights	Points	Flights	Block 0.5 Points	Block 1.0 Points	Points[1]
CY11	ACTUAL	915	6,079	308	1,972	264	1,710	154	1,355	189	116	183	743
	PLANNED	812	5,509	268	2,175	263	1,925	148	1,023	133	111	125	150
Cumulative[2]	ACTUAL	1,371	11,612	564	4,848	426	3,474	181	2,151	200	203	183	753
	PLANNED	1,252	11,042	563	5,051	349	3,689	179	1,819	161	198	125	160
Estimated Quantities Remaining[3]		4,207	48,044	1,437	15,045	827	10,257	1,002	12,442	941	185	1,108	1,862
											8,438[4]		

Notes:
1. Other test activity requiring mission systems aircraft that was not mission systems software capability verification (i.e. maturity flights, survivability measurements).
2. Due to re-baselining in early 2011, "planned" test points are equal to the actual test points for activity prior to 2011.
3. Estimates of tests remaining include only the required number of successful flights and baseline test points. Discovery, regression, and re-fly factors are not included.
4. Mission systems estimate includes total remaining Test Points to complete System Design and Development test plans for Blocks 0.5 through Block 3.0.

System

- The F-35 Joint Strike Fighter (JSF) program is a tri-Service, 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/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 in this environment 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 provides mission capability in three increments: Block 1 (initial training), Block 2 (advanced), and 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

Test Strategy, Planning, and Resourcing

- The program applied the recommendations of last year's Technical Baseline Review (TBR) to the System Design and Development (SDD) phase test and verification plans. The program established a new integrated master schedule for the 2011 calendar year, and rebaselined all test metrics beginning January 2011.
- In November 2011, the program implemented the changes to the SDD flight test schedule recommended by the TBR. These changes included lowering planned flight rates, increasing planned downtime for modifications of test aircraft, changing roles for some SDD test aircraft, adding production aircraft as developmental test aircraft, lengthening software development spans, increasing the number of flights dedicated to weapons integration, and adding sustainment support for flight test.
- Throughout 2011, the program developed a new integrated master schedule (IMS) for the remainder of SDD. In December 2011, the program incorporated the new SDD flight test schedule (which included the TBR recommendations) in the new, draft IMS. The final IMS is expected to be available in early 2012.

F-35 Flight Test

F-35A Flight Sciences, Flight Test with AF-1, AF-2, and AF-4 Test Aircraft

- The program achieved the full complement of planned F-35A flight sciences SDD test aircraft with the delivery of aircraft AF-4 in January 2011. F-35A flight sciences testing focused on expansion of the flight envelope in transonic and supersonic flight regimes, improving handling qualities by reducing the impact of transonic roll-off, and accomplishing the test points required for the initial training capability flight clearance.
- As of the end of November 2011, the test team was able to accomplish the planned sortie rate of 7.7 flights per aircraft per month (264 flights accomplished, 263 planned). However, the number of test points accomplished lagged the planned baseline productivity by 11 percent (1,710 test points accomplished of 1,925 planned). The program discovered a test point metrics accounting error in November and adjusted the CY11 planning numbers accordingly. The error caused a projection of an additional 590 F-35A flight sciences test points than were actually called for in the test plans for 2011.
- In addition to the content of the approved baseline test plans, the program discovered requirements for additional testing. The test team accomplished an additional 358 test points per the program's flight test request process, which is the formal process for adding flight tests that are not part of the existing, approved test plan.

F-35B Flight Sciences, Flight Test with BF-1, BF-2, BF-3, BF-4, and BF-5 Test Aircraft

- In accordance with the post-TBR re-planning guidance, the program modified two mission systems F-35B test aircraft, BF-4 and BF-5, as flight sciences aircraft and modified the original three flight sciences test aircraft (BF-1, BF-2, and BF-3) to improve their STOVL-mode capabilities and instrumentation. BF-4 and BF-5 may accomplish either type of testing: flight sciences or mission systems. In 2011, BF-4 and BF-5 focused on flight sciences. This brought the number of F-35B flight science test aircraft to five, which is the full complement in the new plan.
- F-35B flight sciences focused on preparation for the first developmental test trials on a large deck amphibious ship, which began on October 3, 2011, as planned in the new master schedule for 2011. The test team also worked to

expand the flight envelope for F-35B pilot training (planned to begin in early 2012), conducted air refueling testing, and surveyed handling characteristics in transonic flight regimes.

- As of the end of November 2011, the test team was able to exceed the planned flight rate of 5.1 flights per aircraft per month, exceeding the total flight goal by 15 percent (308 flights accomplished, 268 required). By the end of November 2011, overall test point progress against planned baseline productivity was slightly behind (9 percent). The program also identified additional F-35B flight sciences test requirements and accomplished 213 of these test points added by flight test requests.

F-35C Flight Sciences, Flight Test with CF-1, CF-2, and CF-3 Test Aircraft

- The production team delivered test aircraft CF-2 and CF-3 to the Patuxent River, Maryland, test center in May and June 2011, respectively. CF-3 is primarily a mission systems test aircraft, but is capable of limited flight sciences activity, such as ship trials. The program plans to deliver the final F-35C flight sciences aircraft, CF-5, in late 2012.
- F-35C flight sciences focused on preparing for and executing carrier landing and catapult launch testing in the simulated carrier environment at the Lakehurst, New Jersey, test facility. The test team also began envelope expansion in the transonic regime, weapons bay environment testing, and evaluation of handling qualities with weapons bay doors open.
- As of November 2011, the test team exceeded the planned flight rate of 4.3 flights per aircraft per month, accomplishing 154 flights against a planned total of 148. Test point production exceeded the goal by 32 percent. The program also identified additional flight test requirements for F-35C flight sciences and accomplished 132 of these points added by flight test requests.

Mission Systems, Flight Tests with AF-3, AF-6, and AF-7 Test Aircraft and Software Development Progress

- The program successfully added F-35A production lot 1 aircraft AF-6 and AF-7 as mission systems test assets at the Edwards flight test center, California, in June and May 2011, respectively. Because the program plans for these aircraft to eventually be operational test aircraft, they contain instrumentation that makes them useful as mission systems test aircraft. This brings the total number of dedicated mission systems test aircraft at present to three; this number may be augmented by aircraft BF-4 and BF-5 at the Patuxent River test center, as they have a primary role as F-35B flight sciences assets. For example, aircraft BF-4 accomplished eight mission systems flights early in the year before entering modifications for F-35B flight sciences ship trials. The program plans to provide three more operational test aircraft from production lots 3 and 4 to the mission systems test fleet – F-35B aircraft BF-17 and BF-18 (in late 2012) and F-35C aircraft CF-8 (in early 2013).
- The test team attempted mission systems test points needed for acceptance and delivery of the lot 2 and lot 3 aircraft to the training center. The test team also accomplished other flight test activity requiring the use of mission systems aircraft, such as signature tests and "maturity" flights designed to determine the readiness of the F-35A air vehicle for the start of pilot training.
- As of the end of November 2011, mission systems test aircraft exceeded the planned flight rate of 5.2 flights per aircraft per month by 42 percent. The team exceeded the combined Block 0.5 and Block 1 test point goal of 236 by 27 percent. The program identified additional mission systems flight test requirements and accomplished 67 of these points added by flight test requests. The team had not completed any of the 60 Block 2 flight test points, which the program intended to begin in November 2011.
- Block 0.5, Block 1A, and Block 1B Initial Training Capability for Lot 2 and Lot 3 Aircraft
  - **Block 0.5.** Most of the Block 0.5 test points (78 percent) remained to be accomplished after the end of 2010. In 2011, the test team planned to accomplish 130 of the 301 remaining Block 0.5 test points concurrently with Block 1 testing. Block 1 capability has two parts: Block 1A for lot 2 aircraft and Block 1B for lot 3 aircraft (retrofit to lot 2).
  - **Block 1A.** The program and the Air Force determined that the initial Block 1A capability and the F-35A air vehicle required additional testing and deficiency resolution in order to be suitable for unmonitored flight at the training center. Early in 2011, plans for the airworthiness certification process initially anticipated that 200 to 400 hours would need to be accumulated in order to have sufficient flight hours to facilitate a maturity decision. The Edwards test team added a "maturity" flight test plan and used the instrumented lot 1 mission systems test aircraft, AF-6 and AF-7, which were delivered in May (five months later than previously planned), to accomplish these flights. The results of these flights, along with other flight test data, are inputs to the Air Force's airworthiness decision and official military flight release for the lot 2 aircraft at the training center. Through mid-October 2011, the test team accomplished 34 F-35A maturity flights flown in the initial training syllabus mission profile, accumulating 58.6 hours on AF-6 and AF-7 combined. Between early July and early November, an additional 10 sorties and 19.9 hours were flown in AF-6 and AF-7 with the initial Block 1A software configuration in flights accomplishing other mission systems flight test objectives. By the end of November 2011, the program accumulated a total of 44 sorties and 78.5 hours on the Block 1A software in the F-35A air vehicle for consideration in the Air Force airworthiness decision.
  - **Block 1B.** Software integration tasks for Block 1B mission capability were 90 percent complete by the end of September 2011 when it began flight test, three months late based on the new plan. This increment includes new functionality for sensor fusion, electronic

warfare, and onboard imagery, as well as system security provisions. As of the end of November 2011, less than half of the Block 1B capabilities (12 of 35) had met full lot 3 production contract verification requirements for aircraft delivery. Five of the remaining capabilities were under consideration to be deleted from the requirements since they were associated with weapons capabilities not available until lot 5 in the new IMS. The remaining 18 capabilities have some degree of variance from the expected performance.

  - Tests of two systems integral to Block 1 (and later) capability, the Identification Friend-or-Foe Interrogator (IFFI) and the laser in the Electro-Optical Targeting System experienced delays in 2011. This was due to delays in obtaining clearances from the government agencies that oversee their use. While limited testing of the IFFI system has been conducted off-shore in non-restricted airspace, clearance for testing in national airspace (planned for May) had not been received as of this report. Clearance for testing the laser did not occur until November, while testing was planned to start in June 2011. These delays affected the ability of the test team to accomplish the 192 Block 1 test points assigned for laser and IFFI testing during the year.
- Block 2 and Block 3 Software Development Progress
  - The program intends to provide Block 2 capability for production lot 4 and lot 5 aircraft; lot 4 aircraft should begin to deliver in mid-2012. In the new plan, the program intends Block 2 to contain the first mission systems combat capability – including weapons employment, electronic attack, and interoperability.
  - Concurrent with Block 1 development and integration, the program began integration of initial Block 2A software using the Cooperative Avionics Test Bed (CATB) in early October 2011. The development team augmented the mission systems integration lab, which was busy supporting Block 1 tasks, with the CATB as an integration resource. The new plan calls for the beginning of Block 2A flight test on F-35 mission systems aircraft before the end of November 2011. However, initial Block 2 integration task execution has fallen behind the new plan, having completed approximately half of the planned schedule, and leaving approximately 70 percent of integration tasks to go.
  - Block 3 development is slightly behind the new plan with only 30 percent of initial Block 3 having completed the development phase. In the new plan, the program simplified Block 3 to two production releases instead of three in prior planning and schedules. The program plans the first release, Block 3i, to contain no substantive increase in functions or capability. It will re-host the final Block 2 capability on the upgraded "Technical Refresh 2" processor hardware set. The program intends Block 3i capability for production lot 6 and lot 7 aircraft. Block 3f, the final increment, includes new capability. The program intends to deliver Block 3f for IOT&E and the final lots of low-rate production.

Modeling and Simulation

Verification Simulation (VSIM)

- The program determined that the man-in-the-loop verification simulation that will meet the operational test agencies' intended use would be located at Marietta, Georgia, for both Block 2 and Block 3 testing.
- The contractor worked through validation of the requirements of the simulated battlespace environment and the F-35 own-ship modeling with the program office, the verification team, and the JSF Operational Test Team.
- The Lockheed Martin VSIM verification and validation team provided inputs to the Block 2 flight test plan that will begin execution in late 2011. The program continues to work to source the data that will be needed to validate this simulation for operational testing.
- The program began a technical assessment of simulation validation challenges that have been identified by the operational test community, and is exploring these in a series of detailed technical reviews that began in 2011 and will continue into 2012.

Other Models and Corporate Labs

- Of the 28 models and simulations currently planned to support verification of the F-35, the program office has accredited four. In 2011, the program accredited use of the finite element models contained in the National Aeronautics and Space Administration (NASA) Structural Analysis (NASTRAN) model in verification of F-35 structures. NASTRAN solves large structural stress analysis problems and predicts strength and durability. The program plans to accredit two more models before the end of 2011.
- The changes to the program master schedule enabled several accreditation need dates to move from 2011 to later years. About half of the models and simulation in the verification plan must be accredited in the next 24 months, with the remainder due between 2014-2016.

Static Structural and Durability Testing

- The program halted F-35B durability testing at the end of last year when a wing carry-through bulkhead cracked before 2,000 hours of airframe life. The required airframe lifetime is 8,000 hours. Repair of the bulkhead on the test article was completed in November 2011, and F-35B durability testing is scheduled to restart in January 2012.
- Following the bulkhead crack in the F-35B test article, analysis verified the existence of numerous other life-limited parts on all three variants. The program began developing plans to correct these deficiencies in existing aircraft by repair/modifications, and designing changes to the production process. The most significant of these in terms of complexity, aircraft downtime, and difficulty of the modification required for existing aircraft is the forward wing root rib on the F-35A and F-35B aircraft.

All production aircraft in the first five lots will need the modification before these aircraft reach 1,000 hours.

- The program also halted F-35A durability testing after the F-35B bulkhead crack and restarted it at the end of May 2011. The test article restarted testing in November 2011, after completing inspections subsequent to accomplishing 3,000 effective flight hours of testing. During the second 1,000-hour block of testing, the wing root rib failed, as predicted. The test team is able to continue airframe fatigue testing in the near-term, while analysis determines when and how to repair the test article.
- F-35C structural testing completed all structural test objectives in August 2011, including planned "drop tests" in preparation for simulated carrier trials. Durability testing is scheduled to begin in Spring 2012.

Training System

- The program continued to develop training systems for use at the Integrated Training Center, Eglin AFB, Florida. The Air Force's training command approved courseware and the syllabus for the initial familiarization flight training (a six-mission syllabus) portion of the F-35A transition syllabus. From July through October, the six F-35A lot 2 aircraft ferried to Eglin on a one-time ferry-flight clearance from the production plant in Fort Worth, Texas. The aircraft have been used for verification of Joint Technical Data – the technical directives delineating F-35 maintenance and servicing procedures – while awaiting the military flight release permitting unmonitored flight.
- The program worked with the Air Force's airworthiness authority to determine the data requirements for the military flight release needed to begin flying production aircraft at the training center. Engineering teams cannot monitor these aircraft like they can flight test aircraft. Though planned to be complete by August, the military flight release had not occurred by the end of November 2011. At the time of this report, the program and the Air Force were in the process of examining numerous risks in starting unmonitored flight and training relatively early in, and concurrent with, development. The program and the Air Force have stated an intention to follow an event-driven plan to start training.
- In August 2010, the JSF Program Executive Officer (PEO) asked the JSF Operational Test Team to assess the initial training mission capability intended for the integrated training center. The JSF Operational Test Team developed an Operational Utility Evaluation (OUE) plan and submitted it for approval to DOT&E. In October 2011, DOT&E identified the need to resolve specific safety-related deficiencies in the F-35A and sustainment systems, as well as the need to build-up maturity in the air system, before the OUE test plan would be approved.

Air System-Ship Integration and Ship Suitability Testing

- **F-35B.** The program accomplished the first of two STOVL developmental test ship trials on the USS *Wasp* in October with test aircraft BF-2 and BF-4. The testing focused on developing initial short take-offs and vertical landings in the initial flight envelopes for deck operations, performing initial ship compatibility assessments, and collecting environmental data from instrumented ship locations. Seventy-two short take-offs and vertical landings were completed during the 19-day deployment in conditions of up to 33 knots of wind-over-deck and 10 knots of starboard crosswind. Some standard deck operations and maintenance activities were demonstrated, including fueling and defueling, aircraft tiedown, jacking, tire replacement, augmenter boost pump and door actuator replacements, and hydraulic servicing. Environmental data were collected to assess thermal stress to landing sites and shielded areas, and acoustic effects to ship personnel. Current plans place the second set of trials in August 2013.
- **F-35C.** The program began F-35C carrier landings, catapult take-offs, and jet blast deflector testing at the Lakehurst, New Jersey, test facility in July.

Live Fire Testing

- FUSL testing conducted on the first flight test aircraft (CTOL aircraft AA-1) provided aircraft flight control, electrical, propulsion, and fuel system vulnerability data. Due to commonality of the three variants, these results are extendable to the STOVL and CV variants as well.
- Contractor Fuel System Simulator tests showed the On-Board Inert Gas Generation System (OBIGGS) performance to be inadequate to support the vulnerability reduction requirements of the aircraft. A two-phase redesign effort is underway to provide protection against threat-induced fuel tank explosion across the entire flight envelope. Engine test articles have been delivered and structural test articles have been identified.

Assessment

F-35A Flight Sciences

- The test team was able to complete the F-35A flight sciences testing needed to provide flight envelope for the initial training mission capability and make progress toward other flight sciences goals needed to complete the SDD phase.
- An error in the test point planning metrics was discovered in November and the planned number of flight science test points were adjusted accordingly (590 test points removed from the planned metric). After this correction, test point completion lagged the planned level for the year by 11 percent. This lag was a result of accomplishing fewer test points per flight than planned. Contributing factors included deficiencies in the air vehicle's air data system as well as in-flight data indicating different structural loads than that predicted by computer modeling. These departures from model prediction of loads led to the addition of more build-up points, which are incremental, "stepping stone" expansions of the flight envelope. Additionally, planned air refueling testing did not take place because the instrumented tanker was not available at the expected time.
- The test team worked to overcome two obstacles to progress: test point constraints and aircraft reliability. Aircraft

operating limitations and inadequate instrumentation often constrained the available test points to a small subset of those planned. Aircraft reliability and parts shortages also negatively affected flight generation.

- While the lag is not a significant shortfall at this point in flight sciences testing, the program needs to continue to address the obstacles to flight and test point productivity to avoid a compounding effect. Weapons integration, high angle of attack testing up to 50 degrees, and completion of elevated g-loads testing are significant challenges of traditionally difficult test regimes that lie ahead.
- Discoveries included:
  - An Integrated Power Package failure during ground start on aircraft AF-4 in early August resulted in grounding all aircraft, all variants, for two weeks. A malfunctioning valve in the power and thermal management system created the conditions for the failure. Flights resumed after putting new procedures in place to monitor the valve with instrumentation on SDD flight test aircraft. The program also created a procedural change for production aircraft to manage the risk of failure on aircraft that engineering personnel cannot monitor. The program completed testing of a software change that has since been installed on the F-35A lot 2 aircraft at Eglin in November 2011.
  - The F-35A flight sciences tested evaluated handling characteristics and performance in a larger, more stressful flight envelope than the other two variants (e.g. up to 20 degrees angle-of-attack, with 50 degrees being the required maximum, and 9 g-load factor, which is the planned maximum load factor). The program worked to improve handling characteristics in transonic flight regimes through changes to flight control software, resulting in acceptable handling characteristics at high and medium altitudes (software version R25.0.7). However, the structural loads on the vertical tail fins of the F-35A aircraft, which stem from sideslip occurring in this regime, are higher than predicted and may require modifications to the tails or further changes to flight control software to reduce these effects. Additionally, flight tests of the magnitude and effects of buffet during elevated g-load and angle-of-attack revealed characteristics that need to be further examined. Testing in the regime where buffet is expected to be most pronounced had not occurred by the time of this report, due to load-factor flight envelope limitations. Fixes for handling characteristics must be balanced with other aircraft performance factors to find an acceptable, optimized solution. The program plans to continue this testing into 2012; more discoveries of performance trade-offs or adverse effects to structures are possible.
  - The program previously discovered deficient aircraft braking performance during landing on wet runway surfaces. The program tested new brake control unit hardware and software intended to improve performance. The program accelerated testing of the capability to stop the aircraft after landing on wet runway surfaces to 2011 to support the military flight release for aircraft ferried to the training center. Changes to the wheel brake controller improved this capability, but the program has not determined if the deficiency is resolved. Effective use of the latest design depends on the adequacy of simulations used to train pilots in maintaining directional control while activating differential braking. This requires precise control of brake pedal deflection, which will be difficult if not impossible during non-instrumented flight.
  - Fuel dump tests found that fuel migrated back into the aircraft, similar to results discovered on F-35B test aircraft. This has the potential to create an unsafe condition.
  - Engine airstarts require sufficient revolutions-per-minute of the engine for a successful re-start. The Integrated Power Package and the engine starter generator combine to provide additional torque to achieve the needed revolutions-per-minute in a flamed-out engine during an assisted airstart procedure. Ground tests recently indicated that the power output from the Integrated Power Package and the torque supplied by the starter-generator are lower than expected and may result in a failed start at speeds below 320 knots. Pilot procedures have been written requiring the airspeed to be maintained between 320 and 350 knots for an assisted airstart, which produces a high descent rate. Airstart flight tests have not begun. Software changes are under consideration to reduce the likelihood of failed start. This will affect all variants.
  - The horizontal tail of aircraft AF-1 was discovered to have sustained heat damage at the inboard trailing edge area after long duration afterburner operations on a flight test mission. The damage consisted of blistering of the surface and missing pieces of the trailing edge. Restrictions are in place and the test team is adding instrumentation to gain more accurate data on the conditions and cause of the problem.

F-35B Flight Sciences

- The test team was able to improve the tempo of STOVL-mode flight test early in the year in order to open sufficient flight envelope and accomplish other shore-based build-up for the ship trials in October 2011. Test and engineering teams accomplished a significant amount of modifications to the test aircraft to bring about this needed increase in the pace of STOVL-mode flight test. To accomplish 2011 goals, the test team also worked to overcome the challenges of low aircraft reliability and parts shortages.
- The test team was able to conduct safe flight tests of the STOVL-mode and successfully completed initial ship trials using flight monitoring systems in SDD test aircraft. The program has not completed the final re-designs and plans to correct deficiencies through modifications of F-35B production aircraft intended for the fleet, which cannot be monitored in-flight because these aircraft are not instrumented. Production aircraft will be restricted from STOVL-mode flight operations until Service airworthiness authorities grant a flight clearance. A significant amount

of flight test and development of system maturity of the final STOVL-mode door and propulsion system designs remains to be accomplished. A system mature enough for unmonitored STOVL-mode flight may be needed as early as late 2012 to coincide with the delivery of lot 4 F-35B aircraft to the Marine Corps at Yuma, Arizona. If testing of the changes is not complete and needed modifications are not installed by late 2012, aircraft at Yuma will fly in CTOL-mode only.

- The following table describes the door and propulsion problems by component, and identifies the production cut-in, if known.

F-35B Door and Propulsion Problems				
Category	Component	Problem	Design Fix and Test Status	Production Cut-In
Subsystems	Upper Lift Fan Inlet Door Actuators	Actuator redesigns due to high actuator failure rates.	New actuator under development. Interim design will be tested during SDD, planned for late CY12.	BF-38 LRIP 6
Structure	Auxiliary Air Inlet Door	Problems included inadequate life on door locks, excessive wear and fatigue due to the buffet environment, inadequate seal design.	Redesign currently being installed on BF-1, including associated structural longeron repair. Flight testing to begin in mid-December 2011.	BF-38 LRIP 6
Structure	Lift Fan Door Actuator Support Beam	Cracks occurring earlier than predicted. Root cause analysis showed fastener location incorrectly inserted in design.	BF-1 and BF-2 modifications are complete. BF-3 will not to be modified (will not be used for STOVL Mode 4 operations). BF-4 has resumed Mode 4 operations. Potential design fix is on BF-5; however, limited STOVL mode testing has been done on BF-5 to date (less than 30 total hours as of November 2011).	BF-5 LRIP 2
Structure	Roll Post Nozzle Doors	Doors separated from aircraft BF-2 and BF-3 during flight; door loads not well understood, aero pressures higher than expected. Impact not limited to STOVL mode operations – flight not to exceed 400 KCAS below 18K ft and 0.5 minimum g-load.	BF-3 is being instrumented. All SDD F-35B aircraft have an interim fix with door stiffeners/clips and strengthened torque tube fasteners. Final design is still to be determined (TBD).	Not known
Structure	3 Bearing Swivel Nozzle Door	Door attachment wear/damage found on BF-1 (6/11) requiring new inspection interval every 25 mode-4 flights. During Slow Landing flight testing, measured door loads exceeded limits.	Interim mod on BF-1 (01/12), instrumentation added. Final design and retrofit plan is TBD. Slow Landings now prohibited below 100 knots pending the results of flight testing.	Not known
Structure	Main Landing Gear Doors	Door cracking observed on BF-1, 2, 4 aft door adjacent to aft lock.	Final design is TBD. Instrumentation added to BF-2.	Not known
Propulsion	Drive Shaft	Lift fan drive shaft undergoing a second redesign. Original design inadequate due to shaft stretch requirements to accommodate thermal growth, tolerances, and maneuver deflections.	Analysis of failure of 2nd design and corrective action is ongoing. Additional spacers needed – uniquely fitted for each aircraft – to ensure proper lift fan performance.	BF-44 LRIP 7
Propulsion	Clutch	Lift fan clutch has experienced higher than expected drag heating during conventional (up and away) flight.	Temperature data from the clutch housing is being collected on the test aircraft to determine risk and a path forward.	BF-44 LRIP 7
Propulsion	Roll Post Nozzle Actuator	Roll post nozzle bay temperatures exceed current actuator capability. Actuator failure during Mode 4 operations.	Insulation between the roll post nozzle bay and the actuator is being installed and tested to provide interim solution for LRIP 2 – 4 STOVL aircraft. Increased temperature actuator is scheduled to be available for test in early 2012.	TBD

- The status of F-35B door and propulsion deficiencies follows.
  - Redesign of the auxiliary air inlet doors continued, this being needed to reduce deflection under actual flight loads that have proven to exceed design and modeling predictions. The program plans flight testing of the new design in early 2012. These doors conflicted/jammed during operation on newer F-35B test aircraft, necessitating special attention to door rigging.
  - Analysis continued on the three-bearing swivel nozzle doors and the lower lift fan door as a result of flight tests indicating higher than predicted loads. The program plans to modify the design of the three-bearing swivel nozzle doors and test concurrently with the modified auxiliary inlet door in early 2012. This testing is expected to generate the dynamic loads data required to assess whether any further design changes to the three-bearing swivel nozzle doors will be required to achieve full-life capability.
  - Temperatures in the roll control nozzle actuator area exceeded the heat tolerance of the current actuator design during flight test, necessitating a redesign. The program is

- changing the insulation in the nozzle actuator area as an interim fix and redesigning the nozzle actuator to improve heat tolerance. The program plans new hardware by the end of 2011 for testing.
- Roll control nozzle doors separated in-flight from a test aircraft twice, drawing attention to door rigging and the potential for redesign. The program plans to conduct flight test on a new door in early 2012 to support the redesign effort.
- The interim solution to unacceptably high clutch temperatures is to add a temperature sensor and display page so that the pilot can be aware of increasing temperature inside the clutch housing. Fuel and operational conditions permitting, changing flight regimes (e.g. configuration, altitude, and airspeed) may cool the clutch so that the pilot can engage STOVL modes. Such a cooling procedure may be untenable in combat conditions.
- The program added spacers to the lift fan driveshaft to address unanticipated expansion/stretching that takes place during flight. This is an interim solution while the program redesigns the driveshaft for better performance and durability.

- The vertical lift bring-back requirement is a primary STOVL-mode attribute and is a Key Performance Parameter (KPP). It is the weight of a minimum fuel quantity and other necessary payload needed to safely recover the aircraft on the ship after an operational mission, plus a representative weapons payload. Managing aircraft empty weight growth is essential to being able to meet the vertical lift bring-back requirement. The F-35B aircraft weight management challenge is complicated by balancing available lift, thrust required, and vertical descent rates in the vertical landing mode. Current and projected F-35B aircraft weight growth threatens the ability to meet this vertical lift bring-back requirement. The November 2011 weight data show only 230 pounds of margin between the current weight and the intended not-to-exceed weight of 32,577 pounds, which is the program's technical performance measurement threshold for empty aircraft weight currently programmed for January 2015. This weight margin represents 0.71 percent of the current weight and allows for only 0.22 percent weight growth per year until the technical performance measurement assessment deadline, which is prior to the end of SDD. The program recently determined that allowing a greater descent rate to touchdown (7 feet per second) plus possible positive thrust margins available from the lift fan may add an additional 142 pounds of weight tolerance to the technical performance measure not-to-exceed weight. This additional weight increases the margin to 1.2 percent of current weight and allows for 0.36 percent weight growth per year. Managing weight growth with such tight margins for the balance of SDD will be a significant challenge, especially with over 70 percent of the scheduled F-35B flight sciences test flights remaining to be accomplished in the next 60 months. For comparison, weight growth on the F/A-18 E/F was approximately 0.69 percent per year for first the 42 months following first flight.
- Other discoveries included:
  - The program found that later models of upper lift fan door actuators caused the door to stop moving as commanded. The program intends to redesign the actuator in time to begin flight test in late 2012, and introduce the new actuator into production aircraft in lot 6.
  - The fuel dump system causes fuel to migrate back into the aircraft structure, where it is retained until after landing. While some improvement was noted with modifications to the vent area on test aircraft, the program plans more work to correct this deficiency.
  - Flight test teams discovered cracks in landing gear doors on STOVL aircraft. Analysts determined that gear door stresses were within tolerance. Root cause analysis of the cracks continued through the time of this report.
  - Using the version of flight control software available at the beginning of 2011, undesirable wing roll-off, airframe buffet, and sideslip occurred in transonic flight regimes. Through changes to flight control software, the program improved these handling qualities. By the end of November 2011, testing of the latest flight control software change (version R25.0.7) indicated the handling qualities did not meet the current criteria. No further software modifications specific to transonic roll-off are planned. The program is examining the handling characteristics criteria for operational relevance. Two options remain: a) consideration of structural modifications to improve handling characteristics, or, b) relaxation of the handling characteristics criteria. Testing also began to survey the magnitude and effect of buffet during elevated g-load and increasing angle-of-attack; e.g. up to 16 degrees angle-of-attack, of the 50 degrees required maximum, and 7.5g load factor, which is the required maximum. Testing in the regime where buffet is expected to be most pronounced had not occurred by the time of this report. As with the CTOL aircraft, the test and engineering teams must balance improvements to handling qualities with other performance factors to find an acceptable, optimized solution. This testing will continue into 2012.
  - Aircraft BF-2 experienced damage to coatings on the horizontal tail following afterburner use similar to that found on F-35A aircraft AF-1. Restrictions are in place and the test team is adding instrumentation to gain more accurate data on the conditions and cause of the problem.

F-35C Flight Sciences

- As F-35C flight sciences focused on preparation for and execution of carrier launch and landing testing at Lakehurst, a limited amount of other envelope expansion occurred in 2011. The F-35C flight sciences test points accomplished thus far are approximately 15 percent of the total expected in SDD.
- The lack of available flight envelope in the transonic regime currently constrains testing of F-35C aircraft handling

qualities. In limited testing using flight control software that benefitted from F-35A and F-35B testing, the F-35C aircraft performance in the transonic flight regime demonstrated the predicted intensity of uncommanded rolls but higher buffet levels. The F-35C aircraft was expected to have the greatest challenge of the three variants in the transonic flight regime, which led to the decision to incorporate structural provisions for the installation of external spoilers in one test aircraft.

- The carrier launch and landing testing at Lakehurst provided valuable lessons regarding the impacts of these dynamic environments on the aircraft early in the testing. Corrections and regression testing are needed as a result of the discoveries listed below. The program is also working to correct other performance problems such as excessive nose gear oscillations during taxi, excessive landing gear retraction times, and overheating of the electro-hydrostatic actuator systems that power the flight controls. The program will subsequently evaluate the need for modifications of production aircraft for these items.
- Discoveries included:
  - Flight test aircraft could not engage the arrestment cable during tests at the Lakehurst, New Jersey, test facility. The tail-hook point is undergoing a redesign and the hold-down damper mechanism requires modifications to enable successful arrestments on the carrier. Resolution of these deficiencies is needed for testing to support F-35C ship trials in late 2013.
  - Hold-back bar and torque arm components, which keep the F-35C aircraft from moving forward when tensioned on the catapult at full power, require a redesign due to the use of incorrect design load factors. Actual loads are greater than predicted. The impact of these greater-than-predicted loads on strength and fatigue characteristics is under analysis by the program.
  - Loss of inertial navigation and GPS inputs to pilot displays occurred during a catapult launch. Root cause analysis was in progress at the time of this report.
  - The test team conducted initial testing in the transonic flight regimes with one version of air vehicle software on aircraft CF-2. Problems similar to the other variants were observed, such as excessive buffeting and roll-off, at times making the helmet-mounted displays unreadable.
  - Higher than predicted temperatures exist in the electro-hydrostatic actuator system during flight testing of the aircraft in a landing configuration. This component provides the force to move control surfaces.

Mission Systems

- Assessing mission systems progress requires a review of the allocation of flight test activity so far, and an understanding that the total mission systems verification to date is only approximately 4 percent of that planned to complete SDD mission systems software testing.
  - Operating only one test aircraft for the first six months, and three total aircraft for the remainder of the year, the Edwards test team was able to exceed the planned mission systems flight rate and limited test point productivity for mission systems capability. However, the majority of this year's mission systems test point accomplishment was for F-35A maturity (37 percent) and other non-software verification tasks (34 percent). This occurred partially because of the constraints on test operations caused by delays in obtaining clearances to test the Electro-Optical Targeting System laser and operate the Identification Friend-or-Friend Interrogator. F-35A maturity flights more than offset these test constraints in consuming mission systems aircraft flight test productivity. The need to add maturity flights is a manifestation of highly concurrent production of aircraft and development of the air vehicle. To accomplish these flights, the program had to use the mission systems test aircraft from production lot 1as they represented the low-rate initial production (LRIP) aircraft that would be flying unmonitored at the training center. Even though these aircraft were mission systems test assets, these flights evaluated the overall maturity of the air vehicle, not just the effectiveness of the limited mission systems capability for initial training.
  - Overall, the program has demonstrated very little mission systems capability thus far in flight test on F-35 aircraft. In fact, the program has not delivered some of the intended initial training capability, such as effective and consistent radar performance. Only very limited F-35 flight testing of sensor fusion took place this year. In accordance with the test plans to build up to operationally relevant flight test scenarios, flight tests to date largely focused on verifying correct sensor contributions to sensor fusion, with limited stressors on the system. The program plans more stressing flight test scenarios in upcoming flight testing. It is too early to determine the effectiveness of the fusion design. Knowledge of mission systems performance is extremely limited until the measure of fusion performance is oriented to operationally relevant weapons employment, electronic warfare, threat location, and threat identification.
- The limited progress in demonstrating mission systems capability so far causes increasing concurrency among the first three increments of mission systems software capability.
  - If the program introduces Block 2 into flight test in early 2012 as it plans to do, there will be a significant amount of overlap of the remaining Block 0.5 and Block 1.0 test execution with Block 2 development, integration, and flight testing. Per the status of execution of the test plans at the end of 2011, 40 percent of the Block 0.5 and over 85 percent of Block 1 test points will remain unaccomplished; these are demonstrations of functions and capability that are largely foundational to Block 2 capability. This situation creates uncertainty as to what capability will be provided to production lots 3 and 4 and how this capability will be verified before release to the field.
  - The inherent and growing concurrency in the mission systems flight test plan is a source of risk in the program.

The difficulty of managing multiple configurations on test and operational flight lines to assure use of appropriate software, increasing rework of software, and the potential for greater than expected regression flight tests are significant challenges to the program.
  - This creates an uncertain starting point for the next two years, during which the program plans to evaluate Block 2 capability. Significant challenges come with correcting the current known deficiencies and evaluating weapons delivery capability, interoperability with other platforms, and electronic warfare capability. A significant risk area for the program during this time is the absence of mission systems testing with an operationally representative mission data file, which is the compilation of threat and other system data needed for track identification and appropriate threat countermeasures.
- Discoveries included:
  - The helmet-mounted display system is deficient. It is meant to display key aircraft handling/performance information as well as tactical situational awareness and weapons employment information on the pilot's helmet visor, replacing conventional heads-up display systems.
    - Deficiencies include integration of the night vision capability, integration of Distributed Aperture System video for night vision, symbology jitter or swimming, and latency. These stem in turn from poor acuity with night vision camera hardware, limited computer processing power, inaccurate head position tracking, and poor helmet fit, complicated by vibration-inducing airframe buffet experienced at high angles-of-attack in some dynamic maneuvering regimes.
    - The program began pursuing a dual path to resolve the technical shortfalls and provide a system that will enable flight test to proceed and meet operational mission needs. One path is to complete development of the original helmet-mounted display system by the end of SDD Block 3. The alternate path is to integrate a technically mature, existing helmet-mounted display system that addresses the symbology stability problems that have been discovered, but requires an additional night vision system (such as existing night vision goggles) to provide night combat capability, and does not display Distributed Aperture System imagery on the pilot's visor. The impacts of these two paths on mission systems schedule cannot be measured until plans are integrated into the master schedule.
    - The program made several modifications to the helmet to be useful in daytime flight test and the benign initial training environment. Shimming and visor alignment changes have corrected some of the virtual heads-up display deficiencies for flight test and initial training; however, more work is needed for the existing helmet to support certain flight test missions in the near future (e.g. high angle-of-attack, elevated g-loading, weapons employment) and combat operations.
  - Panoramic cockpit displays in the mission systems aircraft overheat during flight test. The program is pursuing modifications to test aircraft to increase cooling and decrease heat load so that testing can continue.
  - While mission systems software has been stable during flight tests so far, startup time and startup stability is poor, usually taking more than 30 minutes to complete. The most recent Block 1B software improved startup times, but more improvement is needed for suitable operations.
  - Radar anomalies in flight included loss of air target tracks without indicating radar faults or failure to the pilot. Root cause analysis was in progress at the time of this report.

Operational Assessment
- The JSF Operational Test Team completed an operational assessment of the F-35 program and determined that it is not on track to meet operational effectiveness or operational suitability requirements. The JSF Operational Test Team assessed the program based on measured and predicted performance against requirements from the JSF Operational Requirements Document, which was re-validated in 2009.
- The primary operational effectiveness deficiencies include poor performance in the human systems integration (e.g. helmet-mounted display, night vision capability) and aircraft handling characteristics, as well as shortfalls in maneuvering performance (e.g. F-35A combat radius, which is a KPP, and F-35C acceleration).
- The driving operational suitability deficiencies include an inadequate Autonomic Logistics Information System (ALIS) for deployed operations, excessive time for low observable maintenance repair and restoration capability, low reliability and poor maintainability performance, and deficient crypto key management and interface compatibility.
- The assessment was completed prior to release of an updated program integrated master schedule. While additional time and resources in development may aid the program in resolving some deficiencies, several requirements are not going to be met given current, known program plans. After the new master schedule is available, along with documentation of the application of the additional resources applied to SDD plans, an updated operational assessment may be provided.

Air System-Ship Integration and Ship Suitability Testing
- The F-35B initial ship trials on USS *Wasp* supported initial short take-off and vertical landing envelope expansion efforts for shipboard operations with data collected as planned across a portion of the wind-over-deck conditions. As expected, high starboard crosswinds produced the most challenging environment. One approach to hover prior to a vertical landing was waved off by the pilot due to turbulence in the ship's airwake. A minimal nozzle clearance of 2 inches was observed at rotation during a short take-off with high starboard crosswinds when the pilot made an aggressive correction to maintain centerline. The test team demonstrated deck and hangar operations.

Although maintenance was completed while aboard the ship, limited support equipment was positioned on USS *Wasp* and no ALIS equipment supported the deployment aboard the ship. The test team created a virtual private network connection between the ship and the prime contractor in Fort Worth such that they were able to process maintenance actions as if operating at Patuxent River. Aircraft BF-2 diverted to Patuxent River twice during the deployment for maintenance – once for a fuel leak that could not be addressed at sea and once when the team elected to have upper lift fan door actuators replaced ashore. The upper lift fan door actuators on BF-4 had to be replaced twice during the trial period, once at Patuxent Rive and once at sea with an embarked maintenance team.

Ground Structural Testing and Analysis

- The fatigue cracks that occurred in November 2010 in a F-35B wing carry-through bulkhead early in durability testing were the result of unpredicted high stress concentrations. The finite element modeling previously conducted by the program to analyze the airframe was not adequate and did not predict these stress concentrations.
- As a result of the bulkhead crack, the program completed a detailed analysis of the full structural design for all variants, which identified more life-limited parts. A total of 58 parts were identified across all three variants. The most significant of these in terms of complexity, aircraft downtime, and difficulty of the modification for existing aircraft is the forward wing root rib on the F-35A and F-35B aircraft. All production aircraft in the first four lots will need the forward root rib modification before these aircraft reach 1,000 hours.
- The risks of concurrent development, testing, and production are highlighted by the experience with structural testing. Since most flight testing remains to be completed, the potential for more discoveries exist. The program predicts another 22 major discoveries and 43 moderate discoveries within SDD. The program plans to continue durability testing through two airframe lives (16,000 hours). Current schedules indicate the completion of the second airframe life will occur in early 2015 for F-35A and late 2014 for F-35B and F-35C. This means a total of nine aircraft production lots will be procured before completion of durability testing.

Issues Affecting Operational Suitability

- Flight test and lot 1 aircraft demonstrated low reliability compared to the operational requirement (i.e., the reliability required at 50,000 total flight hours for each variant) and compared to where program plans expect reliability to be at this point in system maturity. Based on data at the end of September 2011, the mean flight hours between critical failures were measured to be 2.65 hours for the F-35A, 2.05 hours for the F-35B, and 2.06 hours for the F-35C. These values range between 21 to 31 percent of the planned mean flight hours between critical failure for each variant given the flight hours accumulated so far. However, the rolling three-month trend of this measure is not stable for any of the variants, indicating continued discovery in reliability. Due to the initial low reliability experienced so far in all variants, the program has a significant challenge to provide sufficient reliability growth to meet the operational requirement. The program is working to update the reliability growth plan, last produced in 2006. Significant contributors to low reliability include the following:
  - F-35A wheel and tire assemblies, thermal management system, flight control actuators, fuel systems, and electrical power systems/connectors
  - F-35B lift fan system, thermal management, fire protection system, electrical power system/converters, wheel and tire assemblies, access doors/covers, lower inlet lip, wing and fuselage repairs, panoramic cockpit displays, doors, and actuators
  - F-35C landing gear wiring, wheel and tire assemblies, thermal management system, wing and fuselage repairs, engine nozzle segment, electrical power system, and fuel system.
- Maintenance of flight test and production lot 1 aircraft is taking longer than required for the mature system. For example, mean corrective maintenance time for critical failures for F-35A and F-35B aircraft is approximately twice that required of the mature system. The F-35C air vehicle is currently maintained at the required threshold for this requirement. Mean time to repair data show that all three variants currently are experiencing approximately twice the required time for the mature system. Current maintenance repair times are driven largely by immature health management and autonomic logistics information systems; however, the potential exists for discoveries in flight test and early operational fielding to further reduce maintainability. Timely maturation of these systems, completing and verifying technical order data are critical to improving maintainability for operational units. It is too early to predict whether the required maintainability thresholds can be met.
- The program failed to design the unit-level ALIS hardware for deployability. The squadron operating unit weighs 2,466 pounds and measures 79 inches high by 40 inches deep and 24 inches wide. It also requires climate-controlled environments. The program worked through late 2010 and 2011 to redesign the system and provide improved deployability by late 2014. However, there is no plan for end-to-end testing of the system, and funding of retrofits or changes to the units that will be purchased in the meantime. The problem needs correction in order to take advantage of F-35 capability in forward operating locations expected in combat.
- Data Quality and Integration Management (DQIM) is a vital part of the autonomic logistics global sustainment plan for the F-35. The ALIS version 1.0.3 is supposed to incorporate DQIM; however, missing data elements (e.g. part number, logistics control number, serial number) of vendor supply databases have prevented timely testing and fielding of ALIS version 1.0.3. This results in the development of manual

data tracking processes for early LRIP aircraft. The program expects to have DQIM data products available to support ALIS 1.0.3 fielding in May 2012.

Modification of Low-Rate Initial Production (LRIP) Aircraft

- The aircraft produced in the first five production lots will require significant numbers of structural modifications and configuration upgrades to attain the planned service life and the intended Block 3 capability. The program office worked with the Services this year to organize a funding and scheduling strategy. These are known as concurrency modifications because ground and flight tests concurrent with production identified the need to change the design after production began in order to achieve acceptable performance. These modifications include corrections to airframe parts discovered to have limited life during structural durability testing conducted so far. Additionally, the program has always planned a significant hardware and software upgrade from Block 2 to Block 3 mission systems capability; this will affect the first five lots of aircraft.
- Service plans, particularly in regards to throughput at the training center equipped with the initial production aircraft, must account for the planned downtime, which will be 45-60 days. For example, the program plans the F-35A and F-35B forward wing root rib modification to take a depot repair team 45 days to complete. All of the aircraft intended for operational testing require many of these modifications and the Block 3 upgrade in order for the JSF Operational Test Team to conduct an adequate IOT&E.

Training

- The JSF Operational Test Team developed an OUE test plan to provide the PEO the assessment he requested of the initial F-35A training mission capability, initially planned to begin in August 2011. The readiness-to-test and readiness-to-begin training processes highlighted several issues that have led to delays to the start of pilot flight training.
- Based on the flight schedule planned in April 2010, the program expected to have completed over 1,100 sorties and over 1,980 flight hours on the F-35A SDD aircraft (including the two lot 1 aircraft) by the end of November 2011. Actual numbers were 622 flights and 1,175 hours. The lower than expected flight rate and hours created schedule pressure to start training activities with a less mature aircraft system than planned.
- The primary problem for the program and the Air Force has been determining the acceptable level of risk involved with starting training in immature aircraft. The key event anticipated by the program office and the training center is obtaining a suitable military flight release from the Air Force airworthiness authorities, which is needed before pilots can fly the aircraft at the training center. The results of the maturity flights on the production lot 1 mission systems test aircraft were that approximately half required intervention by flight test control room personnel, an indication of low system maturity and likely mission abort in a non-flight test environment. The abort rate was measured at three times the measure of success set by the program and the airworthiness authority.
- As of the end of November 2011, the program had made progress on some of the safety-related items identified by DOT&E in October. Although the program and the training center leadership had officially committed to an event-driven start of flight training, they had provided no explicit plan for building maturity in the F-35A aircraft in order to safely conduct the OUE and begin F-35A pilot training. As of the end of November 2011, there were less than 80 total flight hours on the training mission software configuration and less than 1,200 hours on the F-35A variant. Historically, more than 2,500 fleet hours have been needed to reduce risk of beginning training in a new aircraft to an acceptable level.

Live Fire Test and Evaluation

- Live Fire FUSL testing of the first flight test aircraft consisted of 25 ballistic tests. Testing confirmed the ability of the airplane to isolate the damage to targeted components. Testing validated the robustness of both the Flight Control and Electrical Power Systems. Further analysis of the data will take place to compare with the pilot-in-the-loop simulations completed in FY09, which provided the basis for FUSL pre-test predictions, and to ensure that test limitations did not obscure potentially significant vulnerabilities.
- Analyses of OBIGGS fuel system simulator tests showed that the system is incapable of providing protection from threat-induced fuel tank explosions during some critical segments of combat missions when the aircraft is most vulnerable. Program focus is currently on the immediate need to meet requirements to protect the aircraft from lightning-generated fuel tank explosions and on redesigning OBIGGS to provide protection throughout all combat mission segments.

Recommendations

- Status of Previous Recommendations. The program and Services are satisfactorily addressing four of seven previous recommendations. The remaining three recommendations concerning use of objective criteria for evaluating flight test progress, integrating flight test of an operational mission data load, restoring shut-off valves, and redesigning the OBIGGS are outstanding.
- FY11 Recommendations. The program should:
  1. Conduct an integrated test review of the final flight test schedule to ensure the new integrated master schedule matches flight test schedule sequencing and content, and that both comply with the TBR-recommended planning factors.
  2. Use a criteria-based event-driven strategy to reduce risk before beginning flight operations with early, immature production aircraft at the training center or elsewhere.

3. Determine the impact of the alternate path for the helmet-mounted display on the integrated master schedule, including potential for cockpit and pilot systems redesigns.
4. Ensure operationally relevant criteria are used to evaluate handling characteristics in transonic flight regimes and in buffet testing.
5. Produce and implement a realistic reliability growth plan.
6. Evaluate and reduce the risk of later than intended completion of structural durability testing given concurrent production.
7. Improve spares efficiency/resupply and test aircraft reliability at the flight test centers.
8. Survey the test plans for certifications required by government agencies outside program and Service control and plan appropriate lead-time for these certifications.

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

Executive Summary

- Defense Intelligence Systems Agency (DISA) development focused on implementing high priority capability enhancements, software corrections, and infrastructure improvements to Global Command and Control System – Joint (GCCS-J) Global, Joint Operation Planning and Execution System (JOPES), and Status of Resources and Training System (SORTS).

GCCS-J Global

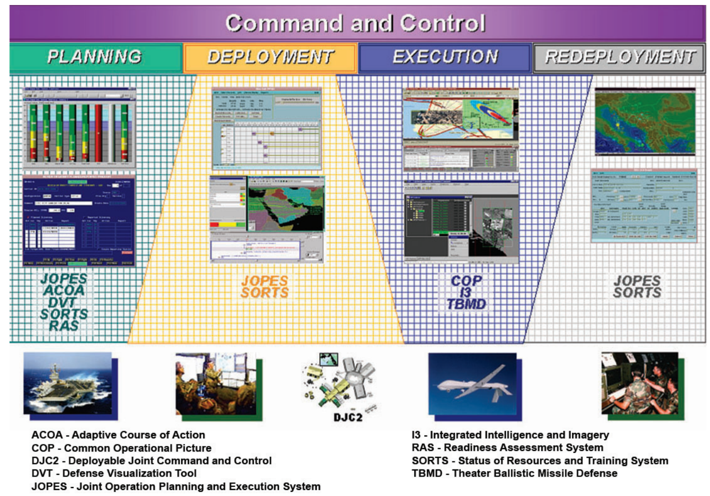
- DISA developed GCCS-J Global v4.2.0.8 to provide operational enhancements, remediate security vulnerabilities, and correct Integrated Imagery and Intelligence application deficiencies. The Air Force 46th Test Wing and JITC completed combined developmental/operational test (DT/OT) and the program manager has resolved all major deficiencies identified during testing. Analysis of combined DT/OT data is still ongoing.

GCCS-J JOPES

- DISA developed GCCS-J JOPES v4.2.1 to support development and modification of operational plans involving Intermediate Locations (ILOC), implementation of the Initial Transportation Tracking Account Number (TTAN) Framework, decoupling of the Deliberate Crisis Action Planning and Execution Segments (DCAPES), and infrastructure upgrades. While many of these enhancements functioned correctly, planners were not able to perform timely flow constraint analysis and mass edits of Unit Line Number records. Based upon OT&E results, DOT&E assessed GCCS-J JOPES v4.2.1 as not operationally effective, but operationally suitable.
- DISA held a GCCS-J JOPES v4.2.1 Acquisition Review Board on October 14, 2011, which resulted in a decision to forgo JOPES v4.2.1 fielding. Instead, DISA decided to develop a JOPES v4.2.0.2 to implement infrastructure upgrades and TTAN Framework. DISA also decided to develop a plan and request approval to begin incremental JOPES modernization, which will include further development and refinement of ILOC capabilities.

GCCS-J SORTS

- DISA developed GCCS-J SORTS v4.2.0.1 Updates 1 and 2 to implement software corrections to the SORTS communications processor, SORTS master database, Readiness Assessment System – Joint Tool and Readiness Assessment System – Input Tool. DOT&E determined that SORTS v4.2.0.1 Update 1 was operationally effective with limitations and operationally suitable. DISA completed the SORTS v4.2.0.1 Update 2 developmental test without any major deficiencies identified. Analysis of SORTS v4.2.0.1 Update 2 developmental test data is still ongoing.



- DISA transitioned SORTS program management responsibilities to the Defense Readiness Review System Implementation Office in late October 2011.

System

- GCCS-J is a command, control, communications, computers, and intelligence system consisting of hardware, software (commercial off-the-shelf and government off-the-shelf), procedures, standards, and interfaces that provide an integrated near real-time picture of the battlespace necessary to conduct joint and multi-national operations.
- GCCS-J consists of three main components:
  - GCCS-J v4.2 Global Release (Force Protection, Situational Awareness, Intelligence applications)
  - JOPES v4.2 (Force Employment, Projection, Planning, and Deployment/Redeployment applications)
  - SORTS v4.2 (Force Readiness and Sustainment applications)
- GCCS-J consists of a client/server architecture using open systems standards, government-developed military planning software, and an increasing use of World Wide Web technology.

Mission

- Joint Commanders utilize the GCCS-J to accomplish command and control.
- Commanders use GCCS-J:
  - As an integrated, scalable command and control, communications, computers, and intelligence system.
  - To link the National Command Authority to the Joint Task Force, component commanders, and Service-unique systems at lower levels of command.

- Conduct contingency and crisis action planning.
- To process, correlate, and display geographic track information on friendly, hostile, and neutral land, sea, and air forces, integrated with available intelligence and environmental information to provide the user a fused battlespace picture.

Major Contractors

- Government Integrator – DISA
- Software Developers:
  - Northrop Grumman – Arlington, Virginia
  - SAIC – Arlington, Virginia
  - Pragmatics – Arlington, Virginia

Activity

- JITC conducted all testing in accordance with the DOT&E-approved Test and Evaluation Master Plan and test plans.

GCCS-J Global

- DISA developed GCCS-J Global v4.2.0.8 to provide operational enhancements, remediate security vulnerabilities, and correct Integrated Imagery and Intelligence application deficiencies.
- The Air Force 46th Test Wing and JITC conducted the GCCS-J Global v4.2.0.8 combined DT/OT at Eglin AFB, Florida, from August 22-26, 2011. Eleven users representing the 46th Test Wing, Headquarters Air Force Combat Command, and Central Command, participated in the OT&E. The Air Force 46th Test Wing and JITC collected additional OT&E data at DISA Headquarters, Fort Meade, Maryland, from September 19-23, 2011.

GCCS-J JOPES

- DISA developed GCCS-J JOPES v4.2.1 to support development and modification of operational plans involving ILOC, implementation of the initial Transportation Tracking Account Number, decoupling of the DCAPES, and infrastructure upgrades.
- JITC conducted OT&E of GCCS-J JOPES v4.2.1 in two phases. JITC conducted the first phase from March 28 to April 1, 2011. JITC resumed testing from May 2-6, 2011, to accommodate the Army Forces Command, which was unable to participate in the original test due to Base Realignment and Closure requirements. Regression testing and problem report resolution continued through July 22, 2011. Twenty-four users representing Pacific Command, Transportation Command, Central Command, Southern Command, Forces Command, Northern Command, Joint Forces Command, Headquarters Army, Headquarters Air Force, and Marine Forces Command participated in the OT&E.
- DISA held a GCCS-J JOPES v4.2.1 Acquisition Review Board on October 14, 2011, which resulted in a decision to forgo JOPES v4.2.1 fielding. Instead, DISA decided to develop an interim JOPES Release v4.2.0.2, within 4 to 6 months, to implement infrastructure upgrades, TTAN Framework, and other fixes from previous testing. DISA also decided to develop a plan and request approval to begin incremental JOPES modernization, which will include further development and refinement of ILOC capabilities.

GCCS-J SORTS

- DISA developed GCCS-J SORTS v4.2.0.1 Update 1 to implement software corrections to the SORTS communications processor, SORTS master database, and other readiness applications. DISA developed GCCS-J SORTS v4.2.0.1 Update 2 to implement software corrections primarily affecting the Army, Air Force, and Coast Guard.
- DISA conducted GCCS-J SORTS v4.2.0.1 Update 1 developmental test at DISA Headquarters, Falls Church, Virginia, from April 14-15, 2011. Developmental testers and operational users participated in the developmental test. JITC and developmental testers collected additional data on April 29, 2011.
- DISA conducted GCCS-J SORTS v4.2.0.1 Update 2 developmental test at DISA Headquarters, Fort Meade, Maryland, from September 6-14, 2011. Operational users from the Coast Guard and Air Force participated in the developmental test. DISA conducted GCCS-J SORTS v4.2.0.1 Update 2 regression testing from September 26 to October 21, 2011.
- DISA transitioned SORTS program management responsibilities to the Defense Readiness Reporting System Implementation Office in late October 2011.

Assessment

- JITC conducted GCCS-J combined DT/OT, or dedicated operational testing, and identified major deficiencies during the operational test phase resulting in extended operational testing or the need for additional regression testing. DISA should have identified many of these major deficiencies earlier in the testing process.

GCCS-J Global

- The Air Force 46th Test Wing and JITC completed combined DT/OT of Global v4.2.0.8 and the program manager has resolved all major deficiencies identified during testing. Analysis of combined DT/OT data is still ongoing.

GCCS-J JOPES

- While users were able to input ILOC information into the JOPES v4.2.1 system, planners were not able to perform timely flow constraint analysis and mass edits of Unit Line Number records to change ILOC data correctly. The ILOC implementation also introduced the potential for users to inadvertently delete ILOC data from the database while attempting to only edit portions of the information using the Mass Edit feature. The ILOC flow constraint analysis requirements need further development by the Joint Staff J3 and the combatant commands, using mission threads or similar visualization methods, to clearly define the mission need and concept of operations. Other functional changes to JOPES v4.2.1 supporting the TTAN Framework, decoupling of DCAPES, and infrastructure upgrades functioned correctly. Based upon OT&E results, DOT&E assessed GCCS-J JOPES v4.2.1 as not operationally effective, but operationally suitable.

GCCS-J SORTS

- JITC observed SORTS v4.2.0.1 Update 1 test activities to provide an independent assessment of the results. DOT&E determined that DISA implemented all software fixes effectively. However, insufficient Defense Readiness Reporting System – Navy interface data were collected to resolve effectiveness for this interface. SORTS v4.2.0.1 Update 1 was operationally effective with limitations and operationally suitable.
- JITC observed SORTS v4.2.0.1 Update 2 test activities to provide an independent assessment of the results. DISA completed developmental testing without any major deficiencies identified. Analysis of developmental test data is still ongoing.

Recommendations

- Status of Previous Recommendations. DISA addressed all previous recommendations.
- FY11 Recommendations.
  1. DISA should develop and field an interim JOPES release that addresses the most urgent user requirements that were successfully demonstrated during JOPES v4.2.1 testing.
  2. The Joint Staff J3 should coordinate and formalize ILOC requirements to ensure further development meets user needs.

Joint Biological Point Detection System (JBPDS)

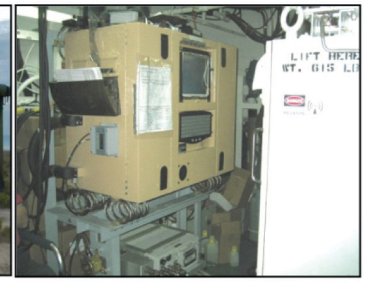
Executive Summary

- DOT&E submitted classified reports to Congress on the Joint Biological Point Detection System's (JBPDS) capability to detect and identify tactically significant biological warfare agent attacks in order to support decisions to initiate medical treatment in June 2009 (for four biological warfare agents) and August 2011 (for six biological warfare agents).
- JBPDS's operational capability varies widely with the biological warfare agent used, the nature of the attack, and environmental conditions.
- The August 2011 report was based on the Army Test and Evaluation Command's Whole System Live Agent Testing conducted from June 2010 to February 2011.

System

- The JBPDS provides detect-to-treat biological agent point detection, identification, and sampling capability.
- The JBPDS consists of a biological suite that has a Biological Aerosol Warning Sensor (or trigger), collector, fluid transfer system, and identifier. The identifier inoculates assays that contain antibodies of specific biological warfare agents.
- The JBPDS provides the capability to collect and preserve samples for confirmatory analyses to support follow-on courses of action for the commander, including treatment, quarantine, countermeasures, and litigation.
- The Services require the system to detect the presence of a biological aerosol and to identify the biological warfare agent in less than 15 minutes.

Shelter



Shipboard

- The Navy will employ the JBPDS aboard ship. The Army employs JBPDS mounted in a High Mobility Multi-purpose Wheeled Vehicle or integrated into the Stryker Nuclear, Biological, and Chemical Reconnaissance Vehicle.

Mission

Units equipped with the JBPDS provide early warning and identification of aerosolized biological warfare agents.

Major Contractor

General Dynamics Armament and Technical Products Division – Charlotte, North Carolina

Activity

- Based upon the June 2009 DOT&E report, the Joint Program Executive Officer for Chemical and Biological Defense approved full-rate production of the JPBDS on October 1, 2009, and directed an update of the Test and Evaluation Master Plan and Whole System Live Agent Testing for the remaining six biological warfare agents not previously tested against the integrated system.
- The Army Test and Evaluation Command conducted Whole System Live Agent Testing Phase II in a Bio-Safety Level-3 containment chamber at Dugway Proving Ground, Utah, from June 2010 to February 2011 for the remaining six biological warfare agents in accordance with the June 2010 DOT&E-approved Test and Evaluation Master Plan.
- DOT&E combined the whole system test data with modeling of agent transport and dispersion to assess the operational implications of system performance against biological warfare agents.

Assessment

- JBPDS has limited capability to detect and identify tactically significant biological warfare agent attacks in order to support decisions to initiate medical treatment for the biological agents identified in the August 2011 DOT&E report.
- JBPDS's operational capability varies widely with the biological warfare agent used, the nature of the attack, and environmental conditions.

Recommendations

- Status of Previous Recommendations. The Services have addressed all previous recommendations.
- FY11 Recommendation.
  1. The Army and Navy combat developers should revise the concept of operations and tactics, techniques, and procedures to account for the performance of the JBPDS.

Joint Chemical Agent Detector (JCAD)

Executive Summary

- The Joint Chemical Agent Detector (JCAD) M4A1, referred to as the M4E1 during testing, is operationally effective and suitable.
- Overall, the M4A1 detects lower levels of chemical warfare vapors than the previous production model, the M4. JCAD provides warning of the presence of chemical warfare vapors in sufficient time to take protective measures.
- The detector is reliable, easy to maintain, and has a high availability rate.

System

- JCAD is a hand-held device that automatically detects, identifies, and alerts operators 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, fixed-site installations, and collective protection shelters. It supplements or replaces the Automatic Chemical Agent Detector Alarm and the Improved Chemical Agent Monitor.
- 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

- Operators use JCAD to determine the presence of chemical warfare agent and toxic industrial chemical vapors by:
  - Checking personnel for contamination
  - Monitoring in and around a stationary vehicle or shelter's interior and exterior, or aircraft while on the ground
- Operators equipped with JCAD, and installation emergency management personnel operating remote JCAD arrays, alert personnel to take personal protection measures and unit force protection measures such as contamination avoidance or an increase in mission-level protective posture.

Major Contractor

Smiths Detection – Edgewood, Maryland, and Watford, United Kingdom

Activity

- The program office awarded a new competition-based contract for procurement of the JCAD. Smiths Detection, the original contractor, won the contract with a modified version of the JCAD referred to as the JCAD M4E1.
- DOT&E approved an updated Test and Evaluation Master Plan on July 22, 2010, to address developmental and operational testing of the JCAD.
- The Army Test and Evaluation Command conducted developmental and operational testing of the new production model JCAD (M4E1) from June to October 2010 in accordance with the approved Test and Evaluation Master Plan.
- DOT&E provided an Operational Assessment of the JCAD M4E1 to support the decision to change the production line to produce the new model.
- On March 30, 2011, the Joint Program Executive Office for Chemical and Biological Defense approved a production cut-in decision for JCAD M4E1 and directed first article testing to verify changes to the system made after the operational test.

- On April 21, 2011, DOT&E approved the Overarching Test Plan for the First Article Test of the JCAD M4E1.
- The Army Test and Evaluation Command conducted JCAD M4E1 first article testing from April to June 2011 to demonstrate the effectiveness of software modifications to address shortcomings identified during earlier developmental and operational testing.
- Based upon the results of the First Article Test, the Army type classified the JCAD M4E1 as the JCAD M4A1 and accepted delivery of production systems.

Assessment

- Based on results from the operational test and First Article Test, the JCAD M4A1 is operationally effective and suitable.
- Overall, the M4A1 detects lower levels of chemical warfare vapors than the M4. The M4A1 and the M4 provide warning of the presence of chemical warfare vapors in sufficient time for individuals to take protection measures to preclude exposure to levels that cause incapacitating health effects, and to levels that cause noticeable effects.
- The detector demonstrated a mean time between operational mission failure of 385 hours in monitor mode (versus a requirement of 750 hours) and 135 hours in survey mode (no stated requirement) during operational testing. First article testing of the JCAD with software modifications to address reliability shortcomings improved reliability in the monitor mode to 803 hours mean time between operational mission failure at the 80 percent lower confidence bound.
- The detector demonstrated an availability rate over 98 percent (versus a requirement of 92 percent).

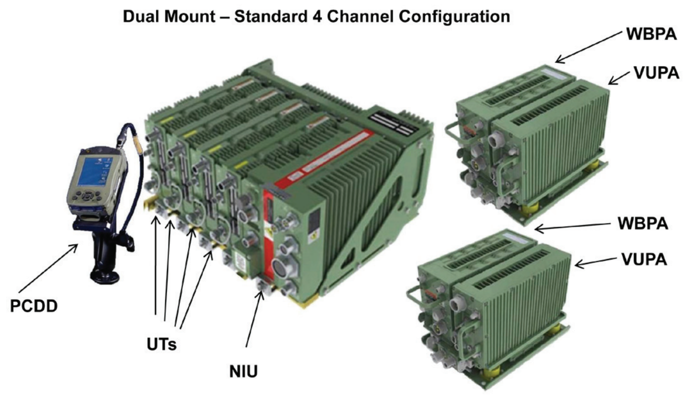
Recommendations

- Status of Previous Recommendations. There were no FY10 recommendations.
- FY11 Recommendations. None.

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

Executive Summary

- Joint Tactical Radio System (JTRS) Ground Mobile Radio (GMR) continues to demonstrate that it has technically immature hardware, software operating environment, and software-programmable waveforms.
- In May 2011, the Army reported a Nunn-McCurdy critical cost breach of the JTRS GMR program. On October 14, 2011, the Defense Acquisition Executive published an Acquisition Decision Memorandum (ADM) that did not support certification and terminated the JTRS GMR program.
- The Army rescheduled its planned December 2010 Milestone C Limited User Test (LUT) from June to July 2011 due to performance and reliability problems noted during its 2010 GMR System Integration Test (SIT). The Army later downgraded the planned LUT to a Customer Test due to a Nunn-McCurdy breach and continuing performance and reliability problems that could not be fixed prior to the planned operational test.
- During the Customer Test, commanders found the GMR was not useful for combat operations due to deficiencies in size, weight, power consumption, lack of transmission range, complexity of operations, and poor reliability. The initial Army user report recommends stopping development of the GMR and not fielding it to operational forces.



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 a portable control display device, universal transceivers, a network/information security interface unit, and power amplifiers, which combine to create radio sets for installation in Army and Marine Corps ground vehicles.

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

- Due to poor JTRS GMR and Wideband Networking Waveform (WNW) performance during the 2010 GMR SIT, the Army delayed its scheduled December 2010 JTRS LUT until June 2011 to allow time for reliability and performance improvements.
- The Army downgraded the rescheduled JTRS LUT to a Customer Test due to deficiencies in JTRS GMR and WNW performance demonstrated during Field Experiment 5 in February – March 2011. The GMR Customer Test was conducted as part of the Network Integration Evaluation (NIE).
- During the Customer Test, NIE commanders attempted to use the JTRS GMR WNW network, but found the network was not useful due to range limitations and poor reliability. Maneuver companies were equipped with 100-foot towers to mitigate the poor performance of the WNW network. The radio's performance did not meet the unit's expectations for range and reliability even with 100-foot towers.
- In May 2011, the Army reported a Nunn-McCurdy critical cost breach of the JTRS GMR program. On October 14, 2011, the Defense Acquisition Executive published an ADM that did not support certification and terminated the JTRS GMR program.
- The JTRS GMR has an approved 2008 Test and Evaluation Master Plan with requirements based upon the 2006 JTRS Operational Requirements Document 3.2.1.

Assessment

- The FY11 JTRS GMR schedule delays were due to technically immature GMR hardware, software operating environment, and waveform software.
- The GMR NIE did not demonstrate the WNW mobile ad hoc network capability. The presence of numerous 100-foot towers (contractor-installed), aerostats, and retransmission mission vehicles created a static WNW network and static company command posts.
- The Army's Brigade Modernization Command (BMC) conducted a review of the JTRS GMR during the NIE. The BMC report noted numerous deficiencies including size, weight, excessive power requirements, significant heat output, complexity of operation, and lack of GMR reliability. The BMC recommended that GMR development be stopped and that the Army not field the GMR.
- The WNW has not demonstrated that it is a viable waveform that can support the operational needs of commanders when units are tactically dispersed.
- JTRS GMR was not reliable in NIE. Reliability was 125 hours Mean Time Between Essential Function Failure versus a 466-hour requirement.
- The joint WNW network manager is not an effective tool to manage the WNW network. Soldiers preferred the commercially-available Simple Network Management Protocol Console software for WNW network management. There are no other JTRS-developed network management capabilities for the other waveforms hosted on the GMR, such as the Soldier Radio Waveform.

Recommendations

- Status of Previous Recommendations. All previous recommendations remain valid.
- FY11 Recommendation.
  1. The program should complete the requirements contained within the October 14, 2011, JTRS GMR Nunn-McCurdy Review ADM.

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

Executive Summary

- In January 2011, the Army conducted a Verification of Correction of Deficiencies (VCD) test with a redesigned version of the Rifleman Radio. The VCD indicated the redesigned radio corrects most of the prior-design radio's deficiencies and improves reliability.
- In May 2011, the JTRS HMS program received a Milestone C Low-Rate Initial Production (LRIP) decision based upon the improved performance of the Rifleman Radio demonstrated during the VCD. The Defense Acquisition Executive approved the Rifleman Radio LRIP quantity of 6,250 radios and a Manpack LRIP of 100 radios based upon its performance in 8 days (reduced from 45 days) of developmental testing.
- In June 2011, the Army conducted a Manpack LUT as a part of its 2011 Network Integration Evaluation (NIE). The Manpack radio demonstrated problems with reliability, transmission range, and voice quality that restricted the unit's ability to accomplish its mission. These same problems were observed during the curtailed period of developmental testing.
- The JTRS HMS program is schedule-driven and has reduced developmental testing to support an aggressive operational test schedule. Therefore, operational testing has and will likely continue to reveal problems that should have been discovered and fixed during developmental testing. The program continues preparation for its scheduled November 2011 Rifleman Radio IOT&E and its scheduled May 2012 Manpack Multi-Service Operational Test and Evaluation (MOT&E).

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 SFF-B (intended for the Shadow Unmanned Aerial Vehicle) and the SFF-D (intended for the Small Unmanned Ground Vehicle).
- 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 use JTRS HMS radios to:

- Communicate and create networks to exchange voice, video, and data using legacy waveforms or the Soldier Radio Waveform (SRW) 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

Rifleman Radio

- The JTRS HMS program initiated a complete redesign of the Rifleman Radio hardware and improved its software to address the deficiencies identified during the 2009 LUT. The redesigned Rifleman Radio features improvements in size, weight, battery life, and increased radio frequency power out.
- In January 2011, the Army conducted a Rifleman Radio VCD at the Maneuver Battle Lab, Fort Benning, Georgia. The VCD was used to confirm that deficiencies in the Rifleman Radio's reliability, doctrine, range, battery life, and thermal characteristics had been properly addressed.
- On May 18, 2011, the Defense Acquisition Executive approved the JTRS HMS Milestone C LRIP decision to purchase 6,250 Rifleman Radios.
- The Army continued development of the Rifleman Radio Test and Evaluation Master Plan (TEMP) to support its planned 1QFY12 NIE Rifleman Radio IOT&E.

Manpack

- The Army conducted two developmental tests of the Manpack radio:
  - Manpack Customer Test, conducted at Fort Benning, Georgia, February 7-11, 2011
  - Formal government developmental test (GDT), conducted at the Electronic Proving Grounds, Fort Huachuca, Arizona, April 15-22, 2011 (originally planned for 45 days)
- At the program's May 18, 2011, Milestone C, the Defense Acquisition Executive approved an LRIP of 100 Manpack radios. The Manpack LRIP is intended to support future developmental and operational tests. A second Manpack LRIP In Progress Review (IPR) is planned for February 2012.
- In July 2011, the Army conducted the Manpack LUT, as part of its NIE at Fort Bliss, Texas, to support the program's post-Milestone C IPR. The Army used the LUT to assess the performance of the Manpack under numerous mission scenarios executed by a cavalry troop.
- The Army is developing a JTRS HMS Manpack Radio Acquisition Strategy Report, Capabilities Production Document (CPD), and TEMP. These documents will be required for future developmental and operational testing.

Assessment

Rifleman Radio

- During the 2009 Rifleman Radio LUT, DOT&E assessed the radio as useful during mission preparation, movement, and reconnaissance activities. During combat engagements, however, the radio demonstrated poor performance and the squad had difficulty with employment of the radio.
- During the 2011 Rifleman Radio VCD, the redesigned radio demonstrated improvement:
  - Operational reliability was 277 hours Mean Time Between Essential Function Failure compared to the radio's revised requirement of 477 hours. This translates to a 92 percent chance of completion of a 24-hour mission compared to a requirement of 95 percent.
  - Transmission range met the radio's requirement of 2,000 meters in an urban setting and 1,000 meters in dense vegetation.
  - Radio battery life exceeded the radio's revised 8-hour requirement.
  - Doctrine for use of the radio demonstrated improvement.
  - Radio temperature was reduced.

Manpack

- The Army reduced the Manpack formal GDT (April 2011) from its originally scheduled 45 days to 8 days to place radios into the NIE JTRS HMS Manpack LUT.
- Both the Manpack Customer Test and formal GDT highlighted deficiencies in performance and poor reliability. The Army determined that the Manpack's Single Channel Ground and Airborne Radio System (SINCGARS) waveform was not ready for test and did not test it during the truncated formal GDT.
- During the NIE JTRS HMS Manpack LUT, the radio demonstrated the following:
  - Ability to transmit and receive on two channels
  - Ability to distribute Position Location Information throughout the network
  - Poor reliability
  - Short range of the Soldier Radio Waveform and SINCGARS waveforms that significantly constricted the operational area of the cavalry troop
  - Inconsistent voice quality
  - SINCGARS waveform did not support unit operations and was immature for operational test
- The NIE JTRS HMS Manpack LUT's reliability data collection was inadequate and not conducted in accordance with the approved test plan.
- The JTRS HMS program is schedule-driven and has reduced developmental testing to support an aggressive operational test schedule. The program continues preparation for its scheduled November 2011 Rifleman Radio IOT&E and its scheduled May 2012 Manpack MOT&E.

Recommendations

- Status of Previous Recommendations. The JTRS HMS program is addressing all previous recommendations.
- FY11 Recommendations. The JTRS HMS program should:
  1. Ensure that adequate developmental testing is performed prior to future operational tests.
  2. Correct any deficiencies noted at the November 2011 Manpack LUT prior to the scheduled MOT&E.
  3. Complete necessary Rifleman Radio and Manpack radio documentation to support future developmental and operational testing.

Joint Tactical Radio System (JTRS) Network Enterprise Domain (NED) Network Managers

Executive Summary

- The Joint Tactical Radio System (JTRS) Wideband Networking Waveform (WNW) Network Managers (JWNM), the Soldier Radio Waveform (SRW) Network Managers (SRWNM), and the JTRS Enterprise Network Manger (JENM) allow signal personnel to manage the networks of JTRS software-defined radio sets.
- Of the JWNM management functions (planning, monitoring, controlling, and reporting), testing primarily examined the planning and monitoring functions.
- Review of JWNM and SRWNM training materials and observation of planning exercises indicate that certain planning tasks are burdensome and prone to errors. A highly skilled user with the intended military occupational specialty is able to develop the plan, enter it into the system, and correct errors. However, the available personnel within the unit for the test events often are not at the skill level designated in the training materials.
- The JWNM monitoring function tested in the Army Network Integration Evaluation (NIE) 11.2 did not meet the operational needs of the users, with software performance hindering system use. Software performance problems included user concerns with timeliness and accuracy of displayed information and system slowdowns and lockups requiring routine hard reboots.
- Without an independent means of determining the actual status of the radios (e.g. if the radio is on or off and where the radio is located) and how the WNW network is performing (e.g. what radios are currently connected), the accuracy of the JWNM monitoring function cannot be determined.
- The SRWNM IOT&E analysis is not complete. Initial observations are that unit signal personnel can load a communications plan on the SRWNM, create the mission data set file, and load it on the Rifleman Radios. This took several days longer than planned. Causes will be identified when the test data are available for analysis. Lessons learned from the testing conducted show the program manager and test community need to develop a better T&E methodology for JWNM, SRWNM, and JENM that clearly establishes the needed level of developmental test, trials, and scoring criteria. Additionally, results identify the data collection tools needed to assess the accuracy of all management functions and determine the readiness to enter operational test.

System

- JTRS Network Enterprise Domain (NED) software applications allow the JTRS software-defined radio sets to provide communications to tactical forces. The software applications include waveforms, enterprise networking services (route and retransmission among waveforms), and enterprise network management.
- The waveforms and enterprise networking services software are integrated into and are considered part of a JTRS radio set, and their performance is part of that reported for the JTRS Ground Mobile Radio (GMR); Handheld, Manpack, and Small Form Fit (HMS); and Airborne, Maritime, and Fixed Station (AMF) radio products.
- The enterprise network management software is separate from the JTRS radio sets and is deployed on designated commercial off-the-shelf laptop computers.
  - The current network manager products are: JWNM for managing WNW networks; and SRWNM for managing SRW networks of JTRS software-defined radio sets.
  - In FY12, the JENM is intended to integrate the JWNM and SRWNM onto a single laptop computer.
  - Enterprise network management functions include planning, monitoring, controlling, and reporting:
    - The planning function develops the network parameters and creates a Radio Mission Data Set file that loads into and configures the GMR, HMS, or AMF radio sets.
    - The monitoring function provides a near-real-time display of the WNW or SRW network status and the conditions of the radios.
    - The control function allows the signal officer to make changes to the network, to include sending commands to the radio operator, changing the configuration parameters of the radio sets, or conducting cryptographic functions (rekey, zeroize, and transfer).
    - The reporting function records all network management events and makes the data available for analysis.

Mission

- Forward-deployed military forces use JTRS radios to communicate and create networks to exchange voice, video, and data during all aspects of tactical military operations.
- Signal staffs use the JWNM and SRWNM to plan, monitor, control, and report on network operations involving JTRS GMR, HMS, and AMF software-defined radio sets running WNW and SRW.

Major Contractors

- The Boeing Company, Phantom Works Division – Huntington Beach, California (the JWNM and JENM developer)
- ITT Electronics Systems Division, Clifton – New Jersey (the SRWNM developer)

Activity

- DOT&E approved the JTRS NED Test and Evaluation Master Plan (TEMP) in July 2011. Shortly after the TEMP was signed, the Nunn-McCurdy actions related to GMR delayed the Milestone that the GMR test event was to support. The Rifleman Radio test events were accelerated from December 2011 to October 2011, and the HMS Manpack radio events were also accelerated.

JWNM

- JWNM developmental testing occurred during the following test events:
  - The JTRS GMR System Integration Test extension conducted by the Army's Electronic Proving Grounds in September and October 2010 at Fort Huachuca, Arizona.
  - The JTRS GMR Field Experiment 5 conducted by the Army's Electronic Proving Grounds in February and March 2011 at Fort Huachuca, Arizona.
- The JWNM also completed a Customer Test with the GMR during the Army NIE 11.2 event in June and July 2011 at White Sands Missile Range, New Mexico. Units participating in NIE 11.2 only monitored GMR/WNW networks. There was no Soldier planning activity in support of the GMR Customer Test; the program office developed and loaded the Radio Mission Data Set files onto the radios.
- Following the GMR Customer Test, the NIE 11.2 Capstone event took place, which was not part of the formal test. Soldiers did develop a network plan for the Capstone event, entered it in the JWNM, and monitored the set-up of the GMR network.

SRWNM

- The SRWNM completed two government developmental tests in August and September 2011 at Fort Huachuca, Arizona, to examine technical readiness for OT&E, and had its IOT&E conducted during the JTRS Rifleman Radio IOT&E in October and November 2011.

JENM

- The JTRS NED Program Office continues development of the JENM, which will integrate the JWNM and SRWNM into a single network management product in FY12.

Assessment

- There are lessons learned from ongoing JTRS NED testing that need to be applied to future events. Without an independent means of registering the true status of JTRS radios using WNW or SRW, the accuracy of the JWNM monitoring function cannot be determined. In addition, the program manager and test community have not agreed on a deliberate, integrated test process to properly test and assess the myriad of capabilities provided by the JWNM, SRWNM, and JENM software. The TEMP outlines a general plan for test, but the reality of execution has not met the proper level of rigor.
- To date, the testing has been mostly demonstrations of various capabilities with very limited instrumented data collection. There is a close link between radio performance, waveform performance, and the network manager performance. More deliberate testing and data collection that can separate JWNM or SRWNM performance deficiencies from radio and waveform problems are needed.

JWNM

- JTRS Field Experiment 5 examined the JWNM planning and monitoring functions for WNW networks for GMR radios, as well as limited experimentation with control functions.
  - Planning: Subject Matter Experts from the Army Signal Center completed two of the three planning types during the pilot of the JWNM training. Planning software was considered intuitive, but not flexible enough to support changes to the plan.
  - Monitoring: The monitoring function exhibited latency of up to 15 minutes in displaying updates and differences between displayed status and radio properties. It is unclear what the cause is for the delay – breakdown of the network over time, waveform problems, and/or reporting parameters selected.
  - Control: Over-the-air zeroization (rendering the radios non-functional) met the 3-minute requirement. Other control functions, such as changing the frequency used by WNW subnets, updating the Simple Network Management Protocol, commanding a GMR to only receive messages, changing the presets on the GMRs, and disseminating revised Radio Mission Data Set files, demonstrated mixed performance results.
- JWNM training for Field Experiment 5 did not provide procedures to troubleshoot, determine, and inform the operators regarding appropriate WNW/GMR parameter changes. Sparing for JWNM components and maintenance

concepts for JWNM are unknown. Problems with loading the JWNM software caused the laptops to freeze up and required operators to restart the computer. This frustrated the operators and delayed completion of the network plan. The program office identified the root cause and a fix.

- The GMR Customer Test during NIE 11.2 examined JWNM monitoring of WNW networks of GMR radios. The program office ended up performing the planning activity instead of the units participating in the NIE.
  - Review of the JWNM training materials and observations of the planning exercises indicate that certain planning tasks are very burdensome, prone to errors, and may be beyond the anticipated skill and knowledge levels of available signal personnel in a unit. Personnel with the military occupational specialty and skill levels consistent with the intended audience of the training material performed much better. Procedures and possibly special aids have to be devised. Soldiers stated that understanding WNW and JWNM configuration information was critical to effectively manage the WNW network and that training must include practical hands-on exercises.
  - The monitoring function did not meet the operational needs of the users. Software performance problems with timeliness and accuracy of displayed information and the routine use of hard reboots to resolve system slowdowns and lockups hindered system use. Personnel were also distracted from using the JWNM during the event due to the need to operate other systems participating in the NIE.

SRWNM

- SRWNM developmental testing confirmed the capability to plan networks, create mission data sets, and then load mission data sets for the Rifleman Radios loaded with the SRW waveform. The Army has determined there is no requirement for SRWNM to monitor the Rifleman Radio/SRW network, so this function was not demonstrated in the Rifleman Radio IOT&E.
- Observation of SRWNM training for the SRWNM IOT&E indicates that aspects of the planning process are burdensome, prone to errors, and might be beyond the anticipated skill and knowledge levels of typical signal personnel within a unit. Personnel with the intended military occupational specialty and skill levels as identified in the training package perform much better.
- The SRWNM IOT&E took place as part of the JTRS Rifleman Radio IOT&E. Analysis of the data is not complete. Initial observations are that unit signal personnel can load a communications plan on the SRWNM, create the Mission Data Set files, and load the Rifleman Radios. However, completing this process took several days longer than planned. Identifying causes for the process delays will be accomplished when the test data are available for full analysis.
- The original network structure for the SRWNM IOT&E focused on the Rifleman Radio architecture and did not include the Manpack radios. As a result, a new network plan had to be developed and loaded onto the radios highlighting the importance of network planning from both a detailed understanding of networking waveforms and operational needs.

Recommendations

- Status of Previous Recommendations. This is the first annual report for JTRS NED.
- FY11 Recommendations.
  1. The program manager should test all network management functions to include having representative users plan and manage networks of size and complexity commensurate with those envisioned for the WNW and the SRW.
  2. The program manager and test community should develop an integrated T&E methodology for JWNM, SRWNM, and JENM to establish the needed level of developmental test, trials and scoring criteria, and data collection tools needed to assess the accuracy of all management functions.
  3. The program manager should use lessons learned from JWNM and SRWNM testing to assess the skill levels needed to operate the systems, improve the training packages, and increase the flexibility of the system software.

Key Management Infrastructure (KMI) Increment 2

Executive Summary

- Key Management Infrastructure (KMI) is designed to provide secure and interoperable cryptographic key generation, distribution, and management capabilities to support mission-critical systems for Combatant Commands, Services, DoD agencies, other Federal government agencies, coalition partners, and allies.
- The Operational Assessment Phase 2 (OA-2) began in late August 2011 with the National Security Agency (NSA) Protect Program Executive Office (PEO) certifying that it was ready for test. When the OA-2 testing completed in late September 2011, the results were a marked improvement over OA-1; however, there were still effectiveness and suitability problems uncovered during the testing event.
- The KMI Program Management Office (PMO) has not fully demonstrated the ability to provide a stable software release and supporting Type 1 token hardware to accomplish all aspects of operational testing. Additional verification of system readiness and usability procedures through an operational assessment are necessary.
- Despite some problems identified during operational testing, the KMI program continues to show steady progress toward delivering a useful cryptographic capability for system managers and users.

AKP - Advanced Key Processor
CIK - Crypto Ignition Key
CLUAS - Card Loader User Application Software
HAIPE - High Assurance Internet Protocol Encryptor
PCMCIA - Personal Computer Memory Card International Association
Reinit - Reinitialization

System

- KMI will provide a means for the secure ordering, generation, production, distribution, management, and auditing of cryptographic products (e.g., asymmetric key, symmetric keys, manual cryptographic systems, and cryptographic applications), and will replace the legacy Electronic Key Management System.
- KMI consists of core nodes that provide database storage, secure routing, and key generation and management services centrally located at an NSA location, as well as individual client nodes distributed throughout the world and used by cryptographic account custodians to order, manage, and distribute key material to Service members and other consumers.
- KMI is a combination of nearly 1,200,000 lines of contractor-developed software code, custom-developed hardware in the form of an Advanced Key Processor (AKP), AKP Crypto Ignition Key (CIK) and Type 1 token for user authentication, and commercial off-the-shelf (COTS) hardware and software. The KMI client node hardware components are comprised of a computer (client host), monitor, printer, AKP with power supply, AKP CIK, High Assurance Internet Protocol Encryptor (KG-250), ten Type 1 tokens, two AKP reinitialization drives, and a bar code scanner (as pictured above). A Personal Computer Memory Card International Association (PCMCIA) AKP Adapter Card Loader User Application Software (CLUAS) is also included with the hardware; however, the software capability to leverage this peripheral is not planned until Spiral 2.

Mission

- Combatant Commands, Services, DoD agencies, other Federal government agencies, coalition partners, and allies will use KMI to provide secure and interoperable cryptographic key generation, distribution, and management capabilities to support mission-critical systems such as the Global Information Grid and initiatives such as Cryptographic Modernization.
- Service members will use KMI cryptographic products and services to enable security services (confidentiality, non-repudiation, authentication, and source authentication) for diverse systems such as Identification Friend-or-Foe (IFF), Global Positioning System (GPS), Advanced Extremely High Frequency (AEHF) Satellite System, Joint Tactical Radio System (JTRS), and Warfighter Information Network – Tactical (WIN-T).

Major Contractors

- General Dynamics Computer Network Division – Needham, Massachusetts (Prime)
- General Dynamics Information Assurance Division – Needham, Massachusetts
- BAE Systems – Linthicum, Maryland
- SAIC – San Diego, California
- L3 Systems – Camden, New Jersey
- SafeNet – Belcamp, Maryland

Activity

- The KMI program completed developmental testing on each KMI node and the integrated system in March 2011. Although developmental testing indicated token reliability was lacking and software stability was unsuitable for operational use, the NSA PEO certified KMI for operational test readiness, and the program entered Operational Assessment Phase 1 (OA-1) in late March.
- OA-1 was a six-week test intended to be executed as a series of mission-based scenarios, with the Joint Interoperability Test Command (JITC) as the Operational Test Agency and Service key management subject matter experts executing the scenarios, with a focus on system performance.
  - The KMI PMO halted OA-1 after three weeks due to an inability to complete most of the required tasks.
  - Over 200 high-priority deficiencies were documented, and client node Mean Time Between Operational Mission Failure (MTBOMF) was significantly below target (3 hours versus 1,107 hours). In addition, token failures were significant and required vendor re-engineering to remedy the various problems.
  - During the OA-1, the KMI PMO requested permission from JITC to apply a new software version for the client nodes that would correct the need for frequent system reboots, but this new software code introduced problems in functions that had worked correctly in previous versions. The PMO declared this testing complete although only approximately 30 percent of the scenarios were successfully executed, while problems were continuing to be found, and new software builds were being produced at a rate of two per week.
  - Following these problems, the KMI PMO implemented testing of the OA scenarios at the contractor site for completion on all software releases.
- After suspending OA-1, JITC and the Service users continued to provide the PMO with regression test support in an effort to find errors and allow completion of all required scenarios. After six weeks of testing by the Services and the NSA, the PMO declared the testing complete.
- The PMO issued new tokens, updated the KMI software, and conducted a formal two week OA-1 regression test where the system demonstrated improved performance. In addition, the first account transition was demonstrated from the legacy Electronic Key Management System into KMI. Problems were still identified in the system performance, token reliability, and client node reliability, and there were suitability concerns with the system documentation.
- The KMI Training Working Group completed formal verification of the training materials in June 2011, presenting to training class participants for OA-2. After the Training Working Group meeting and review of the verification results in July 2011, the Service training leads accepted the training.
- Based on the results of the regression test, closure of the deficiency reports resulting from the OA-1 regression test, and user support for further operational testing, NSA Protect PEO authorized entrance into the OA-2 pilot testing in June 2011. Because problems resulted from the pilot testing (high failure rate of new tokens provided for OA-2, deficiency reports in early testing, problems with Secret Internet Protocol Router Network (SIPRNET) firewall configurations, and representative legacy and transition accounts and procedures), the KMI PMO deferred the formal start of OA-2 until the pilot problems were closed and the transition accounts established.
- The KMI program intended for OA-2 to be a four-week test performed at Service locations with typical users executing mission-based scenarios, with a focus on user readiness for operational deployment and the IOT&E.
  - JITC executed a pilot test the week prior to the official start of OA-2 during which high-priority system problems were discovered that precluded starting OA-2 as planned.
  - JITC conducted the OA-2 from August 24 to September 20, 2011.
  - New tokens were provided to the users for OA-2 that were intended to correct the low reliability seen in the previous batch of tokens, but the redesigned devices continued to have problems, although fewer and with different failure modes than the previous versions.
  - During the OA-2, a critical test, designed to ensure that conversion of the system of record from the legacy Electronic Key Management System to KMI could be accomplished, continued to fail, even after new software versions were produced to fix these problems.
  - The Service system experts again agreed to provide defect discovery support and regression test evaluations to the PMO, with the result being continued software baseline instability with multiple version releases per week.
- The DoD Chief Information Officer, as the Milestone Decision Authority, approved Milestone C and authorized the KMI program to enter the Production, Deployment, and Sustainment phase for Capability Increment 2 on October 28, 2011.

Assessment

- The KMI PMO has not demonstrated the ability to provide stable and reliable software or Type 1 token hardware to accomplish operational testing.
  - Software stability was initially found to be unsuitable for operational use with multiple high-priority deficiencies that would not allow for completion of required tasks.
  - Capabilities that worked in one release ceased to work in subsequent releases, indicating a lack of rigor in contractor regression testing.
  - Token reliability has not been demonstrated as sufficient for use in an operational environment with tokens failing to meet the 10,000-hour Mean Time Between Operational Mission Failure (MTBOMF) requirement.
- The KMI system was improved noticeably between OA-1 and OA-2. Although there are still some stability problems with the software, it is significantly more stable.
  - Notably, the program's major hardware developmental item, the Advanced Key Processor is performing well and exceeds its expected reliability.

- Additionally, the test users like KMI, and the system is perceived as a major improvement over the legacy Electronic Key Management System.
- KMI system documentation, procedures, and training for technical staff, helpdesk personal, and users are inadequate. More hands-on training is necessary for users to gain experience and confidence with KMI.
- Operational testing identified some problems that were missed by developmental testing. The development test environment was initially limited because of no operational data from the legacy system; however, this has now been corrected. Pre-existing developmental testing problems will not preclude KMI from moving forward.
- Successful completion of OA-2 was required for the Milestone C decision and limited deployment to operational sites for IOT&E.
- Based on the improved system performance, PMO-initiated pilot program, and regression testing in October 2011, DOT&E recommended KMI for Milestone C and entrance into IOT&E with specific direction to correct all mission-critical deficiencies, documentation, training, and support services. However, currently, KMI is not sufficiently mature for deployment for full operational use.

Recommendations

- Status of Previous Recommendations. This is the first annual report for this program.
- FY11 Recommendations.
  1. The KMI PMO should require the developmental contractors to demonstrate system readiness for operational assessment by executing mission-based scenarios with no critical discrepancy reports.
  2. After contractor verification of system capability and stability, JITC and Service subject matter experts should independently verify the KMI system's readiness for IOT&E prior to test execution.
  3. The readiness checklist for IOT&E should contain measureable criteria relating to software version stability, token and client MTBOMF metrics, and user-accepted workarounds for all system deficiencies that must be demonstrated prior to starting the test event.
  4. Documentation of all KMI process adjustments needs to be captured and refined for incorporation in system and user-level operating guides.
  5. Additional evaluation of user and manager-level training is needed to ensure that users can understand the KMI processes and operate the system.
  6. The PMO must assure that training for all personnel (users, administrators, core node staff, and helpdesk) includes sufficient hands-on equipment time to allow users to gain more system familiarity, knowledge, and proficiency with KMI.
  7. The KMI PMO should conduct an additional operational assessment to verify that the system is stable, reliable, and on the path to successful performance during IOT&E.
  8. A Red Team evaluation of the KMI core node security posture needs to be scheduled to coincide with the IOT&E, and be completed in time to influence the full deployment decision currently scheduled for June 2012.
  9. The PMO needs to establish a reliability improvement program for the tokens to ensure that progress is being made toward fielding a reliable token that will support the key management mission.

Mine Resistant Ambush Protected (MRAP) Family of Vehicles

FPI Cougar Category I

FPI Cougar Category II

FPI Cougar Ambulance

Navistar MaxxPro Dash ISS

Navistar MRAP Recovery Vehicle

Executive Summary

- The Army and Marines will procure 390 Navistar Mine Resistant Ambush Protected (MRAP) Recovery Vehicles (MRV) to fulfill an urgent need to recover MRAP vehicles in Afghanistan.
- The MRAP program procured 53 Force Protection Industries (FPI) Cougar Category (CAT) II Independent Suspension System (ISS) Kits and 250 Navistar Dash Ambulance vehicles.
- The Army Test and Evaluation Command (ATEC) completed the MRAP ISS Limited User Test (LUT) in June 2011 in accordance with the DOT&E-approved Test and Evaluation Master Plan and test plans.
- Based on results from the MRAP ISS LUT, the Navistar Dash ISS is operationally effective and operationally suitable. The Navistar Dash ISS demonstrated the off-road mobility needed to transport units over Afghanistan-like terrain.
- Based on results from the MRAP ISS LUT, the Cougar Ambulance is operationally effective. A unit equipped with the Cougar Ambulance can provide protected transport and urgent medical care for units in Afghanistan. The Cougar Ambulance is not operationally suitable due to its poor reliability, which contributed to its low availability.
- Based on results from the MRAP ISS LUT, the Navistar MRV is not operationally effective and not operationally suitable for recovery operations on cross-country terrain. The Navistar MRV has poor mobility and poor combat towing to recover damaged MRAP vehicles in Afghanistan. These problems were discovered during developmental testing and should have been resolved prior to the LUT. The Navistar MRV is capable of recovering and combat towing damaged MRAP vehicles on flat improved roads. The Navistar MRV is not reliable.

System

- MRAP is a family of vehicles designed to provide increased crew protection and vehicle survivability against current battlefield threats, such as IEDs, mines, and small arms. The 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 the following MRAP vehicles:
  - FPI Cougar ISS CAT I, CAT II, and Ambulance variants
  - Navistar CAT I Dash ISS and MRV
- The MRAP CAT I vehicle is designed to transport six persons and the MRAP CAT II vehicle is designed to transport 10 persons. The FPI Cougar CAT II Ambulance variant is designed to transport up to two litter patients and four ambulatory casualties. The Navistar MRV is designed to recover disabled and damaged MRAP vehicles.
- MRAP vehicles incorporate current Service command and control systems and counter-IED systems. MRAP vehicles have 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.

Mission

Units equipped with the MRAP CAT I vehicles will conduct small unit combat operations such as mounted patrols and reconnaissance. Units equipped with MRAP CAT II vehicles conduct ground logistics operations including convoy security, troop and cargo transportation, and medical evacuation. The MRAP Cougar Ambulance variant supports the conduct of medical treatment and evacuation. The MRV supports recovery of disabled and catastrophic damaged MRAP and Stryker vehicles.

Major Contractors

- Force Protection Industries, Inc. – Ladson, South Carolina
- Navistar Defense – Warrenville, Illinois

Activity

- In FY11, the MRAP program continued a capabilities insertion program to acquire and test enhanced capabilities and solutions to integrate across the MRAP Family of Vehicles. The program is managing the capability insertion efforts through Engineering Change Proposals. The major capabilities insertions are the ISS and Command, Control, and Communication Suite.
- As of October 2011, 390 Navistar MRVs were procured to fulfill an urgent need in Afghanistan.
- The MRAP procured 53 FPI Cougar CAT II ambulance vehicles.
- The program has procured 250 Navistar Dash ISS ambulances. These variants are undergoing developmental testing.
- In June 2011, ATEC completed the LUT of the MRV, Dash ISS, and the Cougar ISS ambulance variants at Yuma Proving Ground, Arizona, in accordance with a DOT&E-approved test plan.
- In November 2011, the program will execute a LUT at Yuma Proving Ground, Arizona, to examine the operational effectiveness and operational suitability of the Navistar Dash ISS ambulance variant.
- DOT&E delivered LFT&E findings on the FPI Cougar vehicles with ISS to Congress in June 2011.

Assessment

- The MRAP ISS LUT focused on two of the most significant Navistar Dash ISS deficiencies identified in the MRAP All Terrain Vehicle (M-ATV) IOT&E. The results from the MRAP ISS LUT indicate that these deficiencies were successfully resolved. The Navistar Dash ISS is operationally effective and operationally suitable. The vehicle demonstrated improved reliability over the solid axle Navistar Dash. The Navistar Dash ISS demonstrated 1,259 Mean Miles Between Operational Mission Failure (MMBOMF) versus its operational requirement of 600 MMBOMF.
- The Navistar Dash ISS Live Fire test program is ongoing and will be completed in FY12.
- Based on results from the MRAP ISS LUT, the Cougar Ambulance is operationally effective. A unit equipped with the Cougar Ambulance can provide protected transport and urgent medical care for units in Afghanistan. The Cougar Ambulance is not operationally suitable due to its poor reliability, which contributed to its low availability. The Cougar Ambulance demonstrated 367 MMBOMF versus its operational requirement of 600 MMBOMF.
- Live Fire testing of the Cougar Ambulance indicates the vehicle is survivable.
- Based on results from the MRAP ISS LUT, the Navistar MRV is not operationally effective and not operationally suitable for recovery operations on cross-country terrain. The Navistar MRV has poor mobility and poor combat towing to recover damaged MRAP vehicles in Afghanistan. The vehicle could not maneuver in soft sandy soil and had difficulty accelerating on hilly terrain. The Navistar MRV demonstrated 271 MMBOMF versus its operational requirement of 600 MMBOMF. These problems should have been resolved by the materiel developer prior to the LUT. The Navistar MRV is capable of recovering and towing damaged MRAP vehicles on flat improved roads.
- Live Fire testing of the Navistar MRV indicates the vehicle is survivable.

Recommendations

- Status of Previous Recommendations. The MRAP program fixed the off-road mobility and reliability of the Navistar Dash indentified in the MRAP M-ATV IOT&E.
- FY11 Recommendation.
  1. Prior to conducting an FOT&E, the program should improve the cross-country mobility, vehicle power, and system reliability of the Navistar MRV.

Mine Resistant Ambush Protected (MRAP) All Terrain Vehicle (M-ATV) and Special Operations Forces (SOF) Variant

Executive Summary

- DOT&E delivered the Special Operations Forces (SOF) Mine Resistant Ambush Protected (MRAP) All Terrain Vehicle (M-ATV) Operational and Live Fire Test and Evaluation Report to Congress in May 2011. The SOF M-ATV is operationally effective for conducting tactical transport missions including Convoy Escort, Protected Detail, and Area Reconnaissance. The SOF M-ATV is not operationally effective for conduct of the unique SOF combat missions of Direct Action, Urban Patrol, and Special Reconnaissance. The SOF M-ATV is not operationally suitable. The SOF M-ATV is survivable.
- U.S. Special Operations Command (USSOCCOM) completed testing in accordance with the DOT&E-approved Test and Evaluation Master Plan and test plans.
- The MRAP program procured the Underbody Improvement Kit (UIK) to integrate on the M-ATV fleet to improve M-ATV blast protection. DOT&E delivered preliminary findings from Live Fire testing of the UIK to Congress in September 2011.
- The MRAP program plans to execute a Limited User Test (LUT) at Yuma Proving Ground, Arizona, to examine a unit's ability to execute missions with the M-ATV UIK in November 2011.

M-ATV with Underbody Improvement Kit (UIK)

Special Operations Forces M-ATV

System

- The DoD intends for M-ATV 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 for five passenger positions including a gunner. The vehicle 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.
- The M-ATV UIK is designed to provide improved underbody blast protection to the base M-ATV.
- 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.
- 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 five passenger positions including a gunner, 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 special operations. The M-ATVs are fielded to units based upon priorities established by the operational commander.

Major Contractor

Oshkosh Defense – Oshkosh, Wisconsin

Activity

- The MRAP program has procured 421 SOF M-ATV variants for USSOCOM.
- USSOCOM completed the SOF M-ATV IOT&E in November 2010 at Yuma Proving Ground, Arizona, in accordance with the DOT&E-approved test plan.
- In March 2011, due to changes in threat, mission, and other factors, the Joint Requirements Oversight Council approved the increase of the M-ATV Key Performance Parameter threshold curb weight to 32,000 pounds to enable critical improvement to the M-ATV survivability.

- As of September 2011, the program purchased 8,011 UIKs to integrate on the M-ATV fleet in Afghanistan to improve M-ATV underbody blast protection.
- In November 2011, the program will execute a LUT at Yuma Proving Ground, Arizona, to examine a unit's ability to execute missions with the M-ATV UIK.
- The M-ATV UIK Live Fire Test program commenced in April 2011 and will be completed by 2QFY12.

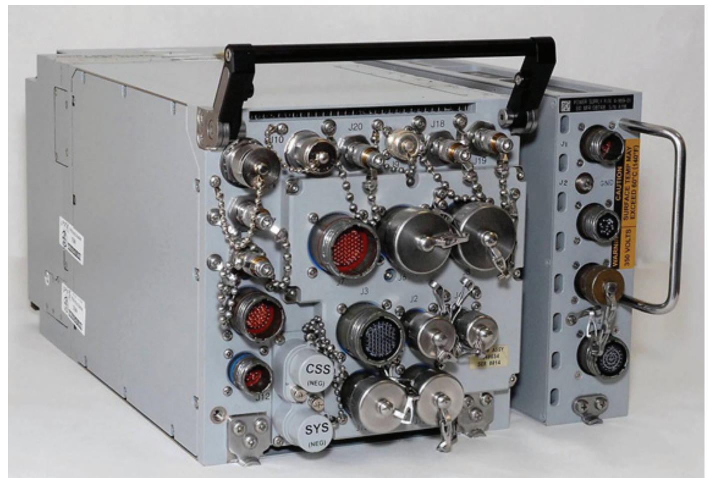
Assessment

- The SOF M-ATV is operationally effective for conducting tactical transport missions including Convoy Escort, Protected Detail, and Area Reconnaissance. The M-ATV provides sufficient armored mobility to conduct tactical transport missions over the types of terrain found in Afghanistan.
- The SOF M-ATV is not operationally effective for conducting the unique SOF combat missions of Direct Action, Urban Patrol, and Special Reconnaissance. The vehicle does not provide responsive acceleration to maneuver over terrain and react to changing tactical situations. The vehicle provides poor visibility to SOF operators seated in the rear of vehicle to observe their surroundings and respond to threats. The M-ATV Common Remotely Operated Weapon Station II (CROWS II) sights provide limited field of view for target acquisition. The vehicle's large visual and loud aural signatures negate the SOF need for tactical surprise.
- The SOF M-ATV is survivable, and provides ballistic protection against IEDs similar to that provided by the base M-ATV.
- The SOF M-ATV is not operationally suitable. The vehicle's rear seat configuration is cramped and not comfortable. During the IOT&E, the SOF riding in the vehicle experienced leg cramps and fatigue caused by the uncomfortable seats after 30 minutes. The SOF crew had difficulty moving in the vehicle to transition from seated positions to fighting position. One-half of the SOF operators complained of nausea while occupying the rear seats during the missions. The SOF M-ATV demonstrated automotive reliability similar to the base M-ATV. Weapon and CROWS II failures degraded the vehicle's reliability and should be fixed. These problems should have been resolved prior to the IOT&E.
- Emerging results indicate the M-ATV equipped with the UIK provides increased protection from underbody blasts compared to the baseline M-ATV.

Recommendations

- Status of Previous Recommendations. There are no previous recommendations.
- FY11 Recommendations. Prior to conducting FOT&E, the program should:
  1. Redesign the SOF M-ATV to accommodate larger rear passenger windows improving the visibility of SOF operators in the rear to observe their surroundings.
  2. Fix the firepower related failures and improve the overall reliability of the M-ATV.
  3. Improve the air flow rate within the SOF M-ATV to provide sufficient air circulation for five passenger crews.

Multi-functional Information Distribution System (MIDS) Joint Tactical Radio System (JTRS)



Executive Summary

- The Navy completed IOT&E of the Multi-functional Information Distribution System – Joint Tactical Radio System (MIDS JTRS) core terminal integrated into the F/A-18E/F in November 2010.
- DOT&E published a Beyond Low-Rate Initial Production Report in April 2011.
- DOT&E determined that the testing was adequate to indicate that the MIDS JTRS, integrated into the F/A-18E/F, was not operationally effective and not operationally suitable.
- Major deficiencies included ineffective Link 16 message exchanges of position, close air support information, and poor terminal/host system integration reliability.
- In August 2011, the Navy commenced a Verification of Correction of Deficiencies test of the MIDS JTRS integration into the F/A-18E/F to assess fixes implemented as a result of IOT&E, as well as to reevaluate reliability.
- The Air Force conducted developmental and operational testing of the integration of the MIDS JTRS into the E-8 Joint Surveillance Target Attack Radar System (JSTARS).
- Currently, not all MIDS JTRS core terminal capabilities, such as Link 16 enhanced data throughput, and instantiation of additional JTRS Software Communications Architecture waveforms, can be operationally tested because of host aircraft configurations and funding availability.

System

- When integrated into a host platform, MIDS JTRS provides Link 16 digital datalink, Link 16 digital voice communications, and Tactical Air Navigation capabilities, plus three additional programmable channels capable of hosting additional 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 Link 16 throughput and Link 16 frequency re-mapping.
- Link 16 digital datalink is a joint and allied secure anti-jam high speed datalink 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. Tactical Air Navigation is a legacy aircraft navigation system used in many military aircraft with air-to-air as well as air-to-ground modes of operation.
- The system includes the MIDS JTRS terminals and the host platform components and interfaces such as controls, displays, antennas, high power amplifiers, and any radio frequency notch filters.

Mission

- U.S. Services and many allied nations will deploy 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 Tactical Targeting Network Technology and Mobile User Objective System) 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

- ViaSat – Carlsbad, California
- Data Link Solutions – Wayne, New Jersey, and Cedar Rapids, Iowa

Activity

- The Navy Commander, Operational Test and Evaluation Force (COTF) completed the IOT&E of the MIDS JTRS as integrated on the F/A-18E/F at the Naval Air Warfare Center China Lake, California, and during detachments to Naval Air Station Fallon, Nevada, and Nellis AFB, Nevada, in November 2010.
- DOT&E published a Beyond Low-Rate Initial Production Report in April 2011.
- The Air Force's Detachment 2, 605th Test and Evaluation Squadron completed integrated and dedicated operational testing of the MIDS JTRS as integrated into the E-8 JSTARS aircraft in July 2011 in Melbourne, Florida.
- COTF commenced the F/A-18E/F MIDS JTRS Verification of Correction of Deficiencies on August 15, 2011, at Naval Air Station China Lake, California. Testing should conclude in December 2011.
- All testing was conducted in accordance with DOT&E-approved Test and Evaluation Master Plans and operational test plans.

Assessment

- The MIDS JTRS IOT&E data indicated significant performance shortfalls. Link 16 messages that provide situational awareness of friendly force positions and intentions were consistently exchanged during 90 percent of the F/A-18E/F sorties flown, compared to the Key Performance Parameter threshold requirement of 98 percent. Link 16 close air support messages were successfully exchanged only 26 percent of attempts. Poor system reliability during start-up prevented timely mission launch during 16 percent of sorties.
- The MIDS JTRS, as integrated into the F/A-18E/F, demonstrated an operational availability of 68 percent compared to the Key Performance Parameter threshold requirement of greater than 90 percent.
- Terminal reliability was 63.8 hours mean time between operational mission failure compared to a threshold requirement of greater than 220 hours, and system integration reliability was 8.1 hours, compared to the threshold requirement of greater than 25 hours. Terminal reliability deficiencies were primarily found on ViaSat Terminals, as Data Link Solutions Terminals met the threshold requirement of 220 hours, although with a low (<50 percent) confidence level.
- The Built-In Test false alarm rate was one false alarm every 4.8 flight hours compared to the requirement of no more than one false alarm every 113 flight hours.
- Post-test causality analysis indicated that manufacturing and quality control problems with ViaSat-produced MIDS JTRS terminals led to new failure modes discovered during IOT&E. Other deficiencies were traced to errors in the Link 16 waveform software code and inadequate aircrew and maintenance personnel training.
- Problems discovered during the IOT&E will, if not corrected, significantly reduce the utility of this system to the aircrew. The MIDS Program Office must correct the new failure modes discovered during the IOT&E to improve the mission effectiveness and reliability of the MIDS JTRS terminal and F/A-18E/F integration. All real-world F/A-18 missions require, among other onboard systems, an operational Link 16 and Tactical Air Navigation capability to permit launch, entry into threat airspace, and allow for a safe recovery. A high failure rate of the installed MIDS JTRS will adversely affect mission readiness and on-time take-off rates.
- Test data from the integration of the MIDS JTRS into the E-8 JSTARS are still being analyzed; however, emerging results from IOT&E and Joint Interoperability Test Command interoperability testing indicate potential deficiencies with the exchange of imagery and attack aircrew-initiated acknowledgements in response to command messages. Emerging results indicate the system was effective in transmitting Link 16 datalink and voice communications. Completion and reporting of service Link 16 interoperability testing in December 2011 should clarify these potential problems.
- The integration of the MIDS JTRS into the E-8 aircraft appears to be reliable at the system level; however, prior to operational testing, two MIDS JTRS terminals failed and were returned to the vendor for hardware repair. Further reliability data collection in FY12 will provide clarification and confidence in data collected during the operational test.

Recommendations

- Status of Previous Recommendations. The Navy and the MIDS Program Office made satisfactory progress on the previous recommendations related to the integration of MIDS JTRS into the F/A-18E/F.
- FY11 Recommendations. The Navy should:
  1. Work with the MIDS Program Office to continue with the implementation of corrections to the MIDS JTRS system, terminal performance, and suitability shortfalls identified in past and current operational testing.
  2. Work with the MIDS Program Office to develop more fidelity and better discrimination for the Built-in-Test system to improve detection and reduce false alarm rates, specifically for the F/A-18E/F MIDS JTRS integration.
  3. Work with the MIDS Program Office to continue aggressively monitoring and engaging with prime terminal vendors to improve terminal quality and system-level reliability requirements. The Navy and Air Force should continue data collection of MIDS JTRS as integrated into their host platforms to confirm to at least 80 percent confidence that the MIDS JTRS terminal and host platform integration meet reliability requirements.
  4. Identify host platform integration candidates to test future JTRS waveforms and Link 16 enhanced throughput capabilities.
  5. Provide improved maintenance training, checklists, and fault diagnostics tools to reduce the quantity of MIDS JTRS terminals returned to flight because the avionics maintenance team could not duplicate reported faults. In addition, the Navy should provide a checklist for cryptographic key loading procedures.

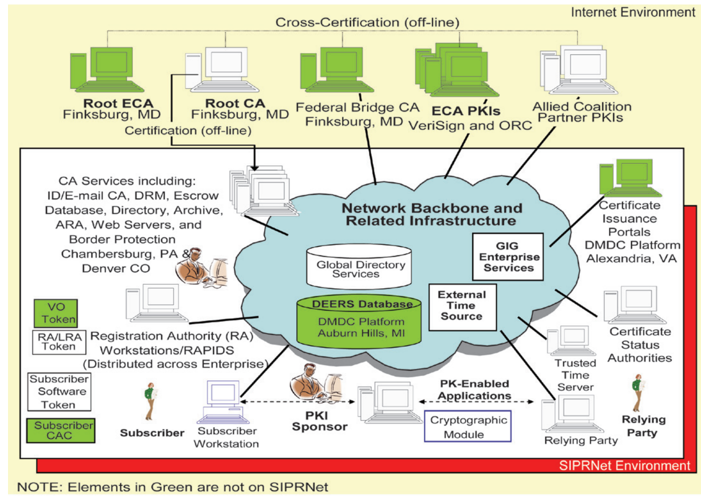
Public Key Infrastructure (PKI) Increment 2

Executive Summary

- In September 2010, the National Security Agency (NSA) Senior Acquisition Executive approved the procurement of 25,001 Secret Internet Protocol Router Network (SIPRNET) tokens to support IOT&E. The NSA requested that an Accelerated Life Test (ALT) (independent laboratory testing) be conducted on the SIPRNET token to ensure the token reliability deficiencies, uncovered during the FY10 Operational Assessment of the DoD Public Key Infrastructure (PKI) Increment 2, Spiral 1were resolved.
- On January 26, 2011, following the successful completion of the ALT, the NSA Senior Acquisition Executive authorized deployment of the previously procured 25,001 tokens and the procurement and deployment of an additional 60,000 tokens to ensure an adequate number of tokens would be on-hand for IOT&E.
- The IOT&E was divided into two phases: Phase 1 issued tokens to establish a minimum required user base (16,500), while Phase 2 demonstrated scalability and sustainability as the user base continued to grow.
- During the IOT&E, the PKI Program Management Office (PMO) issued 17,194 tokens over a seven month span with only 58 token failures reported, meeting the reliability requirement that 91 percent of tokens will last for at least three years.
- The interim logistics process was evaluated and accepted for the distribution of 85,000 tokens.
- The IOT&E exposed significant logistics hurdles due to undefined processes for procuring, distributing, and tracking tokens. The Defense Manpower Data Center (DMDC), which currently handles the common access card (CAC) processes on the Non-secure Internet Protocol Router Network (NIPRNET), will take on similar responsibilities for the SIPRNET token in 3QFY12 to mitigate these deficiencies. However, detailed plans including assignment of roles and responsibilities and the establishment of token distribution sites are undefined.
- Currently, the PKI PMO and military Services' and Agencies' end-to-end token distribution and accountability processes are not fully defined and require testing. Given the IOT&E assessment of the current process, the lack of a clearly defined process is likely to lead to significant backlogs in getting SIPRNET PKI tokens out to the force, reducing overall network security and impeding the Services' ability to meet the OSD requirement of having tokens deployed for all SIPRNET account holders by the end of CY12.

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) (both NIPRNET and SIPRNET), as well as secure local storage of information.



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

- 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 and government off-the-shelf applications to provide IA and e-business capabilities.
- PKI is a service of products that provide and manage X.509 certificates for public key cryptography. Using authoritative data, DoD PKI creates a credential that combines identity information with cryptographic information. The certificate identifies the individual PKI user and binds that person to a particular public/private key pair. In this way, DoD PKI provides a representation of physical identity in an electronic form.
- DoD PKI Certification Authorities for the NIPRNET and SIPRNET tokens reside in the Defense Information Systems Agency (DISA) Defense Enterprise Computing Centers (DECCs) in Chambersburg, Pennsylvania, and Oklahoma City, Oklahoma. Network Security Service PKI is now operational on the SIPRNET, and the Joint Interoperability Test Command (JITC) performed a system failover of the capability in early September 2011.
  - DoD PKI is comprised of commercial off-the-shelf hardware and software, and other applications developed by NSA.
  - Certificates are imprinted on the DoD CAC 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 complete and deployed on the NIPRNET. Increment 2 is being developed and deployed in three spirals on the SIPRNET and NIPRNET to deliver the infrastructure, PKI services and products, and logistical support for Spiral 1 (tokens), Spiral 2 (tactical and austere environments), and Spiral 3 (Federal and coalition capabilities). DoD PKI Increment 2 provides authenticated identity management via a personal identification number-protected token to enable DoD members and others to securely access the SIPRNET. Full implementation will enable authorized users to access restricted websites, enroll in online services, and encrypt and digitally sign email.

Mission
- Military operators, communities of interest, and other authorized users will use DoD PKI to enable net-centric operations, specifically, 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 personal identification number-protected CACs or SIPRNET tokens to enable DoD members, coalition partners, and others to access restricted websites, enroll in online services, and encrypt and digitally sign email. 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 Contractors
- BAE Systems – Linthicum, Maryland (Prime)
- General Dynamics Information Technology – Needham, Massachusetts
- 90Meter – Newport Beach, California
- SafeNet – Belcamp, Maryland

Activity
- In September 2010, the NSA Senior Acquisition Executive decided to limit token production to 25,001 tokens due to token reliability problems discovered during the FY10 Operational Assessment of the PKI Increment 2, Spiral 1.
- To resolve the unacceptable token reliability, the NSA conducted and verified the accelerated three-year life testing (independent of the PKI PMO) in a controlled setting, including assessing the effects of temperature, humidity, salt, fog, and personal electrostatic discharge.
- In September 2010, the NSA Senior Acquisition Executive approved the procurement of 25,001 SIPRNET tokens to support IOT&E. The NSA requested that an ALT (independent laboratory testing) be conducted on the SIPRNET token to ensure the token reliability deficiencies uncovered during the FY10 Operational Assessment of the DoD PKI Increment 2, Spiral 1 were resolved.
- On January 26, 2011, following the successful completion of the ALT, the NSA Senior Acquisition Executive authorized deployment of the previously procured 25,001 tokens and the procurement and deployment of an additional 60,000 tokens to ensure an adequate number of tokens would be on-hand for rapid distribution for IOT&E.
- Due to delays in identifying users, configuring networks, and issuing tokens, the IOT&E was divided into two phases: Phase 1 issued tokens to establish a minimum required user base (16,500), while Phase 2 demonstrated scalability and sustainability as the user base continued to grow.
- JITC conducted Phase 1 IOT&E for DoD PKI Increment 2, Spirals 1 and 2 from March 1 to August 8, 2011, in accordance with the DOT&E-approved test plan. Typical users from a variety of operational environments participated in the test event.
  - Testing evaluated infrastructure processes supporting the distribution and management of 16,500 SIPRNET tokens. Testing also assessed sustainability of the tokens in the operational environment.
  - JITC and the DISA Field Security Office conducted Penetration Testing on the DECCs in Chambersburg, Pennsylvania, and Oklahoma City, Oklahoma, from June 6 to July 31, 2011.
- JITC conducted Phase 2 of the IOT&E from August 8 to September 21, 2011.
  - The JITC testing examined token reliability to validate the data from the NSA accelerated life testing, while the overall PKI system capacity was tested under heavier usage conditions to determine if it could handle the processing load.
  - The middleware patching and software upgrading processes were supposed to be thoroughly examined to ensure the PKI system could be maintained; however, the processes were not ready for testing during the IOT&E.
  - Additionally, the PKI PMO and JITC conducted a failover of the PKI system between Chambersburg, Pennsylvania, and Oklahoma City, Oklahoma, to demonstrate its initial continuity of operations capabilities.

Assessment

- The independent ALT conducted and verified by NSA indicated the tokens meet reliability requirements for the required three-year service life. One exception was a risk of damage from moderate exposure to personal electrostatic discharge. Testing did not address reliability in tactical environments. SIPRNET tokens, unlike the CAC, can be reused by being reissued to new users. Testing did not address impacts to reliability caused by token reuse.
- Token reliability has improved significantly since the FY10 Operational Assessment. During the IOT&E, the PKI PMO issued 17,194 tokens over a seven month span with only 58 token failures reported, meeting the reliability requirement that 91 percent of tokens will last for at least three years.
- The IOT&E was adequate to make an assessment and was conducted in accordance with the DOT&E-approved test plan.
- The interim logistics process was evaluated and accepted for the distribution of 85,000 tokens.
- The IOT&E exposed significant logistics hurdles due to undefined processes for procuring, distributing, and tracking tokens. The DMDC, which currently handles the CAC processes on the NIPRNET, will take on similar responsibilities for the SIPRNET in 3QFY12 to mitigate these deficiencies. However, detailed plans including assignment of roles and responsibilities and the establishment of token distribution sites are yet undefined.
- Currently, the military Services' and Agencies' token distribution processes are not well-defined and may lead to reduced overall network security and the Services being unable to meet the OSD requirement of having tokens deployed for all SIPRNET account holders by the end of CY12. The affect of IA deficiencies is that SIPRNET users will be required to use multiple passwords for authentication to gain system access instead of the streamlined PKI access to the network and public/private key-enabled capabilities.
- Penetration testing examined PKI to assess Prevent, Detect, React, and Restore system capabilities and procedures and indicated that NIPRNET PKI is secure with some minor limitations, including physical vulnerabilities and detection shortfalls. SIPRNET PKI penetration testing results are classified.
- Middleware patching and software upgrading processes were insufficiently documented to be adequately tested at IOT&E, which affects PKI system security and supportability.
- Overall, the PKI system and technical capabilities are sound, but the SIPRNET standard operating procedures, training, logistical support, lifecycle sustainment, and continuity of operations planning lack maturity and documentation. Once these supporting infrastructures and documentation are defined and established, user and system administrator-level training can be adequately accomplished for the system to properly and securely operate.
- The SIPRNET PKI system load balancing and failover capabilities, processes, and documentation need refinement. These capabilities are critical for proper operation within the GIG and will affect the overall system performance and restoral abilities in the event of problems at the DECCs in Chambersburg, Pennsylvania, and Oklahoma City, Oklahoma.
- Operational testing did not identify any significant problems that were missed by developmental testing nor were there preexisting developmental testing problems that will preclude PKI Increment 2 from moving forward.

Recommendations

- Status of Previous Recommendations. The PKI PMO satisfactorily addressed one of two recommendations from the FY10 annual report for Increment 2, Spirals 1 and 2. The recommendation concerning correction of physical security vulnerability at Letterkenny Army Depot remains.
- FY11 Recommendations.
  1. Additional testing, post IOT&E should assess system scalability as the user population continues to grow. The PMO should complete a life cycle sustainment plan and define the role of the DMDC in future sustainment. Prior to procurement of additional tokens, DOT&E recommends additional tests to assess the effectiveness and suitability of the DMDC supportability and sustainment processes. The PMO should update and build upon the life cycle sustainment plan and develop a logistical support concept of operations to clarify Agencies' and Services' roles and responsibilities.
  2. The DoD Chief Information Officer, U.S. Cyber Command, PMO, and the Services should work closely together to develop the necessary policies, processes, and procedures to increase the ability to accountably distribute tokens to end users.
  3. The PMO should provide a written continuity of operations plan and ensure the alternate SIPRNET site is operational and that load balancing and automated system failover capabilities are in place and tested as part of future T&E events.
  4. The PMO should provide refined PKI standard operating procedures, training, and system documentation for users, helpdesk personnel, and system administrators.
  5. The PMO should fully develop and document PKI middleware patching and upgrading processes to ensure the system is able to be maintained and secured.
  6. Testing is needed to assess sustainability of tokens in all operating environments, including tactical environments. Further testing is needed to establish bounds for token reuse and to assess impacts to reliability from reissuing tokens to users.
  7. Overly aggressive testing event dates waste critical test resources for assessing PKI capabilities that are not ready to be assessed. The PMO should work to establish a more realistic timeline for future PKI development, capability testing, and milestone decisions, while managing expectations of those with PKI equities.

Army Programs

Network Integration Evaluation (NIE)

In June and July 2011, the Army executed the Network Integration Evaluation (NIE) 11.2 at Fort Bliss, Texas, and White Sands Missile Range, New Mexico. The Army intends the NIE to be the first in a series of similar events to be conducted over the next several years. The purpose of the NIE is to provide a venue for operational testing of Army acquisition programs, with a particular focus on the integrated testing of programs related to tactical mission command networks. Additionally, the NIEs are intended to serve as a venue for evaluating emerging capabilities that are not formal acquisition programs.

The intended objective of the NIE to test and evaluate network components together in a combined event is sound. The NIE events should allow for a more comprehensive evaluation of an integrated mission command network instead of piecemeal evaluations of individual network components. In theory, NIEs offer the opportunity to reduce overall T&E costs by combining test events. Conducting NIEs two times a year creates an opportunity for "event-driven" operational testing as opposed to "schedule-driven" testing. For example, if a system was not developmentally ready to enter operational testing at one NIE event, it would have additional opportunities to enter testing in a subsequent NIE.

The NIE 11.2 offered a first look at the Army's NIE concept. This large-scale event employed a Brigade Combat Team as the test unit operating over a six-week period. During the NIE, four acquisition systems underwent Limited User Tests (LUT):

- Joint Tactical Radio System (JTRS) Handheld, Manpack, and Small Form Fit (HMS) – Manpack (MP) Radio
- Force XXI Battle Command Brigade and Below Joint Capability Requirement
- Spider XM7 Network Command Munition
- Network Integration Kit

Additionally, JTRS Ground Mobile Radio underwent a Customer Test during NIE 11.2, and the Army conducted evaluations of 25 additional systems in various stages of development. These systems, which the Army has termed "systems under evaluation" (SUEs), are not formal acquisition programs of record, but rather systems that may offer value for future development.

NIE ASSESSMENT

Test Design. The Brigade Modernization Command in conjunction with the Army Test and Evaluation Command's (ATEC) Operational Test Command developed realistic, well-designed operational scenarios for use during the NIE.

Test Unit. Having a dedicated test unit, 2nd Brigade, 1st Armored Division, stationed at Fort Bliss,Texas, makes the planning and execution of the complex NIE much easier and more effective than would otherwise be the case.

Schedule-Driven Programs. The Army remains schedule-driven. In NIE 11.2, the Army proceeded to the LUT for the JTRS HMS-MP even though the program did not complete planned developmental testing prior to the LUT. JTRS HMS-MP was not at an adequate level of maturity to benefit from operational testing, but the Army proceeded nevertheless. As a result, little new was learned about JTRS HMS-MP performance and unnecessary test costs were incurred. The JTRS Ground Mobile Radio LUT was downgraded to a Customer Test due to the program's Nunn-McCurdy breach, and executed with poor results due to insufficient time to fix problems identified previously.

Test Cost. It is not evident that NIEs will reduce test costs. Reportedly, NIE 11.2 cost $67 Million. By comparison, the Early Infantry Brigade Combat Team (E-IBCT) LUT 09, consisting of six individual systems and the E-IBCT LUT 10 with five systems, cost approximately $10.3 Million and $12.3 Million respectively. Most operational tests do not require putting an entire brigade combat team in the field, as was the case in NIE 11.2. Much of the NIE 11.2 costs can be attributed to the 25 SUEs that the Army chose to assess at this venue in conjunction with the LUTs conducted for the programs of record. Whether the knowledge gained of the SUEs justified the NIE's overall cost is unclear.

Redundant Systems. The NIE 11.2 would have benefited from clearly defined event objectives that would have served to focus the Army's evaluation effort. The network established for NIE 11.2 contained a mixture of Modified Table of Organization and Equipment systems, Theater Provided Equipment, and developmental systems. Many of these systems provided redundant communications capabilities and it was not apparent what the structure of the baseline network was intended to be, nor was it apparent what network structure the Army was seeking to evaluate. The presence of these redundant communications systems altered the expected usage and mission profiles of the systems that were under test, complicating the evaluations.

Too Many Systems. The Army should be cautious about inserting too many untried, experimental systems into the NIEs. The 25 SUEs contained in the NIE 11.2 stressed the Army's evaluation capacity. Too many systems in an event create problems with data collection, to include collecting useful reliability data, and instrumentation, detracting from the

Army's capability to perform focused evaluations. Additionally, having too many systems in an event will exceed the test unit's capacity to integrate and train Soldiers on new devices. It also complicates evaluation by not establishing a clear baseline of network structure and performance from which to measure improvement.

Mobile Operations. Future NIEs should expand the range of operational scenarios to include mobile battalion and brigade operations. In the NIE 11.2, brigade and battalion tactical operations centers and company command posts operated from fixed sites and were dependent upon a fixed aerial tier of 100-foot towers and aerostats in order to establish network connectivity. In future events, the Army should place a greater emphasis on scenarios that require mission command-on-the-move and the establishment and maintenance of mobile, ad hoc networks. Both of these are desired Army network characteristics that have not been demonstrated to date.

Threat Information Operations. In NIE 11.2, the Army took some positive steps in integrating threat information operations, such as electronic warfare and computer network operations, into operational testing. The Army should build upon these efforts, incorporate lessons learned, and ensure that future network operational testing contains a robust information operations opposing force.

NIE Management. The Army has established an NIE leadership and governance structure, which they call the TRIAD, consisting of a co-equal partnership between ATEC, Training and Doctrine Command, and the Army acquisition community. ATEC's participation in this structure raises concerns with the TRIAD's potential to compromise ATEC's mission to serve as the independent tester and evaluator for Army acquisition programs. There was at least the appearance during NIE 11.2 that agencies other than ATEC were making test design and execution decisions that ATEC should have been making. This problem could become significant in future events in which program of record systems are conducting Initial Operational Tests embedded in the NIE.

Apache Block III (AB3) Upgrade

Executive Summary

- In September 2010, the USD(AT&L) granted Milestone C approval permitting low-rate initial production of the first 51 remanufactured Apache Block III (AB3) aircraft.
- In response to deficiencies noted during the November 2009 Limited User Test (LUT), the AB3 program redesigned and retested the Integrated Helmet and Display Sight System (IHADSS) and made software corrections.
- The Army continued developmental testing of subsystems including the AB3 transmission and drive system, the Modernized Targeting Acquisition Designation Sight (M-TADS), voice communication and navigation subsystems, IHADSS, Fire Control Radar (FCR), and the rocket and gun systems.
- The program continues to collect, report, track, and score reliability, availability, and maintainability data and pursue corrective actions to improve reliability.
- The Army has begun interoperability flight testing between the AB3 and the Gray Eagle unmanned aircraft system (UAS).
- The Army Research Lab completed all ballistic tests in accordance with the AB3 Alternative LFT&E Strategy. Analysis of data is ongoing and a vulnerability assessment is scheduled to be completed by 2QFY12.

System

- The AB3 is a modernized version of the AH-64D Attack Helicopter that is intended to sustain the Apache fleet through the year 2040. The Army intends to organize the AB3 in Attack/Reconnaissance Battalions assigned to the Combat Aviation Brigades. Each Battalion will have 24 aircraft.
- The Army acquisition objective is 690 AB3 aircraft: 634 remanufactured and 56 new builds.
- The AB3 aircraft increase in capability includes:
  - Level 2 through 4 UAS control
    - Level 2 receives UAS video feed
    - Level 3 controls the UAS sensor
    - Level 4 controls the sensor and flight of the UAS
  - Improved Radar Electronic Unit to provide radio frequency interferometer passive ranging, extended fire control radar range, and maritime targeting capability
  - 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, which includes satellite communication and Link 16 datalink, and an integrated communication suite to meet global air traffic management requirements
  - 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 types of 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 USD(AT&L) granted Milestone C approval in September 2010 permitting low-rate initial production of the first 51 remanufactured aircraft. The Army inducted the first airframe in March 2011 and the program expects to complete the first fully-assembled production AB3 aircraft in October 2011.

- Following the November 2009 DOT&E-approved LUT, the program continued developmental testing with two fully-configured AB3 prototype aircraft and one Improved Drive System-configured aircraft used for performance and flight maneuvers testing. As of September 30, 2011, the AB3 program completed 1,587 developmental flight test hours. IOT&E is scheduled for April 2012.
- In response to deficiencies noted during the LUT, the program redesigned the IHADSS helmet to improve its fit and functionality, and has made software corrections to make it easier to adjust radio squelch, provide feedback to the pilot while changing radio frequencies, simplify UAS linkup procedures, and achieve compliance with interoperability standards.
- Developmental testing completed since the LUT included:
  - Laser designation and rangefinder accuracy and boresight retention testing of the M-TADS
  - Characterization and vibration analysis of the 30 mm gun
  - Ground and flight testing of the voice communication and navigation subsystems
  - Pilot evaluation of the IHADSS
  - Flight testing of the covert lighting system and flight performance and handling qualities evaluation
  - Endurance qualification and oil-out testing of the AB3 transmission and drive train
  - Regression testing of the FCR
  - Accuracy and verification testing of the rocket system
- The AB3 program conducted a Logistics Demonstration from January to March 2011 at the Boeing facilities in Mesa, Arizona.
- The program continues to collect, report, track, and score reliability, availability, and maintainability data and pursue corrective actions to improve reliability.
- In March and July 2011, the Army conducted manned-unmanned teaming exercises at El Mirage, California, to assess AB3 interoperability with the Gray Eagle unmanned aircraft and the One-System Ground Control Station.
- In August 2011, the Army collected infrared and ultraviolet signature measurements of the AB3 in-flight at Redstone Arsenal, Alabama. This data will be used to evaluate AB3 survivability against man-portable infrared air defense systems.
- The Army Research Lab completed all ballistic tests in accordance with the DOT&E-approved AB3 Alternative LFT&E Strategy. This included system-level dynamic and subsystem-level static shots against the drive system and the composite main rotor blades, and static shots against the redesigned crew armor.

Assessment

- The AB3 demonstrated compliance with all of the flight performance thresholds with the exception of Hover Out-of-Ground Effect. The Hover Out-of-Ground Effect capability met 99 percent of the performance requirement. The 1 percent shortfall should have little operational impact.
- During flight testing, pilots discovered that the M-TADS video vibrates excessively during certain flight regimes. Subsequent testing revealed that the cause of the vibration was the natural frequency of the TADS Electronics Display and Control overlays with the main rotor frequency. The Army is exploring options to correct the problem.
- The Logistics Demonstration suggests that AB3 is largely supportable with the current technical manual and tools. Maintenance personnel completed 3,282 AB3-unique maintenance tasks using the draft Interactive Electronic Technical Manual (IETM). Maintainers accepted approximately 97 percent of these tasks with minor changes for incorporation into the IETM. The program plans to retest the 101 rejected tasks in a follow-on logistics demonstration in 3QFY12.
- The Army reviewed the damage incurred during static and dynamic ballistic tests performed on the new composite main rotor blades and improved drive system components in September 2011. The Army is updating their vulnerability model by incorporating these results. The model, along with the results of ballistic and non-ballistic testing, will be used to make an overall assessment of the aircraft's vulnerability in 2QFY12.
- In Limited Verification Testing of the AB3 FCR, the radar met or exceeded 37 of 44 specification thresholds. Where the AB3 FCR did not meet thresholds, it performed as well or better than the legacy FCR.
- Interoperability testing between the AB3 and Gray Eagle unmanned aircraft is ongoing. Ground and flight testing between the Gray Eagle and AB3 programs have identified the following connectivity problems:
  - A difference in frame size of the video output from Gray Eagle (640 x 480 pixels) and the frame size expected by AB3 (720 x 480 pixels)
  - Sensor movement commands sent from AB3, when received by Gray Eagle, were inverted; when the AB3 pilot wanted the sensor to slew up it went down, and when he wanted it to slew right it went left
  - Differences in the data rate and data format between AB3 and Gray Eagle

Recommendations

- Status of Previous Recommendations. The Army continues to address all FY09 and FY10 recommendations. The results of developmental testing and the IOT&E will provide data to assess the progress in each area.
- FY11 Recommendations. The Army should:
  1. Assess the operational impact of M-TADS video vibration during the IOT&E.
  2. Resolve the connectivity problems discovered during interoperability testing between AB3 and Gray Eagle before IOT&E.

Armored Tactical Vehicles – Army

FMTV

HEMTT

HMMWV

Executive Summary
- The Army has contracted for 18,418 Family of Medium Tactical Vehicles (FMTV).
- Emerging results of combined developmental/operational testing indicate that the FMTV vehicles provide comparable mission performance relative to fielded FMTVs. The transportation unit was effective at completing local and line-haul missions.
- The FMTV vehicles demonstrated required crew protection and improved crew protection to ballistic threats relative to fielded FMTVs based on LFT&E.
- DOT&E provided a High Mobility Multipurpose Wheeled Vehicle (HMMWV) Expanded Capacity Vehicle (ECV) Family of Vehicles (FoV) LFT&E report to Congress in February 2011.
- In 3QFY11, the Army initiated the HMMWV Modernized Expanded Capacity Vehicle (MECV) program.
- The Heavy Tactical Vehicle program selected a C-kit underbody protection design for Heavy Expanded Mobility Tactical Truck (HEMTT) A4 in March 2011 after completion of underbody testing of two C-Kit designs.

System
FMTV
- The FMTV re-procurement is the fourth stage of FMTV evolution. These vehicles consist of light and medium variants intended to operate on- and off-road.
  - The Light Medium Tactical Vehicle (LMTV) transports a 5,000-pound payload and a 12,000-pound towed load.
  - The Medium Tactical Vehicle (MTV) transports a 10,000-pound payload and a 21,000-pound towed load.

HEMTT
- The HEMTT is a family of heavy tactical trucks that includes a load handling system, cargo, tanker, light equipment transporter, and wrecker vehicles.

HMMWV
- The HMMWV is a general purpose tactical wheeled vehicle with light and heavy variants.
  - The Light Variant includes the light utility, weapon carrier, and ambulance with a minimum payload of 2,600 pounds.
  - The Heavy Variant includes the heavy shelter carrier, light and heavy howitzer towing variant, and ambulance with a minimum payload of 4,550 pounds.

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

HEMTT
- The Army issues HEMTT to distribution companies and general supply sections of forward support companies of brigade support battalions. These companies deploy units to a new theater of operations, relocate units to new operating sites, establish unit areas of operations, provide supply and transport support, recover vehicles, and redeploy units to home station.

HMMWV
- The HMMWV provides highly mobile light tactical wheeled transport for command and control, troop and light cargo, medical evacuation, and weapon platforms to division and below units. This vehicle is employed throughout the entire battlefield and operates in off-road and cross-country environments.

Major Contractors
FMTV & HEMTT
- Oshkosh Corporation – Oshkosh, Wisconsin

HMMWV
- AM General – South Bend, Indiana

Activity

FMTV

- As of September 2011, the Army has contracted with Oshkosh Corporation to produce 18,419 FMTV vehicles.
- The FMTV Re-buy LMTV and MTV Cargo trucks completed a Production Verification Test (PVT) in April 2011. The PVT is ongoing for the Wrecker Variant to ensure performance, reliability, and maintainability meet the requirements of the system.
- The Army Test and Evaluation Command (ATEC) completed the FMTV developmental/operational test in June 2011 at Aberdeen Proving Ground, Maryland, in accordance with the DOT&E-approved plan. The purpose of the test was to confirm that an FMTV-equipped unit can employ the new LMTV and MTV variants to support transportation missions.
- The FMTV Re-buy LMTV Cargo trucks completed Live Fire Testing (LFT) in January 2011. The purpose of the LFT was to confirm that the Oshkosh FMTV provides the required level of crew protection.

HEMTT

- In November 2010, the Army initiated the HEMTT A4 Rapid Initiative program to develop an underbody kit called the C-Kit for improved crew protection for the wrecker and Light Equipment Transporter (LET) variants.
- The Heavy Tactical Vehicle program selected a C-Kit underbody protection design for HEMTT A4 in March 2011 after completion of underbody testing of two C-Kit designs at Aberdeen Test Center, Aberdeen, Maryland. One hundred and nine new production vehicles have the C-Kit installed and began arriving in theater in June 2011. The program will install the remainder of the 289 C-Kits on existing theater HEMTT A4 assets.

HMMWV

- DOT&E provided a HMMWV ECV FoV LFT&E report to Congress in February 2011.
- In 3QFY11, the Army initiated the HMMWV MECV program. The MECV program focus is to improve the protection, performance, and payload of the HMMWV Up-Armored fleet.
- The Army approved the MECV competitive acquisition, test, and evaluation strategy in July 2011 to provide light tactical vehicles to Air Assault units. The Army continues preparation of the MECV Request for Proposal scheduled for 1QFY12.
- DOT&E approved the M997A3 HMMWV Ambulance Test and Evaluation Master Plan. Developmental testing is ongoing.
- The Army is procuring an additional 500 HMMWV ambulance variants for the Army National Guard in support of Homeland Security missions.

Assessment

FMTV

- During PVT, the LMTV Cargo variant demonstrated 8,002 Mean Miles Between Operational Mission Failure (MMBOMF) exceeding its reliability requirement of 2,200 MMBOMF. The MTV Cargo variant demonstrated 6,669 MMBOMF, exceeding its reliability requirement of 2,000 MMBOMF.
- Emerging results of combined developmental/operational testing indicate that the FMTV Re-buy vehicles provide comparable mission performance relative to fielded FMTVs.
  - The transportation unit was effective at completing line- and local-haul missions.
  - Air conditioner failures were the one common failure mode experienced during both developmental/operational test and the PVT.
  - Several twist locks used to secure cargo to the Load Handling System failed.
  - Soldier maintainers accomplished all maintenance tasks on FMTV variants.
- The FMTV Re-buy vehicles demonstrated required crew protection and decreased crew vulnerability to ballistic threats based on LFT&E.

HEMTT

- The HEMTT A4 C-Kit is designed to work with the previously installed cab armor package known as the B-kit. The B-kit provides protection to the sides and roof of the cab. The C-Kit adds additional underbody armor, blast attenuating seats and floor mat, and upgraded steering gear.
- Based on LFT&E, the HEMTT A4 C-Kit decreases crew vulnerability to underbody threats. Testing indicates that protection levels up to some Mine Resistant Ambush Protected (MRAP) vehicle levels may be attainable.

HMMWV

- The HMMWV ECV FoV (in their respective armor configurations) decreases crew vulnerability to ballistic threats, based on LFT&E.
- Ballistic testing of early HMMWV Blast Mitigation System design indicates that achieving underbody protection equivalent to that provided by the MRAP All Terrain Vehicle (M-ATV) is feasible.

Recommendations

- Status of Previous Recommendations. The Army addressed all previous recommendations.
- FY11 Recommendations.

FMTV

1. The program should address heating, ventilation, and air conditioning failures and improve the reliability of Load Handling System twist lock failures prior to fielding FMTV.
2. The program should continue exploring additional protection against current underbody and under-wheel threats.

HMMWV

3. The program should develop the MECV Test and Evaluation Master Plan to ensure planning and resourcing of developmental, live fire, and operational testing is adequate.

Early Infantry Brigade Combat Team (E-IBCT)

Executive Summary

- The USD(AT&L) signed an Acquisition Decision Memorandum (ADM) in February 2011 that modified the Early Infantry Brigade Combat Team (E-IBCT) program. This ADM approved a continued low-rate initial production (LRIP) of one additional brigade set of the Network Integration Kit (NIK). No additional NIK procurement was authorized.
- The Army Test and Evaluation Command (ATEC) executed a NIK Limited User Test (LUT) at White Sands Missile Range, New Mexico, in June 2011 in accordance with a DOT&E-approved test plan. During the LUT, a Mine Resistant Ambush Protected (MRAP)-equipped infantry battalion with 25 NIKs executed a series of offensive, defensive, and stability missions during three 96-hour scenarios.
- Because the February 2011 E-IBCT ADM ended any further procurement of the NIK beyond one additional brigade set, the NIK program has completed its operational testing with the 2011 LUT.

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

System

- The E-IBCT program now consists of the NIK. The NIK is mounted on a tactical wheeled vehicle such as the High Mobility Multi-purpose Wheeled Vehicle or the MRAP vehicle.
- The NIK hardware components consist of:
  - Joint Tactical Radio System (JTRS) Ground Mobile Radio (GMR)
  - Integrated Computer System
  - Incremental Battle Command Extension (IBEX) (IBEX is a laptop computer system used by the operator for text chat and file transfer via the NIK)
- The JTRS GMR, as a component of the NIK, hosts the following waveforms:
  - Wideband Networking Waveform (WNW)
  - Soldier Radio Waveform (SRW)
  - Single Channel Ground and Airborne Radio System (SINCGARS)
- The NIK interfaces with the Force XXI Battle Command Brigade and Below/Blue Force Tracking (FBCB2/BFT) system.

Mission

IBCTs equipped with the NIK will perform all tactical operations (offensive, defensive, stability, and support) that are currently conducted by infantry forces. The Army intends the E-IBCT NIK to enhance brigade and below command and control capabilities.

Major Contractor

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

Activity

- The USD(AT&L) signed an ADM in February 2011 that modified the E-IBCT program. The key decisions were:
  - Approval of continued LRIP of one additional brigade set of the NIK (not to exceed 100 units). This brigade set is in addition to the brigade set purchased in the LRIP as part of the December 2009 E-IBCT Milestone C decision. No additional NIK procurement beyond these two brigade sets was authorized.
  - Termination of the Tactical and Urban Unattended Ground Sensors (T-UGS and U-UGS) and the Class 1 Unmanned Aerial System.
  - Approval of continued LRIP for two additional brigade sets of the Small Unmanned Ground Vehicle (SUGV). The Army was directed to consider any additional SUGV production decisions under a separate Army program.

- Approval for the Army to continue NIK testing to determine whether the NIK should be fielded to one Brigade Combat Team.

- The Army conducted the NIK Technical Field Test (TFT), a developmental test, in March – April 2011 at White Sands Missile Range, New Mexico. The TFT was intended to verify the correction of NIK deficiencies identified in LUT 10 conducted in September 2010.
- Army Test and Evaluation Command executed a NIK LUT at White Sands Missile Range, New Mexico, in June 2011 in accordance with a DOT&E-approved test plan. This LUT was conducted in conjunction with the larger Army Network Integration Event (NIE). During the LUT, an MRAP-equipped infantry battalion with 25 NIKs executed a series of offensive, defensive, and stability missions during three 96-hour scenarios.

Assessment

- The TFT focused on three of the most significant NIK deficiencies identified in LUT 10. The results of the TFT indicated that these three deficiencies were successfully resolved.
  - NIK SINCGARS range and voice quality were demonstrated to be comparable to legacy SINCGARS.
  - NIK "warm" start-up times were significantly improved over LUT 10 and were within the 10-minute system requirement.
  - Army Research Laboratory's Survivability/Lethality Division assessed the information assurance vulnerabilities identified in the LUT 10 to have been fixed.
- The TFT also examined NIK mobile network capability, including network re-join times, message completion rates (MCRs), and message latency. During the TFT, the NIK network demonstrated re-join times and message latencies within requirements and a satisfactory MCR of over 90 percent.
- During the 2011 LUT, the NIK provided the test unit two basic operational capabilities: tactical voice communications via the SINCGARS waveform and the capability for chat and file transfer among NIKs via WNW using the IBEX as the input device. Key findings from the 2011 LUT were:
  - Overall, the NIK had little impact on the test unit's ability to execute its assigned missions. The NIK did not provide any additional new capability of sufficient usefulness to have an effect upon battalion operations.
  - The NIK demonstrated little usefulness at the company-level and below. The NIK data network was rarely used at these echelons. At the platoon-level, where 20 of the 25 battalion's NIKs were to be found, the NIK was of little or no value, if not an actual hindrance to platoon operations.
  - The IBEX file transfer capability was useful in sharing relevant mission command files such as operations orders and intelligence products between the battalion tactical operations center and the company command posts.
  - SINCGARS range and voice quality and system start-up times and procedures were satisfactory.
  - The NIK met its reliability requirements, demonstrating a Mean Time Between System Abort of 890 hours versus a requirement of 112 hours and a Mean Time Between Essential Function Failure of 89 hours versus a requirement of 37 hours.
  - The capability of NIKs to form an effective mobile, ad hoc network was not addressed in this LUT. NIK's operated predominately from stationary sites and relied primarily on fixed relay towers to establish communications connectivity, negating the need to establish a mobile, ad hoc network.
- Because the February 2011 E-IBCT ADM ended any further procurement of the NIK beyond one additional brigade set, the NIK program has completed its operational testing with the 2011 LUT. Subsequent to the 2011 LUT, the Army made the decision not to purchase the additional brigade set authorized in the E-IBCT ADM. Furthermore, in October 2011, the DoD decided to cancel the GMR program, the radio component of the NIK. The NIKs, which have already been purchased by the Army, may have some value as a test asset for future development of the Army's desired WNW tactical network.

Recommendations

- Status of Previous Recommendations. The NIK program fixed the NIK problems identified in LUT 10. However as a result of the February 2011 ADM, there is no longer a requirement for further NIK operational testing.
- FY11 Recommendations. None.

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

Executive Summary

Quick Reaction Capability (QRC) AN/TPQ-53 Radar

- The Army is developing and fielding 38 Quick Reaction Capability (QRC) radars to support an Urgent Materiel Release. Fielding began in 2010 with 10 systems operating in Iraq and Afghanistan. The Army contracted with Lockheed Martin Missile Systems and Sensors to build 32 QRC radars, and plans to purchase the remaining 6 QRC radars from a yet to be selected Program of Record vendor. The Army designated the QRC system as the AN/TPQ-53 radar in September 2011.
- The Army conducted three QRC AN/TPQ-53 radar test events at Yuma Proving Ground, Arizona, in October 2010, January 2011, and June 2011. Testing focused on acquiring threat rocket, artillery, mortar fires, and the radar's integration with the Counter Rocket, Artillery, and Mortar (CRAM) system.
- During testing in January 2011 at Yuma Proving Ground, the QRC AN/TPQ-53 radars under test acquired, tracked, and provided accurate locations of most rocket, artillery, and mortar systems. The radar has difficulty detecting certain types of rockets and artillery rounds.

Program of Record EQ-36 Radar

- In August 2011, the Army released to industry the EQ-36 radar Program of Record low-rate production Request for Proposal (RFP) contract as part of the Source Selection Evaluation Board process.
- The Army will select a contractor to produce 136 Program of Record EQ-36 radars based on the results of a Source Selection Evaluation Board in FY12.

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 sector search.
- The radar provides target location of threat indirect fire systems with sufficient accuracy for effective counterfire.
- The EQ-36 is designed to operate with the CRAM system and the future Indirect Fire Protection Capability System.
- The Army intends to field the EQ-36 radar to the sensor platoons in Brigade Combat Teams and Fire Brigades to replace the current AN/TPQ-36 and AN/TPQ-37 Firefinder Radars.

- The EQ-36 is operated by a crew of four Soldiers and transportable by C-17 aircraft, with battlefield mobility provided by two Family of Medium Tactical Vehicle trucks.
- The Army is developing and fielding 38 QRC radars to support an Urgent Material Release. Fielding began in 2010 with 10 systems operating in Iraq and Afghanistan. The Army contracted with Lockheed Martin Missile Systems and Sensors to build 32 QRC radars and plans to purchase the remaining 6 QRC radars from a yet to be selected Program of Record vendor. The Army designated the QRC systems as the AN/TPQ-53 radar in September 2011.
- The Army will select a contractor to produce 136 Program of Record EQ-36 radars based on the results of a Source Selection Evaluation Board in FY12.

Mission

Field Artillery units protect friendly forces by employing the EQ-36 radar to determine timely and accurate location of threat rocket, artillery, and mortars systems for defeat with counterfire engagements. Air Defense Artillery units will use the EQ-36 radar integrated into the CRAM and Indirect Fire Protection Capability System to warn friendly forces and to engage incoming threat indirect fires.

Major Contractors

- QRC AN/TPQ-53 Radar: Lockheed Martin Missile Systems and Sensors – Syracuse, New York
- EQ-36 Radar: The Army will select the Program of Record EQ-36 radar contractor in FY12.

Activity

Quick Reaction Capability (QRC) AN/TPQ-53 Radar

- The Army completed initial fielding of 12 QRC AN/TPQ-53 radars in July 2011. The Army plans to field the remaining QRC AN/TPQ-53 radars FY12-14.
- The Army conducted three QRC AN/TPQ-53 radar test events at Yuma Proving Ground, Arizona, in October 2010, January 2011, and June 2011. Testing focused on acquiring threat rocket, artillery, and mortar fires and the radar's integration with the CRAM system.

Program of Record EQ-36 Radar

- In August 2011, the Army released to industry the RFP for the EQ-36 radar Program of Record low-rate production contract as part of the Source Selection Evaluation Board process.
- The Source Selection Evaluation Board process includes a Live Ammunition System Demonstration (LASD) at Yuma Proving Ground, Arizona, which began in September 2011. The EQ-36 Program of Record RFP contract solicited vendor participation in the LASD requesting contractor-operated systems for evaluation.
- During the LASD, the program tested the operational, live fire acquisition, and communication capabilities of the participating systems against the full system requirements. Army radar subject matter experts from the Fires Center of Excellence, Fort Sill, Oklahoma, monitored each system during testing and provided their observations to the Source Selection Evaluation Board.
- The LASD will support the first low-rate initial production decision of the EQ-36 Program of Record Radars. DOT&E will report on the LASD results to support the Milestone C update decision scheduled for 2QFY12.

Assessment

- Based on radar testing at Yuma Proving Ground and Army reporting from theater to date, radar reliability remains poor and is well below system requirements. The QRC AN/TPQ-53 radar is demonstrating one system abort every 30 hours; the Program of Record requirement is one system abort every 185 hours.
- During testing in January 2011 at Yuma Proving Ground, the QRC AN/TPQ-53 radars under test acquired, tracked, and provided accurate locations of most rocket, artillery, and mortars systems. The radar has difficulty detecting certain types of rockets and artillery rounds.
- Using updated software, the QRC AN/TPQ-53 radar demonstrated improvements in reducing the rate of misclassifying aircraft as threat projectiles in the 90-degree and 360-degree modes.
- During June 2011 testing, the QRC AN/TPQ-53 radar decreased the rate of false location reporting in which the system reports detecting a threat projectile when no projectiles had actually been fired. The radar's misclassifying and false location reporting rates remain below the Program of Record requirement of one false report in 12 hours.

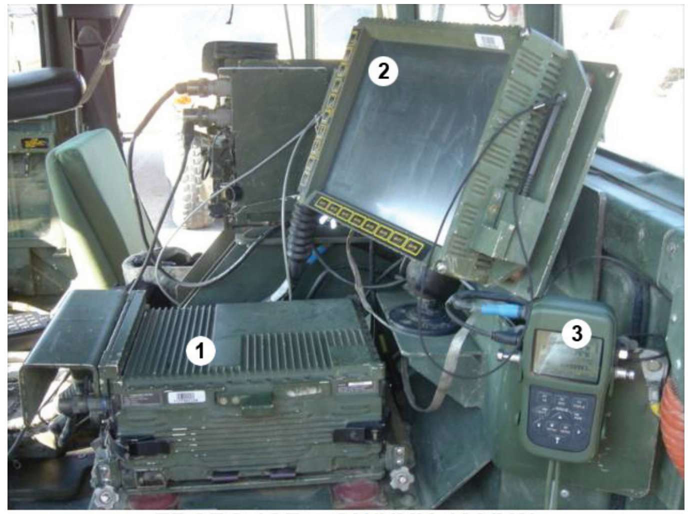
Recommendations

- Status of Previous Recommendations. The Army is satisfactorily addressing all three FY10 recommendations.
- FY11 Recommendations. The Army should:
  1. Continue testing all EQ-36 software updates.
  2. Increase dedicated reliability testing focusing on decreasing system aborts.
  3. Continue conducting operational assessments of the deployed AN/TPQ-53 radars.

Force XXI Battle Command Brigade and Below (FBCB2)
Joint Capabilities Release (JCR)/Blue Force Tracker 2 (BFT2)

Executive Summary
- In FY11, the Army and Marine Corps conducted a Limited User Test (LUT) of Force XXI Battle Command Brigade and Below (FBCB2) Joint Capabilities Release (JCR)/Blue Force Tracker 2 (BFT2). The test demonstrated the system is operationally effective for combat operations. Commanders and units experienced improved situational awareness and improved transfer of orders and graphics compared to previous versions of FBCB2/BFT1.
- During the LUT, FBCB2 JCR/BFT2 demonstrated a 275-hour Mean Time Between Essential Function Failure (MTBEFF) compared to its requirement of 700 hours. The demonstrated MTBEFF translates to a 77 percent probability of successfully completing a 72-hour mission without an essential function failure compared to the requirement of 90 percent. The reliability demonstrated during the LUT is equivalent to that of the existing deployed version of FBCB2, which Soldiers have found acceptable to support operations in Iraq and Afghanistan.
- The Army conducted the FBCB2 JCR/BFT2 LUT to support its planned February 2012 fielding decision.
- The FBCB2 JCR/LUT resolved 11 of the 12 performance and reliability deficiencies described in DOT&E’s 2004 Beyond Low-Rate Initial Production (BLRIP) report. Reliability remains as the only unresolved problem.
- The LUT highlighted interoperability problems with the terrestrial line-of-sight Enhanced Position Location Reporting System (EPLRS) versions of FBCB2. The versions that use satellite communications performed well.

System
- FBCB2 JCR is a networked battle command information system that enables units to share near-real-time friendly and enemy situational awareness information, operational maps and graphics, and command and control (C2) messages.
- FBCB2 JCR/BFT2 is a technology upgrade from FBCB2/BFT to provide improved capability and ensure interoperability between Army and Marine Corps forces. The improvements include updated computer hardware and software, improved satellite connectivity, and the addition of communications security (COMSEC) devices.



FBCB2 JCR – AN/UYK-128(V3)
1 - JV5 Computer
2 - Display
3 - Global Positioning System Device

- FBCB2 JCR is fielded in both mobile and command post versions. It is supported by the following transmission means:
  - BFT2 – satellite support for mobile operations
  - EPLRS – terrestrial radio support for mobile operations
  - Tactical Internet – network support for command post operations

Mission
- Army and Marine Corps commanders use FBCB2 JCR/BFT2 to provide integrated, on-the-move, near-real-time battle command information and situational awareness from brigade to maneuver platform.
- Units employ FBCB2 JCR/BFT2 to gain near-real-time situational awareness and C2 capability intended to assist in the accomplishment of their combat missions.

Major Contractor
Northrop Grumman, Information Systems – McLean, Virginia

Activity
- In 2004, the Defense Acquisition Executive approved an FBCB2 full-rate production decision. The DOT&E BLRIP report highlighted a need for additional operational testing to address 12 performance and reliability deficiencies.
- In 2006, the Joint Requirements Oversight Council approved the requirement to upgrade FBCB2 to a JCR version that would ensure interoperability between the Army and Marine Corps.

- During FY11, the Army conducted three developmental tests on versions of FBCB2 JCR and BFT2.
- In December 2010, the Army and Marine Corps conducted a combined Customer Test/Field User Evaluation to test FBCB2/BFT performance and interoperability when used by the 11th Armored Cavalry Regiment at the National Training Center, California, and the 1st Marine Regiment at Camp Pendleton, California.
- In June — July 2011, as part of the Network Integration Evaluation (NIE), the Army conducted an FBCB2/BFT2 LUT to support a planned February 2012 Army fielding decision. The NIE tested an FBCB2/BFT2 network with elements from:
  - 2nd Brigade, 1st Armored Division, White Sands Missile Range, New Mexico
  - Marine Corps Battalion, Camp Pendleton, California
  - Simulated Corps command post, Fort Hood, Texas
  - Aviation Systems Integration Laboratory, Huntsville, Alabama
- The Army is planning a developmental test in October 2011 to assess actions taken to correct deficiencies highlighted during the FY11 FBCB2 JCR/BFT2 LUT.
- The Army is planning a formal logistics demonstration for November 2011.

Assessment

- The Army's developmental testing demonstrated FBCB2 JCR/BFT2's capability to interoperate between the Army and Marine Corps, employ communications security, and utilize the increased bandwidth of BFT2.
- During the LUT, FBCB2 JCR/BFT2 did not meet its reliability requirement and demonstrated a 275-hour MTBEFF point estimate compared to its MTBEFF requirement of 700 hours. The point estimate translates to a 77 percent probability of successfully completing a 72-hour mission without an essential function failure compared to the requirement of 90 percent.
- The FBCB2 JCR/BFT2 LUT demonstrated the system is operationally effective for combat operations. Soldiers and Marines using the system experienced:
  - Improved situational awareness of friendly and enemy forces compared to previous versions of FBCB2
  - Improved ability to transfer orders and operational graphics compared to previous versions of FBCB2
  - Command and control communications exceeding the range of terrestrial combat net radio
  - Interoperability between Army and Marine Corps forces using BFT2
  - Interoperability with previous versions of FBCB2 supported by BFT1
  - Satisfactory employment of the new communications security
- The FBCB2 JCR/BFT2 LUT highlighted the following deficiencies:
  - Less than required reliability
  - Situational awareness "fading," which would freeze display icons for 30 seconds to 5 minutes
  - New Equipment Training was not adequate to train new FBCB2 operators
  - All versions of FBCB2 supported by line-of-sight EPLRS radios demonstrated poor interoperability
- The FBCB2 JCR/BFT2 LUT resolved 11 of the 12 deficiencies noted in the 2004 BLRIP report. Reliability remains unresolved. Nonetheless, the demonstrated reliability is equivalent to that of the existing deployed version of FBCB2, which Soldiers have found adequate to support combat operations.

Recommendations

- Status of Previous Recommendations. There are no previous recommendations.
- FY11 Recommendations. The Army should:
  1. Improve FBCB2 JCR/BFT2 reliability, fix FBCB2 JCR software (situational awareness fading), and improve New Equipment Training.
  2. Determine the future requirements of EPLRS and FBCB2 JCR. If the Army should determine the need for EPLRS supported FBCB2 JCR, the Army will need to conduct operational testing of FBCB2 JCR/EPLRS to support a fielding decision.

Global Combat Support System – Army (GCSS-A)

Executive Summary

- The Army Test and Evaluation Command (ATEC) completed a Limited User Test (LUT) on Release 1.1 during September and October 2010. Based on the LUT results, DOT&E assessed Global Combat Support System – Army (GCSS-A) as sufficiently effective and suitable to enter into the production and deployment phase. Primary areas of concern from the LUT were lack of full compliance with Federal Financial Management Information Act (FFMIA) and system responsiveness. Corrective actions have been implemented by the Program Management Office (PMO) to address these deficiencies.
- An IOT&E is scheduled to be conducted in October 2011.

System

- The GCSS-A is an information technology system made up of commercial off-the-shelf and non-developmental software and server hardware.
- The core functionality of the GCSS-A comes from the adaptation of a commercially-available Enterprise Resource Planning (ERP) system. The ERP system integrates internal and external management information across an entire organization, including finance/accounting, manufacturing, sales and service, and customer relationship management, and automates this activity with an integrated software application.
- The hardware component of GCSS-A is limited to the production server at Redstone, Alabama, and Continuity of Operation (COOP) server at Radford, Virginia.
- The GCSS-A program includes the Army Enterprise Systems Integration Program (AESIP) that provides the enterprise hub services, centralized master data management, and cross functional business intelligence and analytics for the Army ERP solutions, including the General Fund Enterprise Business System (GFEBS) and Logistics Modernization Program (LMP).

Mission

Army logisticians will use this system to access information and exchange operational logistics data related to tactical maintenance, materiel management, property accountability, tactical financial management, and logistics planning.

Major Contractors

- ERP Solution Component: Northrop Grumman Space and Mission Systems Corporation – Carson, California
- AESIP component: Computer Sciences Corporation – Falls Church, Virginia

Activity

- ATEC completed a LUT of Release 1.1 from September 1 to October 29, 2010, with 11th Armored Cavalry Regiment (ACR), Fort Irwin, California, in accordance with the DOT&E-approved test plan.
- An IOT&E is scheduled to be conducted on GCSS-A in October 2011. ATEC will conduct the test on the 2nd Heavy Brigade Combat Team/1st Armored Division, Fort Bliss, Texas. The IOT&E will provide information for a Full Deployment Decision. The IOT&E will use live data with representative users conducting day-to-day live operations at their unit locations (both garrison and field).

Assessment

- Based on the LUT results, DOT&E assessed GCSS-A Release 1.1 as sufficiently effective to enter into the production and deployment phase. Two areas of concern identified during the LUT were financial compliance and system responsiveness.
  - The 1996 FFMIA requires agencies to implement systems by complying with Federal accounting standards, the U.S. Standard General Ledger at the transaction level, and Federal financial management systems requirements. The Army Audit Agency (AAA) released a report on October 29, 2010, that found GCSS-A did not demonstrate

the applicable compliance with the FFMIA, and recommended the compliance be demonstrated before the Milestone C decision. Upon further review, AAA determined that the system was not required to be fully compliant until full fielding. The PMO and the AAA have a plan of action to accomplish this compliance.
  - GCSS-A users in a tactical environment are expected to use the Very Small Aperture Terminal (VSAT) satellite communication. The LUT user surveys indicate that GCSS-A experienced long delays and time-outs over the VSAT connection. The PMO took corrective actions to address the bandwidth challenges and follow-on surveys show a marked improvement in system responsiveness. IOT&E will include verification that GCSS-A can perform effectively via VSAT in tactical environments.
- The system was not required to have fully mature tactics, techniques, and procedures, training, logistics support, and reliability before Milestone C. Results of the LUT indicate that the risk to enter IOT&E is manageable.
- U.S. Army Research Laboratory, Survivability/Lethality Analysis Division conducted an information assurance vulnerability evaluation June through August 2010, and the Threat Systems Management Office completed a penetration test in October 2010. The program office completed a limited COOP demonstration on November 18, 2010. Some vulnerabilities were found on the GCSS-A's ability to protect and detect, with immediate action taken by the PMOs to resolve. Additional penetration and COOP testing will be conducted in support of the IOT&E to verify the resolution.

Recommendations
- Status of Previous Recommendations. This is the first annual report for this program.
- FY11 Recommendations. None.

Joint Lightweight Tactical Vehicle (JLTV)

Executive Summary

- Joint Lightweight Tactical Vehicle (JLTV) prototype vehicles built by three vendors have completed the Technology Development (TD) phase. These TD vendors may be selected to participate in the Engineering and Manufacturing Development phase.
- The JLTV Milestone B decision is planned for 3QFY12.
- During TD testing, all vendor vehicles experienced difficulty with mobility in soft soil due to vehicle weight and other vehicle design factors. In the TD, the reliability of vendor vehicles demonstrated between 71 to 902 Mean Miles Between Operational Mission Failure (MMBOMF) versus the required 3,600 MMBOMF.
- The Army increased the underbody threat requirement during TD to be equivalent to the protection provided by the all terrain version of the Mine Resistant Ambush Protected (MRAP) vehicle. The ability to achieve the increased level of protection while also satisfying other JLTV requirements is not known.

System

- The JLTV Family of Vehicles (FoV) is the Marine and Army partial replacement for the High Mobility Multi-purpose Wheeled Vehicle (HMMWV). The program intends JLTV to provide increased crew protection against IED attacks, improved mobility, and higher reliability than the HMMWV.
- The JLTV FoV consists of two vehicle categories. The JLTV Combat Tactical Vehicle (CTV) is designed to seat four passengers. The JLTV Combat Support Vehicle is designed to seat two passengers.
- The JLTV Combat Tactical Vehicle (CTV) has a 3,500-pound payload and five variants:
  - Close Combat Weapons Vehicle
  - Special Purpose Vehicle
  - Command and Control on the Move Vehicle
  - General Purpose Vehicle
  - Heavy Guns Carrier Vehicle
- The JLTV Combat Support Vehicle Variant has a 5,100-pound payload and two variants:
  - Utility Prime Mover
  - Shelter Carrier
- The JLTV program initiated a competitive prototyping approach before procuring vehicles in order to reduce risks in the integration of the technology, improve design, reduce cost, and gain knowledge of prototype capabilities.

JLTV
Notional Combat Tactical Vehicle

JLTV
Notional Combat Support Vehicle

Mission

- Military units will employ JLTV as a light tactical wheeled vehicle to support all types of military operations. JLTVs will be used by airborne, air assault, light, Stryker, and heavy forces as reconnaissance, maneuver, maneuver sustainment, and command and control platforms.
- Small ground combat units will employ JLTV in combat patrols, raids, long-range reconnaissance, and convoy escort.

Major Contractors

Technical Phase

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

Activity

- Three vendor JLTV prototype vehicles have completed the TD phase of program. These TD vendors may or may not participate in the next program phase. The JLTV Engineering Manufacturing Design phase will be an open competition to selected vendors to produce prototypes.
- JLTV vendors vehicles conducted endurance testing at Montegetta Proving Ground, Australia, and Aberdeen Test Center, Maryland, to demonstrate reliability and maintainability.
- The program completed a JLTV User Demo in March 2011 at Aberdeen Proving Ground, Maryland. The User Demo focused on the suitability of JLTV to conduct crew and individual mission tasks.
- The program completed TD ballistic testing in June 2011 at Aberdeen Proving Ground, Maryland, to assess the capability of the JLTV to meet Force Protection requirements.
- The JLTV Milestone B decision is planned for 3QFY12.

Assessment

- During TD testing, all vendor vehicles experienced difficulty with mobility in soft soil due to vehicle weight and other vehicle design factors. In the TD, the reliability of vendor vehicles demonstrated between 71 to 902 Mean Miles Between Operational Mission Failure (MMBOMF) versus the required 3,600 MMBOMF.
- All three JLTV vendor vehicles had problems demonstrating functionality of government furnished command, control, and communication equipment in vehicles.
- The JLTV vehicle-unique safety problems limited execution of the JLTV User Demo to assess ingress/egress, coupling and uncoupling of the trailer and vehicles, and performing the gunner drills.
- The JLTV payload deficiencies affected Soldier and Marine employment of the vehicle in the JLTV User Demonstration. Lack of adequate storage space for ammunition, restricted visibility due to small windows, positioning of window panels, and uncomfortable seats with poor seating arrangements were common problems between vendor prototypes and variants.
- Based on ballistic testing, the TD Force Protection requirements are achievable.
- The Army increased the underbody threat requirement during TD to be equivalent to the protection provided by the all terrain version of the MRAP vehicle. The ability to achieve the increased level of protection while also satisfying other JLTV requirements is not known.

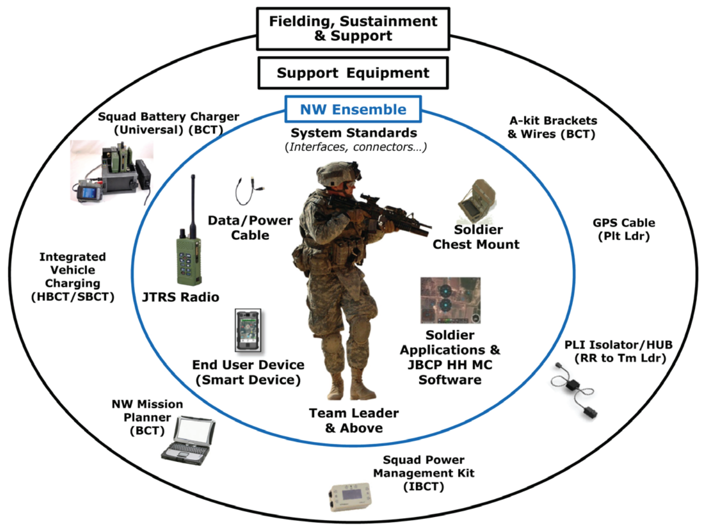
Recommendations

- Status of Previous Recommendations. The Army addressed all previous recommendations.
- FY11 Recommendations. The program should:
  1. Capitalize on the lessons learned from the JLTV TD testing to update the Engineering and Manufacturing Development Reliability, Availability, and Maintainability Growth Plan.
  2. Submit a Test and Evaluation Master Plan to support the Milestone B decision in 3QFY12.

Nett Warrior
(formerly Ground Soldier System)

Executive Summary

- The Army conducted the Nett Warrior Limited User Test (LUT) of three competing systems from October 18 through November 5, 2010, at Fort Riley, Kansas. DOT&E provided an operational assessment on results from the LUT on April 21, 2011.
- The Army intended to make a Milestone C decision for Nett Warrior in 2QFY11, but the decision was delayed due to program restructuring directed by the Army's Configuration Steering Board (CSB).
- The CSB de-scoped the requirements to allow for the integration of a small End-User Device (EUD) based on current smart device technology. The intent is to produce a new configuration with significant weight and cost reduction.
- The de-scoping focused on system attributes such as operational temperature range (reduced), immersion in water (no longer a requirement), and electromagnetic effects (reduced). The CSB did not change any of the Key Performance Parameters in the restructuring of the program.
- The Army missed the opportunity to test the new configuration of Nett Warrior during the November 2011 Network Integration Evaluation 12.1 and prior to a Milestone C decision (now planned for 2QFY12).



BCT - Brigade Combat Team
HBCT - Heavy Brigade Combat Team
JTRS - Joint Tactical Radio System
Plt Ldr - Platoon Leader
SBCT - Stryker Brigade Combat Team
GPS - Global Positioning System
JBCP HH MC - Joint Battle Command Platform Handheld Mission Command
IBCT - Infantry Brigade Combat Team
RR - Rifleman Radio
Tm Ldr - Team Leader

System

- In June 2010, the Ground Soldier System was formally renamed "Nett Warrior" program.
- Nett Warrior 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 mission command and position location information down to the team leader level. Nett Warrior, as tested at the LUT, 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
- The new EUD version of Nett Warrior that emerged from the CSB consists of the following:
  - A small integrated EUD based on current smart device technology
    - A computer to process information and populate the display, a display to view information and allow for user interaction, and commercial GPS navigation capability
    - Government software and mission applications
  - An AN/PRC-154 Rifleman Radio transmitter/receiver from the Joint Tactical Radio System family of radios connected to an EUD to send and receive information and voice data
  - A system power source and support equipment in order to recharge the power source and provide power management in austere, underdeveloped areas
  - Support equipment for the program that includes a mission planning device for use at platoon level and above, as well as various expeditionary power generation, power storage, and power management devices for austere environments
- The program change allows the replacement of four components (military helmet-mounted head display, ruggedized keyboard, computer/navigation model, and associated batteries and cables) with a single EUD performing all the functions in a single integrated device based on a rapidly advancing commercial technology.
- Yearly Nett Warrior enhancements that will integrate improved commercial EUD technologies and other initiatives will be tested during the Army's Network Integration Evaluations.

Mission

Leaders within the Brigade Combat Team 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

- The contractors who participated in the LUT:
  - General Dynamics C4 Systems – Scottsdale, Arizona
  - Raytheon – Plano, Texas
  - Rockwell Collins – Cedar Rapids, Iowa
- Vendor selection for the EUD version of Nett Warrior is still pending. Due to the reconfiguration of the Nett Warrior System, the three contractors who were being considered were informed of the new requirements, which invalidated the old system designs.

Activity

- On April 21, 2011, DOT&E provided an operational assessment of the Nett Warrior LUT that took place October 18 to November 5, 2010. The LUT complied with the DOT&E-approved test plan.
- In June 2011, the overarching integrated project team recommended that the program proceed to Milestone C provided that voice communications are corrected so that they are understandable; light emissions from the eyepiece are corrected so positions are not given away; and weight is reduced.
- During the July 6, 2011, Army Systems Acquisition Review Council, the Vice Chief of Staff of the Army recommended that the Army conduct a CSB to validate Nett Warrior's use of an EUD that utilized smart device technology as was recommended by Soldiers who participated in Network Integration Evaluation 11.2. This caused the Milestone C decision to be postponed.
- The August 2011 Joint Requirements Oversight Council Memorandum 118-11 provided classification guidance that allowed for an EUD that utilized smart device technology.
- The August 2011 CSB endorsed the recommendation to de-scope Nett Warrior requirements. The G-3/5/7 validated these requirements on October 5, 2011.
- The de-scoping focused on system attributes such as operational temperature range (reduced), immersion in water (no longer a requirement), and electromagnetic effects (reduced). The CSB did not change any Key Performance Parameters.
- The new Nett Warrior configuration that emerged from the CSB allowed for the integration of a small EUD based on current smart device technology. This is intended to reduce weight and cost by replacing the military helmet-mounted head display, ruggedized keyboard, computer/navigation model, and associated batteries and cables.

Assessment

- The value of a Nett Warrior-like system to provide leaders needed situational awareness has been established in the LUT and in theater (e.g., three separate units deployed with legacy Land Warrior systems to Operation Iraqi Freedom and Operation Enduring Freedom between 2007-2011 in response to operational needs statements and reports that Land Warrior was a great capability in complex terrain).
- There were two Nett Warrior problems observed during the LUT that should have been corrected during developmental testing. Those problems included unclear voice communications and excessive light emissions during night time operations.
- The Army missed the opportunity to test the new configuration of Nett Warrior during the Network Integration Evaluation 12.1 in November 2011 and prior to a Milestone C decision (now planned for 2QFY12).
- Nett Warrior will undergo an information assurance test as part of IOT&E.

Recommendations

- Status of Previous Recommendations. During FY11, the Army continued to address the previous recommendations.
- FY11 Recommendations.
  1. Given that the system requirements have been de-scoped, the Army needs to provide data and evaluations for any testing that has already occurred or conduct additional testing for the de-scoped system.
  2. The Army needs to conduct information assurance testing on the de-scoped system in accordance with DoD Directive 8500.01E, DoD Instruction 8500.2, and the DOT&E Procedures for Operational Test and Evaluation of Information Assurance in Acquisition Programs (January 21, 2009).

Patriot / Medium Extended Air Defense System (MEADS)

Executive Summary

- The Army conducted one major developmental Patriot flight test mission and a Post-Deployment Build-7 (PDB-7) Developmental Test and Evaluation (DT&E) in FY11. The Army conducted three major developmental Patriot flight test missions in early FY12.
- The third guided flight of the Patriot Advanced Capability-3 (PAC-3) Missile Segment Enhancement (MSE) interceptor achieved a successful intercept of a ballistic missile target in the extended PAC-3 MSE battlespace.
- In the first three PDB-7 flight tests, Patriot achieved successful intercepts of four short-range ballistic missile targets using PAC-3 and Guidance Enhanced Missile (GEM) interceptors.

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 improved lethality.
- Earlier versions of Patriot interceptors include the Patriot Standard missile, the PAC-2 Anti-Tactical Missile (ATM), and the GEM family (includes the GEM-T and GEM-C missile variants intended to counter tactical ballistic missiles and cruise missiles, respectively).
- The Medium Extended Air Defense System (MEADS) was intended to be a more deployable, mobile, and capable air and missile defense system than Patriot. Planned MEADS developments included 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.

Major Contractors

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

Activity

Patriot

- The Army began the PDB-7 DT&E on July 27, 2011, at White Sands Missile Range (WSMR), New Mexico. Ground testing runs for record ended on October 7, 2011. Developmental endurance and flight testing is scheduled to complete in January 2012. Data analysis is ongoing.
- A third MSE missile flight test (Flight Test 7-3) was conducted at WSMR in March 2011. Patriot fired two MSE interceptors at a ballistic missile target. The first MSE intercepted the target and the second intercepted debris from the first intercept.
- During the first PDB-7 flight test (P7-4) at WSMR in November 2011, Patriot fired two PAC-3 missiles at a short-range ballistic missile target. The first PAC-3 intercepted the target. Data analysis is ongoing.

- During the second PDB-7 flight test (P7-3) at WSMR in November 2011, Patriot fired two GEM interceptors at a short-range ballistic missile target. The first GEM intercepted the target. Data analysis is ongoing.
- During the third PDB-7 flight test (P7-2) at WSMR in November 2011, Patriot fired a GEM-T and GEM-C interceptor at each of two short-range ballistic missile targets. The GEM-Ts intercepted both targets. Data analysis is ongoing.
- The Army updated the Test and Evaluation Master Plan, which DOT&E approved on September 1, 2011.
- The next Patriot operational test, the PDB-7 Limited User Test (LUT), is scheduled to begin in 3QFY12.

MEADS

- The DoD has decided not to field MEADS, although it will continue program development through the design and development phase of the program. It is unknown whether Germany or Italy will continue MEADS development after the U.S. withdraws from the program.
- Three MSE developmental flight tests are planned as part of the MEADS test program. They will contribute to future assessments of MSE capability and will support the build up to the PDB-8 IOT&E.

Assessment

- During flight test 7-3, Patriot demonstrated the capability to kill a tactical ballistic missile target with an MSE interceptor in the extended MSE battlespace. The MSE interceptor performance was consistent with preflight predictions and body-to-body impact was achieved, resulting in the destruction of the target. The system met the mission objectives.
- Based on the PDB-6.5 LUT conducted during FY10, DOT&E assesses the current Patriot system as effective against some threats and partially suitable due to poor radar reliability and system availability. There has been substantial variance in Patriot's reliability and resulting availability as observed during testing. The causes of this variance are unknown. Obstacles to adequate T&E of the Patriot PDB-6.5 system included:
  - The lack of lethality information for aircraft, cruise missile, and air-to-surface missile threats used to assess end-to-end system effectiveness.
  - The lack of representative Soldier operators during the PDB-6.5 LUT regression test of the Patriot system software that is now in the field.
  - The lack of a robust interoperability event.
  - The lack of a robust Force Development Experiment, preventing the Army from thoroughly examining tactical standard operating procedures prior to developing Patriot PDB-6.5 tactics, techniques, and procedures. As a result, the engagement procedures used during the PDB-6.5 LUT against some threats led to decreased system performance.
  - Not providing suitable time for organizational-level diagnostics and maintenance during operational performance test phases.

Recommendations

- Status of Previous Recommendations. The Army satisfactorily addressed 10 of the previous 16 open recommendations. The Army should still address the following recommendations:
  - Conduct Patriot testing during joint and coalition exercises.
  - Upgrade the Patriot hardware-in-the-loop systems to model electronic countermeasures and identification friend-or-foe systems.
  - Conduct a Patriot flight test against an anti-radiation missile target to validate models and simulations.
  - Review the risks of not conducting all flight tests against ballistic missiles using two interceptors.
  - Improve Patriot training.
  - Have Patriot participate with live interceptors in Terminal High-Altitude Area Defense (THAAD) flight testing.
- FY11 Recommendations. In addition to addressing the above recommendations, the Army should:
  1. Conduct all operational testing regression tests with representative Soldier operators.
  2. Conduct a robust Force Development Experiment prior to the PDB-8 IOT&E to ensure that tactics, techniques, and procedures are adequate to support a successful operational test.

Spider XM7 Network Command Munition

Executive Summary

- The Army will use Spider instead of persistent landmines to comply with the requirements of the 2004 National Landmine Policy.
- The Army continued corrective actions to address Spider system and training deficiencies following the FOT&E conducted in May 2010.
- The Army conducted a Spider Limited User Test (LUT) as part of the Army's Network Integration Evaluation at Fort Bliss, Texas, and White Sands Missile Range, New Mexico, in June 2011. The LUT focused on demonstrating progress towards meeting Munition Control Unit (MCU) reliability requirements and demonstrating MCU reuse improvements. The program office will use the results to support a request for additional low-rate initial production (LRIP).
- The program achieved Initial Operational Capability in June 2011 with the fielding of Spider to the 4th Brigade Combat Team (Airborne), 25th Infantry Division, Fort Richardson, Alaska.
- DOT&E will report on the operational effectiveness, suitability, and survivability of the Spider system in calendar year 2013 following a third FOT&E. Based on analysis conducted to date, Spider has demonstrated effectiveness and lethality when operated with efficient operator-observer communications and clearly defined Rules of Engagement. Spider has demonstrated poor suitability and is difficult to sustain in an operational environment.

System

- The Army intends to use Spider as a 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
- A Spider munition field includes:
  - Up to 63 MCUs, 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

- All employments use "man-in-the-loop" control to engage targets.
- 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.
- The Army achieved Initial Operational Capability with Spider in June 2011 with fielding to the 4th Brigade Combat Team (Airborne), 25th Infantry Division, Fort Richardson, Alaska.

Mission

Maneuver or engineer units employ Spider to establish a force protection obstacle or as a stand-alone 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

- Based on demonstrated performance in the Spider FOT&E in May 2010, the Spider full-rate production decision was delayed from FY11 to FY13.
- The Army continued corrective actions to address Spider deficiencies with system complexity and training following the FOT&E conducted in May 2010.

- In May 2011, DOT&E approved changes to the April 2010 Spider Test and Evaluation Master Plan. The updates addressed follow-on testing to demonstrate corrective actions in an operationally realistic environment.
- The Army conducted a LUT as part of the Army's Network Integration Evaluation at Fort Bliss, Texas, and White Sands Missile Range, New Mexico, in June 2011. The LUT focused on demonstrating progress toward meeting MCU reliability requirements and reuse improvements.
- In June 2011, the Army conducted a Spider Force Development Test at Fort Bliss, Texas. Soldiers employed and detonated non-lethal Spider munitions during the test.
- The Army continued fielding Spider systems to deployed and non-deployed units providing Home Station, Combat Training Center, and in-theater training as part of the fielding package.
- The Army and DOT&E initiated planning for the third FOT&E in 1QFY13 to support a full-rate production decision.
- The Spider Milestone Decision Authority is expected to approve the production of additional LRIP systems to support continued fielding prior to a full-rate production decision scheduled for 2QFY13.

Assessment

- 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 4 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 has demonstrated effectiveness and lethality:
  - An Engineer company successfully employed, operated, and achieved lethal effects during the May 2010 FOT&E.
  - An Engineer platoon validated proposed tactics, techniques, and procedures for the employment of non-lethal munitions and successfully employed non-lethal munitions during the June 2011 Force Development Test.
- Spider has demonstrated poor suitability. Sustaining the system in an operational environment is difficult:
  - During the May 2010 FOT&E, Spider did not meet MCU reliability and reuse requirements, attributable to system complexity and ineffective training provided by the program office.
  - In June 2011, a unit composed of Engineer and Infantry Soldiers demonstrated in a LUT that software and training enhancements made following the May 2010 FOT&E increased the likelihood of achieving MCU reliability and 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; this increases a unit's training burden.
- Current software changes to achieve MCU reliability and reuse requirements are incomplete. Increased efforts are needed to prevent future impacts to operational suitability.
- Further testing focused on reducing system complexity in the hands of Soldiers is needed to avoid impacts to operational suitability.

Recommendations

- Status of Previous Recommendations. The Army initiated actions to address previous recommendations.
- FY11 Recommendations. The Army should:
  1. Complete development and implementation of software changes to achieve MCU reliability and reuse requirements by eliminating the possibility of sterilization during emplacement and recovery operations.
  2. Complete development and implementation of hardware and software changes to reduce system complexity in the hands of Soldiers and to improve the efficiency of the sustainment training program.
  3. Plan and execute a comprehensive, DOT&E-approved, FOT&E to demonstrate Spider system effectiveness and suitability in support of an Army full-rate production decision.

Stryker Double-V Hull (DVH)

Executive Summary

- The Double-V Hull (DVH) was quickly developed, tested, and fielded in response to needs from commanders in Operation Enduring Freedom (OEF) regarding Stryker force protection/survivability shortfalls against underbody IEDs and blast threats. Testing and analysis confirm that the DVH Infantry Carrier Vehicle (ICV) (ICVV) improves Stryker vehicle protection against IEDs; the details are classified.
- The Stryker ICVV is operationally effective. There were no significant differences between the existing Strykers currently used in OEF and DVH Strykers regarding mobility and the ability of units equipped with the two types of vehicles to accomplish the mission.
- The Stryker DVH is operationally suitable. The Stryker DVH demonstrated better reliability and maintainability than the OEF variant.
- The Army Test and Evaluation Command continues to execute the non-ICV variant and DVH developmental, operational, and live fire testing through 3QFY12.

System

- The Army intends for the Stryker DVH to provide improved survivability against IED and blast threats, beyond the protection provided by current flat-bottom Stryker vehicles with OEF kits.
- The Stryker ICVV is the base variant for seven additional configurations: the Anti-Tank Guided Missile Vehicle, the Commander's Vehicle, the Engineer Squad Vehicle, the Fire Support Vehicle, the Mortar Carrier Vehicle, the Medical Evacuation Vehicle, and the Infantry Carrier Vehicle DVH-Scout (ICVV-S). The ICVV-S is a new configuration to allow for internal stowage of the Long Range Advance Scout Surveillance System.
- The DVH configuration consists of a redesigned lower hull, energy attenuating seats, and an up-armored driver station. An upgraded suspension and driveline are incorporated because of the additional weight.
- The DVH-equipped Stryker Brigade Combat Team (SBCT) has the same mission profile as a non DVH-equipped SBCT. The Army intends to use the DVH as Theater Provided Equipment in Afghanistan, and provide the Army with a long-term capability to simultaneously deploy SBCTs into a non-permissive environment.
- The Army does not plan to purchase Stryker DVH versions of the Reconnaissance Vehicle, Mobile Gun System, or the Nuclear, Biological, Chemical Reconnaissance Vehicle.

M1126 Infantry Carrier Vehicle

M1129 Mortar Carrier Vehicle

M1130 Commanders Vehicle

M1131 Fire Support Vehicle

M1132 Engineer Squad Vehicle

M1133 Medical Evacuation Vehicle

M1134 Anti-Tank Guided Missile Vehicle

Mission

- Combatant commanders employ a DVH-equipped SBCT as a full-spectrum combat force that conducts operations (offensive, defensive, stability, and support) against conventional or unconventional enemy forces in all types of terrain and climate conditions. In addition, it operates in all spectrums of conflict (major theater war, smaller-scale contingency, and peacetime military engagement).

Major Contractor

General Dynamics Land Systems – Sterling Heights, Michigan

Activity

- The Army executed a comparison LFT&E program to compare DVH IED protection relative to existing OEF-kitted Stryker vehicles. The LFT&E program consisted of 13 full-up system-level IED events against baseline OEF-kitted Strykers, and 18 events against Stryker DVH structures, ICVV prototypes, and full-up ICVVs.
- The Army executed operational testing of Stryker DVH ICVs from January to February 2011 to characterize any degradation to reliability, availability, maintainability, and cross-country mobility, and compare DVH performance to the Strykers currently used in OEF.
- The Army Test and Evaluation Command continues to execute non-ICV configuration DVH developmental, operational, and live fire testing through 3QFY12. The Army is conducting ICVV-S operational testing, and Mortar Carrier Vehicle DVH developmental and operational testing, now through February 2012 at Yuma Proving Ground, Arizona.
- All of the live fire and operational testing executed this year, except one test, was in accordance with DOT&E-approved test plans. Phase II of the Stryker ICVV Operational Assessment was not executed in accordance with a DOT&E-approved test plan and was not adequate. While the data collection plan for Phase II was adequate, the actual collection of data was not, resulting in little usable data except for responses to surveys.

Assessment

- The DVH was quickly developed, tested, and fielded in response to needs from commanders in OEF. Testing and analysis confirm that the ICVV improves Stryker vehicle protection against IEDs; the details are classified.
- The Stryker DVH is operationally effective. There were no significant differences between the existing Strykers currently used in OEF and DVH Strykers regarding mobility and the ability of units equipped with the two types of vehicles to accomplish the mission.
- The Stryker DVH is operationally suitable. The Stryker DVH demonstrated better reliability and maintainability than the OEF variant. During initial testing, Army evaluators identified three problems with the driver's compartment that hampered driver evacuation. The Army subsequently fixed those problems. In addition, the driver's compartment of the vehicle is too small for larger Soldiers. The Army is planning a driver's compartment redesign to improve space intrusions identified during ICVV testing.

Recommendations

- Status of Previous Recommendations. The Army addressed all three previous recommendations.
- FY11 Recommendation.
  1. The Army should increase the driver's available space in the driver's compartment.

Stryker Mobile Gun System (MGS)

Executive Summary

- During the December 2010 Stryker Double-V Hull (DVH) Configuration Steering Board, the Army decided not to pursue full-rate production for the flat-bottom Stryker Mobile Gun System (MGS).
- The Army Test and Evaluation Command conducted Engineering Change Order Block III validation with Soldiers at a developmental test/operational test event in August 2011 to assess material fixes for six deficiencies.
- DOT&E assessed the program has mitigated (by either material fixes or changes to tactics, techniques, and procedures) 17 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 and the MGS. There are eight configurations of the Infantry Carrier Vehicle 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). Add-on slat armor (high hard steel arranged in a spaced array) provides RPG protection.

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

- During the December 2010 Stryker DVH Configuration Steering Board, the Army decided not to pursue full-rate production for the Stryker flat-bottom MGS. The Army determined it could not integrate the DVH design onto the MGS platform unless the Stryker Modernization program occurred to accommodate weight and power deficiencies.
- A total of 142 MGSs have been produced and fielded.
- The integration of Stryker Reactive Armor Tiles (SRAT) II on the MGS has not occurred due to problems with integration of armor tiles on the rear doors. Live fire cannot be completed until the Army defines how SRAT II will be applied to the rear doors.
- The Army, in coordination with DOT&E, submitted the fifth and sixth reports to Congress in December 2010 and

July 2011, updating the status of actions taken by the Army to correct or mitigate all Stryker MGS deficiencies, as directed in Section 115 of the FY09 Duncan Hunter National Defense Authorization Act.
- The Army Test and Evaluation Command conducted Engineering Change Order Block III validation with Soldiers at a developmental test/operational test event in August 2011 to assess material fixes for six deficiencies.
- The Army conducted testing in accordance with the DOT&E-approved Test and Evaluation Master Plan.

Assessment

- The MGS demonstrated Mission Equipment Package reliability during the August 2011 Reliability Gunnery. Overall, the program has mitigated (by either material fixes or changes to tactics, techniques, and procedures) 17 of the 23 deficiencies identified in the 2008 Secretary of Defense Report to Congress. Although all of the deficiencies the Army associates with the operational requirements document have been mitigated, DOT&E considers correction of two of the outstanding deficiencies – lack of gun pod protection and RPG protection – to be essential to ensure the operational effectiveness of the MGS in combat situations such as those that exist in the current theater of operations.
- In the 2007 Beyond Low-Rate Initial Production Report, DOT&E assessed the MGS as not operationally effective when operating in a degraded capacity. DOT&E assesses that the gun pod can be easily disabled, causing the MGS to operate in a degraded capacity, thereby making the MGS not operationally effective. Lack of adequate gun pod protection makes the MGS vulnerable to widely proliferated threats including RPGs, which increases the likelihood of the MGS operating in a degraded capacity. The Army has no plans to improve gun pod 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 protection of 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, if this program moves forward.

Recommendations

- Status of Previous Recommendations. The Army addressed two recommendations from FY10. There have been delays due to SRAT II integration with the vehicle's rear doors and as a result, the remaining FY10 annual report recommendations have not yet been addressed by the program.
- FY11 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. Finalize configuration for SRAT II and schedule live fire testing in order to validate the SRAT II design and configuration to provide long term RPG protection.
  2. Increase gun pod protection.
  3. Continue to provide a semi-annual report to Congress updating the status of corrections until the RPG protection deficiency is corrected.

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

Executive Summary

- The Nuclear, Biological, and Chemical Reconnaissance Vehicle (NBCRV) is operationally effective for chemical reconnaissance on primary and secondary roads, and operationally suitable when equipped with slat armor. The NBCRV is not operationally effective for reconnaissance of cross-country terrain, chemical surveillance, and biological surveillance.
- The NBCRV provides limited biological detection and on-the-move chemical standoff detection capability with more rapid reporting than the M93 series Fox Nuclear, Biological, and Chemical Reconnaissance System that it will replace.
- Initial testing of the NBCRV, equipped with Stryker Reactive Armor Tile II (SRAT II), indicates the added weight of the armor kit negatively affects NBCRV mobility in steep terrain, such as Afghanistan. The Army needs to conduct additional developmental testing to characterize factors and conditions that lead to component failures that negatively affect mobility.
- The NBCRV provides protection against the threshold requirement threats with limitations. Live fire testing indicates potential performance deficiencies in the protection provided by the SRAT II configuration. The details are classified.

System

- The NBCRV is one of eight configurations of the Infantry Carrier Vehicle variant of the Stryker family of vehicles. Chemical, biological, and radiological sensors and communications systems are integrated into 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. Rocket-propelled grenade protection is currently provided by add-on slat armor (high hard steel arranged in a spaced array). SRAT II, an alternative add-on reactive armor kit intended to provide additional protection, is undergoing developmental and live fire test and evaluation.
- The NBCRV is equipped with a filter 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
- An 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, equipped with the NBCRV, conduct reconnaissance and surveillance 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, conducts limited independent operations.

Major Contractor

General Dynamics Land Systems – Sterling Heights, Michigan

Activity

- In IOT&E phase one, conducted from September to October 2006, the NBCRV experienced numerous operation mission failures. The program undertook a reliability improvement program and made a number of changes to the system configuration tested in IOT&E phase one. The Army Test and Evaluation Command conducted IOT&E phase two at Dugway Proving Ground, Utah, from September 20 to October 1, 2010. The test was conducted in accordance with the DOT&E-approved Test and Evaluation Master Plan and test plan.
- The Army Test and Evaluation Command conducted SRAT II qualification testing, ballistic hull testing, a second phase of follow-on controlled damage experimentation, and four additional full-up system-level events in July 2011 to support the final NBCRV survivability assessment; testing was conducted in accordance with DOT&E-approved test plans.

Assessment

- The NBCRV is operationally effective for chemical reconnaissance on primary and secondary roads due to its ability to collect chemical agents from improved road surfaces using the dual-wheeled sampling system. The NBCRV is not operationally effective for area reconnaissance of cross-country terrain due to the inability of the dual-wheeled sampling system to maintain wheel contact with rough terrain.
- The NBCRV is not operationally effective for chemical surveillance due to poor performance in detecting chemical warfare agents.
- The NBCRV is not operationally effective for biological surveillance when employed in two-vehicle squads or three-vehicle platoons because of the limited coverage by point sensors. The NBCRV provides limited biological detection and identification capability when employed as a larger array of biological sensors.
- The NBCRV is operationally suitable when equipped with slat armor. During operational testing, the NBCRV demonstrated improved base vehicle reliability and exceeded the Army's reliability requirement during developmental testing.
- Initial testing of the NBCRV, equipped with SRAT II, indicates the added weight of the armor kit negatively affects NBCRV mobility in steep terrain, such as Afghanistan. During a 3,090-mile NBCRV reliability test with the SRAT II, the system experienced multiple driveline failures, including three broken differentials and multiple broken axle half-shafts. Driveline failures negatively affect mobility by limiting the speed of travel and the vehicle's ability to traverse steep terrain.
- The NBCRV provides protection against the threshold requirement threats with limitations. Live fire testing indicates potential performance deficiencies in the protection provided by the SRAT II configuration. The details are classified.
- The NBCRV provides limited biological and on-the-move chemical standoff detection capability, and more rapid reporting than the M93 series Fox Nuclear, Biological, and Chemical Reconnaissance System that it will replace.

Recommendations

- Status of Previous Recommendations. The Army has not conducted the additional testing recommended in FY10 and should complete the planned additional developmental testing with the SRAT II kit to characterize the factors and conditions that lead to broken axle half-shafts and the resulting mobility impacts.
- FY11 Recommendation.
  1. The Army should resource an adequate T&E program to characterize potential performance deficiencies with SRAT II, as well a plan to correct any performance deficiencies identified in test.

Navy Programs

Navy Programs

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

Executive Summary

- The Navy completed IOT&E of a new high-frequency array called the Low Cost Conformal Array (LCCA) in FY10. DOT&E issued a classified Beyond Low-Rate Initial Production (BLRIP) report for the array in FY11 and concluded that the system is effective and suitable.
- The Navy completed FOT&E of the Acoustic Rapid Commercial Off-the-Shelf (COTS) Insertion for Sonar (A-RCI) Advanced Processor Build 2007 version (APB-07) system in FY10. DOT&E issued a classified report combined with an assessment of the APB-07 version of the AN/BYG-1 Combat Control System in FY11.
- The Navy commenced FOT&E of A-RCI APB-09 in March 2011. Testing is scheduled to be completed in early FY12.

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 (called APBs) and hardware upgrades (called 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 (ASW), 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 arrays) along with the 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 or TB-29).
- A-RCI processes and displays the data from the LCCA. Combined with the legacy high-frequency sail array mounted in the front of the sail, LCCA provides the submarine crew with a near 360-degree high-frequency passive sonar capability. The LCCA is used to increase tactical control and situational awareness when operating in areas that are heavily populated with surface vessels.

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
- 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 FOT&E of A-RCI APB-07 in late 2010 in accordance with a DOT&E-approved test plan. Testing was conducted on four submarines, included two hardware variants, and was combined with the IOT&E periods of two new sonar arrays: the TB-34 and the LCCA. Some of the testing periods were also combined with the operational testing of the APB-07 variant of the AN/BYG-1 Combat Control System. Coordinating these tests provided testing efficiencies and enabled an end-to-end evaluation of mission performance. DOT&E issued a classified combined A-RCI and AN/BYG-1 APB-07 test report in July 2011.

- The Navy completed IOT&E of the LCCA in 2010. DOT&E issued a classified BLRIP report in May 2011.
- DOT&E approved the A-RCI APB-09 Test and Evaluation Master Plan (TEMP) in September 2010. Operational testing of the APB-09 variant commenced in March 2011 and will continue into early FY12.
- The Navy began drafting a TEMP for the APB-11 and APB-13 A-RCI variants, and expects to issue it by mid 2012. As part of these efforts, DOT&E requested the Navy investigate new methods of land-based testing and onboard simulated target injection methods to augment at-sea operational tests.

Assessment

- The Navy's schedule-driven process prevents operational test results from directly supporting development of the follow-on APBs. The Navy is scheduled to complete operational testing of the A-RCI APB-09 system in early FY12. 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-09 operational testing will not be included in the development of APB-11.
- The DOT&E classified BLRIP report for the LCCA concluded the following:
  - LCCA is operationally effective and operationally suitable.
  - The Navy conducted adequate in-water testing to provide an initial assessment of the operational utility of the LCCA and associated A-RCI processing and displays. Additional testing is recommended to examine LCCA's ability to contribute to ASW missions.
- The DOT&E classified FOT&E report for the A-RCI APB-07 and BYG-1 APB-07 systems concluded the following regarding A-RCI testing adequacy and system performance:
  - The Navy did not conduct adequate testing to assess the A-RCI APB-07 system's capability to support Mine Detection and Avoidance and ASW operations.
    - There were three significant problems with the Mine Detection and Avoidance tests: the targets and minefield condition were not operationally representative, the Navy did not execute the test in accordance with the approved test plan, and hardware limitations aboard the test ship preclude a full examination of the functionality under test.
    - There were two significant problems with the ASW test event: an accurate and meaningful measurement of search time could not be determined due to the tactics employed by the test ships, and the test was not executed as planned with regard to the repositioning times between events and the starting distances between the two submarines at the beginning of each test run.
  - Testing of the APB-07 system to examine situational awareness in areas of high contact density and testing of precision underwater mapping and navigation were adequate.
  - A-RCI is not effective in supporting operator situational awareness and contact management in areas of high contact density.
  - The newly introduced Precision Underwater Mapping and Ping-to-Ping Matching algorithms are effective. However, additional testing is recommended to confirm effectiveness in other underwater environments and aboard submarines with different hardware variants.
  - Testing was not adequate to make a determination of the APB-07 system's ASW effectiveness. Given the data available and the limitations of the test, DOT&E concluded that no evidence existed to change the conclusions from its previous reports on A-RCI. Specifically, 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.
  - The A-RCI APB-07 system demonstrated significantly different reliability and availability performance between the two hardware variants on which it was hosted. The TI-06 APB-07 system was not operationally suitable, but the TI-08 APB-07 system was operationally suitable.
- The A-RCI bi-annual upgrades to software and hardware results in the 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.

Recommendations

- Status of Previous Recommendations. The Navy has made progress in addressing most of the recommendations contained in the October 2009 BLRIP 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. Evaluate the ability of A-RCI to detect and classify a snorkeling diesel submarine operating in littoral waters containing several diesel-powered vessels.
  4. Consider investing in improvements to the Onboard Trainer to improve trainer reliability and target realism.
  5. 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.
- FY11 Recommendations.
  1. The Navy should consolidate the A-RCI and AN/BYG-1 TEMPs into an Undersea Enterprise Capstone document.
  2. DOT&E's BLRIP report on the LCCA contained five classified recommendations.
  3. DOT&E's FOT&E report on A-RCI APB-07 contained 17 recommendations. The most significant unclassified recommendations are:
     - Improve the detection and localization performance for submarines operating in high density surface ship environments. Consider investing in automation that

will assist the operator in processing the large amount of constantly changing contact data and determining which contacts pose an immediate collision or counter-detection threat.

- Improve operator training such that operators understand and effectively employ new APB functionality when fielded. Many of the newly introduced features in APB-07 that were designed to improve mission performance were not used consistently during the test.
- Investigate the software reliability problems observed during testing and determine whether the TI-06 hardware or the hosting of the A-RCI APB-07 on TI-06 is the primary cause of the failures that occurred.
- Implement a reliability growth program for A-RCI APB development and conduct sufficient testing to ensure that reliable systems are fielded to the submarine fleet.

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) and Aegis Guided Missile Destroyers (DDGs 103-112) upgraded with AWS Baseline 7.1R is expected to complete in 1QFY12.
- The preliminary evaluation of data collected during operational testing of AWS ACB08 suggests that Aegis Cruisers equipped with the AWS ACB08 has not adversely affected Undersea Warfare mission performance. DOT&E expects to issue a formal test report in 2QFY12.

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 Destroyers 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 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 in FY10 with the exception of air defense and suitability testing.
- COTF conducted the testing in accordance with the DOT&E-approved test plan.
- Air defense and suitability testing, originally scheduled for September 2010, are now scheduled for 1QFY12. COTF postponed and rescheduled this testing on five separate occasions due to the unavailability of the test ship to support scheduled testing.
- The Navy deployed at least one AWS ACB08-equipped Cruiser in FY11 in advance of operational air defense and suitability testing.

- The Navy repaired critical software faults discovered during earlier developmental testing of AWS Baseline 7.1R. Operational testing is scheduled to be conducted concurrently with ACB08 testing in 1QFY12. The Navy deployed at least one AWS Baseline 7.1R-equipped Destroyer in FY11 in advance of operational testing.
- The Navy continues to update the Test and Evaluation Master Plan 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 ongoing; however, the preliminary assessment is that Aegis Cruisers equipped with AWS ACB08 has not adversely affected Undersea Warfare mission performance. DOT&E expects to issue a formal test report in 2QFY12.
- Aegis Guided Missile Cruisers upgraded with AWS ACB08 and Aegis Guided Missile Destroyers upgraded with AWS Baseline 7.1R have limited ability to counter high-speed surface threats in littoral waters.

Recommendations

- Status of Previous Recommendations. The Navy satisfactorily addressed two of the previous four recommendations. However, the Navy should continue to improve the AWS ability to counter high-speed surface threats in littoral waters and Standard Missile reliability, and synchronize the conduct and reporting of OT&E with intended ship-deployment schedules to ensure that future AWS baselines complete OT&E prior to deployment.
- FY11 Recommendation.
  1. The Navy should devote increased effort to accomplish all planned key operational tests of AWS ACB08 deferred in FY11 in accordance with the DOT&E approved Test and Evaluation Master Plan and test plan.

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

Executive Summary

- The Advanced Anti-Radiation Guided Missile (AARGM) program spent most of FY11 correcting hardware and software deficiencies discovered in developmental testing and during its first IOT&E attempt in 4QFY10 that ended with program decertification.
- Corrections of deficiencies discovered in FY10 were verified during developmental testing conducted between November 2010 and January 2011.
- An integrated developmental/operational test (IT) period was conducted between February and July 2011.
- The Operational Test Authority conducted an operational test readiness review in July 2011 and re-initiated dedicated IOT&E in August 2011.
- During FY11 IT and IOT&E, the Navy fired a total of four missiles at actual and simulated threat targets and emitters. As required by DOT&E, low-rate initial production (LRIP) missiles were used for all live-fire tests.
- As of September 2011, the Navy completed approximately 40 percent of planned operational test sorties, accumulating over 150 hours of missile operating time.
- IOT&E is scheduled to finish in the 2QFY12. Analysis of operational test events is ongoing with a corresponding beyond-LRIP report anticipated in 3QFY12.

System

- The AGM-88E AARGM is the follow-on to the AGM-88B/C/D High Speed Anti-Radiation Missile (HARM) using a modified HARM body and fins. AARGM is employed on F/A-18C/D/E/F/G platforms.
- The AARGM incorporates Millimeter Wave (MMW), GPS, and digital Anti-Radiation Homing (ARH) guidance, a Weapon Impact Assessment transmitter, and an Integrated Broadcast Service Receiver (IBS-R).
  - MMW technology allows enhanced target discrimination during terminal weapon guidance

  - ARH improvements over HARM include an increased field-of-view and larger frequency range
  - The GPS allows position accuracy in location, time, and weapon impact assessment transmissions
  - The IBS-R enables reception of national broadcast data

Mission

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

Major Contractor

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

Activity

- In 2QFY10, the Navy issued a change to the AARGM Capability Production Document (CPD) due to limitations discovered during the developmental test. This CPD change delayed the start of IOT&E to allow correction of system deficiencies, deferred a Key Performance Parameter target requirement to FOT&E, and clarified the acceptable target environment and reactive targeting constraints for IOT&E. These CPD changes enabled AARGM to first enter IOT&E in FY10.
- AARGM commenced IOT&E in June 2010, but during initial captive-carry flight tests, it suffered six operational mission failures. In September 2010, the Navy subsequently de-certified AARGM from IOT&E, and DOT&E rescinded approval for the program's operational test plan. As a condition for returning to IOT&E, DOT&E insisted the AARGM program conduct all future tests with LRIP missiles.

- The AARGM program spent most of FY11 correcting the hardware and software deficiencies discovered in developmental testing and during its first IOT&E attempt in FY10. The Navy successfully verified corrections of deficiencies during another developmental test phase conducted between November 2010 and January 2011.
- The Commander, Operational Test and Evaluation Force (COTF), in conjunction with the AARGM program office (PMA-242), conducted an IT phase from February to July 2011. Nine additional deficiencies were reported from these events, two of which were considered operational mission failures.
- During July 2011, DOT&E approved an updated COTF operational test plan, and the Operational Test Agency conducted an Operational Test Readiness Review. As a result, dedicated IOT&E was re-initiated in August 2011.
- During FY11 IT and IOT&E, the Navy fired a total of four missiles at actual and simulated threat targets and emitters. As required by DOT&E, LRIP missiles were used for all live-fire tests.
- As of September 2011, the Navy completed approximately 40 percent of planned operational test sorties, accumulating over 150 hours of missile operating time. These totals include sorties and hours accrued during integrated testing that DOT&E considers operationally representative.
- IOT&E is scheduled to finish in 2QFY12.

Assessment

- Although occurring prior to FY11, DOT&E assessed that four of the six operational mission failures encountered during the first IOT&E period were discoveries developmental testing should have identified.
- IT and dedicated IOT&E is appropriately scoped and resourced with 10 live-fire LRIP missiles, along with captive-carry, reliability, and compatibility testing in operational environments against threat-representative targets. COTF adequately validated and accredited targets for AARGM before the restart of IOT&E.
- Analysis of IT and IOT&E events is ongoing with a corresponding beyond-LRIP report anticipated in 3QFY12.

Recommendations

- Status of Previous Recommendations. The Navy satisfied both FY10 recommendations. The MMW and ARH sensors were characterized in developmental testing, and LRIP missiles are being used for all operational tests.
- FY11 Recommendations. The Navy should:
  1. Conduct sufficient FOT&E to verify the correction of the nine deficiencies discovered during IT and any emergent anomalies during IOT&E.
  2. Conduct sufficient FOT&E to adequately assess those requirements deferred by the change to the AARGM CPD.

AIM-9X Air-to-Air Missile Upgrade

Executive Summary

- The Navy requested to re-baseline the AIM-9X program as a result of Service funding, cost, and schedule overruns. The USD(AT&L) classified AIM-9X Block II (or AIM-9X-2 hardware with version 9.3 software) as a new program entering a pre-Milestone C decision.
- Operational testing during FY11 assessed the AIM-9X-2 missile with Operational Flight Software (OFS) 9.2 and 9.3. The Services have not yet produced their final report. Preliminary results show four of five hits during live flight testing and nominal performance during captive-carry events.
- DOT&E signed and approved the AIM-9X Block II Test and Evaluation Master Plan (TEMP) in support of the June 2011 Milestone C decision. The Operational Test Readiness Review (OTRR) is scheduled for April 2012 for IOT&E of the Block II.

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 improved flare rejection performance.
- AIM-9X is highly maneuverable, day/night capable, and includes the warhead, fuze, 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.
- The AIM-9X Block II is the combination of AIM-9X-2 hardware and OFS 9.3 software.
- AIM-9X-2 is the latest hardware version and is designed to prevent parts obsolescence and provide processing capability for the upcoming OFS 9.3 software upgrade. The AIM-9X-2 missile includes a new processor, a new ignition battery for the rocket motor, an electronic ignition safety/arm device, and the DSU-41/B Active Optical Target Detector (AOTD) fuze/datalink assembly.
- AIM-9X-2 with OFS 9.2 provides similar capabilities as the currently fielded AIM-9X Block I, OFS 8.212.
- OFS 9.3 is a software upgrade that will add trajectory management to improve range, datalink with the launching aircraft, improved lock-on-after-launch, target re-acquisition, and improved fuzing.

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

- The Navy completed AIM-9X-2 with OFS 9.2 operational testing in January 2011. The Navy's Commander, Operational Test and Evaluation Force and Air Force Operational Test and Evaluation Center flew captive-carry missions using the F-18 aircraft at the Naval Air Weapons Center, China Lake, California, and using the F-15/F-16 aircraft at Eglin AFB, Florida. The testing supported a decision to field captive air training missiles.
- The USD(AT&L) made the decision to re-baseline the program and classify it as a new program entering a pre-Milestone C decision. The new program is designated AIM-9X Block II, which combines AIM-9X-2 hardware with OFS 9.3. This decision was primarily driven by a cost per unit increase due to the new DSU-41/B AOTD fuze/datalink assembly, reductions in Service funding, software costs, and schedule delays.

- The AIM-9X-2, OFS 9.3 development and test schedule overlapped with the AIM-9X-2, OFS 9.2 tests. The Navy and Air Force cancelled the OFS 9.2 missile fielding in favor of OFS 9.3.
- The Joint Requirements Oversight Council signed the Block II Capability Production Document in May 2011. DOT&E signed and approved the AIM-9X Block II Milestone C TEMP in June 2011. The TEMP outlined 4 integrated test events, 17 live fire events, and 61 captive-carry missions.
- After TEMP approval, the Navy completed two of seven AIM-9X-2, OFS 9.3 shots (developmental test and developmental/operational test) required before the April 2012 OTRR.

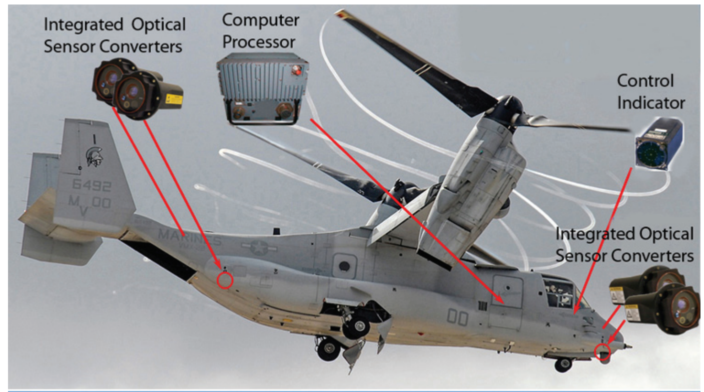
Assessment

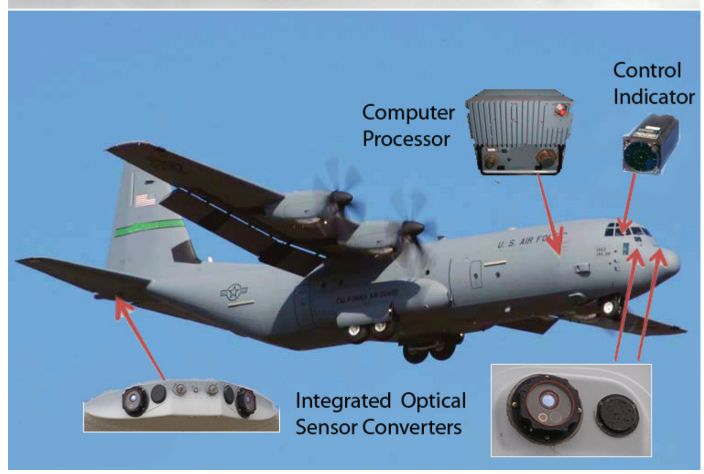
- The operational assessment of AIM-9X-2 with OFS 9.3, which the Navy completed in March through April 2011, consisted of five live missile shots (including four developmental test missile shots) and nine captive-carry sorties performed by F-15 and F/A-18 aircraft. At the time of this annual report, the Services had not yet completed their final report. The Services completed an Initial Impressions Report in support of the late June Milestone C decision.
- Initial AIM-9X-2 OA results indicate hits on four of five live fires and nominal performance on all captive-carry missions. Captive-carry data indicate the system is meeting its requirements, but statistical significance is low.
- After the operational assessment, mean time between critical failure was 470 hours. The Navy plans to complete 6,500 hours of captive-carry reliability testing by the end of IOT&E; the Capability Production Document requires 500 hours mean time between critical failure.
- Recent captive-carry testing has revealed declining missile reliability due to communication problems in 9.303 software and host aircraft compatibility deficiencies. The program office plans to fix these deficiencies, along with software changes in OFS 9.308. Raytheon plans another software build prior to the OTRR.
- The program office plans to execute an AIM-9X-2, OFS 9.3 OTRR in April 2012. The schedule of live fire events required before the OTRR is aggressive; the Navy and Air Force must execute five more live flight tests prior to the OTRR. Testing delays could result in a delayed OTRR.

Recommendations

- Status of Previous Recommendations. The Navy satisfactorily addressed previous annual report recommendations.
- FY11 Recommendations. The Navy should:
  1. Ensure progression to IOT&E is event-driven, not schedule-driven or tied to a specific date, such as April 2012.
  2. Require adequate testing and developmental test completion before progressing to operational testing.

AN/AAR-47 Hostile Fire Indication (HFI) Software Upgrade





Executive Summary

- DOT&E assessed the AN/AAR-47 Hostile Fire Indication (HFI) software upgrade as operationally effective with limitations and operationally suitable, and assessed that it provides improved situational awareness for aircrew. Specific details are documented in the classified DOT&E AN/AAR-47 operational assessment report to the Navy.
- The AN/AAR-47 HFI warning capability can become degraded in certain environments. This limitation applies to all platforms on which the AAR-47 is integrated.
- The HFI software upgrade did not degrade the system's missile warning performance.
- The Navy should continue to develop HFI algorithms to improve threat detection and identification.
- The Navy accomplished testing according to the DOT&E-approved Test and Evaluation Master Plan (TEMP) and test plans.

System

- The AN/AAR-47 is a defensive system that warns pilots of missile threats and commands dispensing of flares as an infrared countermeasure. It is composed of a control indicator, a computer processor, and four Integrated Optical Sensor Converters (IOSC).
- Since full-rate production in 1987, the sensor has evolved. The current sensor upgrade, designated B(V)2, improved missile warning performance in all operational environments by adding hardware to the sensor to improve detection in the ultraviolet cluttered background environments.
- There are currently 2,900 systems that have been delivered worldwide. The platforms on which the system has been deployed are as follows: KC-130T, KC-130J, CH-35D, CH-53E, AH-1W, AH-1Z, UH-1N, P-3C, MV-22B, MH-60R, MH-60S, UC-12W, CH-46E, SH-60B, and HH-60H.
- The HFI capability is a software upgrade only with no changes to hardware.

Mission

Combatant commanders utilize the AN/AAR-47 to enhance survivability of several types of fixed- and rotary-wing aircraft against shoulder-fired, vehicle-launched, and other portable infrared-guided missile threats. The HFI capability enhances survivability by providing aircrew situational awareness of small arms fire and rockets near the aircraft so the aircrew can take appropriate action.

Major Contractor

Alliant Techsystems Inc. Defense Electronics Systems – Clearwater, Florida

Activity

- The Commander, Operational Test and Evaluation Force was the responsible operational test agency for the AN/AAR-47 operational assessment, which included the following test activities:
  - Simulation runs at the Naval Research Laboratory, Washington, DC, and at the Electronic Warfare Software Support Activity hardware-in-the-loop facility at Point Magu, California, from June through December 2010.

- Live fire testing at the Weapons Survivability Laboratory, China Lake, California, in June and November 2010.
- Human Factor evaluations at the Manned Flight Simulator, Patuxent River, Maryland, in November 2010.
- Open-air flight testing at the Marine Corps Air Station, New River, North Carolina, in July and October 2010 and from January through February 2011.
- Open-air flight testing at the Naval Air Warfare Center, China Lake, California, from December 2010 through February 2011.

- The Navy conducted these test activities in accordance with the DOT&E-approved TEMP and test plans.
- The Navy is upgrading the current HFI software (version 30.41) to improve HFI information displayed in the cockpit and to simplify system menus accessed by aircrew and maintenance.

Assessment

- DOT&E assessed the AN/AAR-47 HFI software upgrade as operationally effective with limitations and suitable, and determined that it provides improved situational awareness for aircrew. Specific details are documented in the October 18, 2011, classified DOT&E AN/AAR-47 operational assessment report to the Navy.
  - The AN/AAR-47 HFI warning capability can become degraded in certain environments. This limitation applies to all platforms on which the AN/AAR-47 is integrated.
  - The HFI software upgrade did not degrade the system's missile warning performance.
  - The false alarm rate for hostile fire is currently below the classified requirement and is therefore satisfactory.
  - The missile warning prioritization functionality was satisfactory (because incoming missiles are more lethal than small arms hostile fire, the system is designed to give higher priority to missile warning than to hostile fire warning).
  - The operational flight program 230.1 for the AN/APR-39 display configuration functions properly and provides improved situational awareness.

Recommendations

- Status of Previous Recommendations. The Navy has resolved all previous annual report recommendations.
- FY11 Recommendations. The Navy should:
  1. Develop tactics, techniques, and procedures to mitigate AN/AAR-47 HFI limitations.
  2. Continue to develop algorithms to address system limitations and improve overall performance.

AN/BYG-1 Combat Control System

Executive Summary

- The Navy completed FOT&E on the AN/BYG-1 Advanced Processor Build 2007 (APB-07) Combat Control System in early FY11. Performance was similar to previous AN/BYG-1 APBs.
- Although the Navy planned to complete AN/BYG-1 APB-09 testing before the first APB-09 submarine deployed, this did not occur due to the lack of test asset availability.
- At-sea FOT&E of APB-09 began in March 2011 and is scheduled to be completed in early FY12.
- The Navy is completing development of the APB-11 version and operational testing is planned to begin in early FY13.

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 (COTS) computer technology. 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 back fit into *Los Angeles*, *Ohio*, and *Seawolf* class submarines
  - Biannual software upgrades (called APBs) and hardware upgrades (called Technology Insertions (TIs)). While using the same process and nomenclature, these APBs and TIs are distinct from those used in the Acoustic Rapid COTS Insertion (A-RCI) program.
- The Navy intends improvements to provide expanded capabilities for Anti-Submarine and Anti-Surface Warfare, high-density contact management, 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

- The Navy completed FOT&E of AN/BYG-1 APB-07 in late 2010 in accordance with a DOT&E-approved test plan. Testing was conducted on four different submarines, including two hardware variants, and was combined with the IOT&E periods of two new sonar arrays: the TB-34 and the Low Cost Conformal Array. The testing periods were also combined with the operational testing of the APB-07 variant of the A-RCI sonar system. This provided testing efficiencies and enabled an end-to-end evaluation of mission performance. DOT&E issued a classified combined A-RCI and AN/BYG-1 APB-07 test report in July 2011.
- The Navy began installing the AN/BYG-1 APB-09 system on *Virginia* class submarines in 2010, and continued to install the system on *Los Angeles* class submarines through 2011. Although the Navy planned to complete AN/BYG-1 APB-09 operational testing before the first submarine with the system deployed, this did not occur due to the rapid fielding cycle and the lack of available test assets when the system was ready for operational testing to occur.
- The Navy conducted an Information Assurance Vulnerability Evaluation of APB-09 in December 2010 and conducted a network penetration test of the system in January 2011.
- APB-09 FOT&E began in March 2011 on a *Virginia* class submarine and continued into early FY12. The test events were coordinated with the testing of the A-RCI APB-09 sonar upgrades and the *Virginia* class submarine.

- The Navy began drafting an updated Test and Evaluation Master Plan for the APB-11 and APB-13 AN/BYG-1 variants and expects to issue it by mid-FY12.

Assessment

- 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 AN/BYG-1 APB-09 system in 2011. 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-09 operational testing has not been included in the development of APB-11, which is nearing completion.
- The DOT&E classified report to Congress for the A-RCI APB-07 and AN/BYG-1 APB-07 systems concluded the following regarding AN/BYG-1 testing adequacy and system performance:
  - The Navy conducted adequate testing to assess the AN/BYG-1 APB-07 system's capability to support situational awareness in areas of high contact density, to localize enemy submarines, and to provide effective information assurance. Testing did not examine AN/BYG-1's ability to employ weapons or its performance in the Anti-Surface Warfare and Strike mission areas.
  - APB-07 is not effective in supporting operator situational awareness and contact management in areas of high contact density.
  - Although AN/BYG-1's offensive targeting solutions were usually sufficient to provide the torpedo an opportunity to detect the target, APB-07 is not effective in short-range Anti-Submarine Warfare scenarios.
  - APB-07 does not provide effective information assurance, because it does not provide an effective mechanism to detect unauthorized network penetrations. Although APB-07 does provide a limited, manual detection capability, the crew does not receive sufficient training to make this capability effective.
  - APB-07 is operationally suitable and continues to exhibit excellent reliability and availability.

Recommendations

- Status of Previous Recommendations. The Navy has implemented three of the four FY10 recommendations. The remaining recommendation is to consolidate the *Virginia*, A-RCI, and AN/BYG-1 Test and Evaluation Master Plans into an Undersea Enterprise Capstone document.
- FY11 Recommendations. The Navy should:
  1. Consider investing in automation that will assist the operator in areas of high contact density.
  2. Consider improving operator training such that operators understand and effectively employ new APB functionality when fielded. Many of the newly introduced features in APB-07 that were designed to improve mission performance were not used consistently during the test.

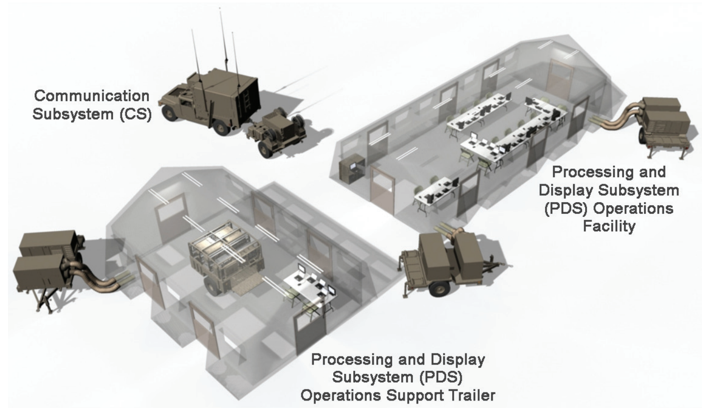
Common Aviation Command and Control System (CAC2S)

Executive Summary

- The Marine Corps restructured the Common Aviation Command and Control System (CAC2S) program in 2008 and divided Increment I into a two-phased approach. This report is on CAC2S Increment I, Phase 1 only.
- The Marine Corps Operational Test and Evaluation Activity (MCOTEA) conducted a CAC2S Phase 1 operational assessment in August 2010 to support the program's Phase 1 Milestone C acquisition decision in November 2010. The program finished developmental testing in December 2010 and MCOTEA conducted IOT&E in April 2011.
- DOT&E assessed the CAC2S Phase 1 IOT&E was not adequate due to limitations that arose during test execution. Many important measures of operational capability could not be adequately assessed because of test venue limitations and insufficient data collection. This prevented DOT&E from conducting a full assessment of the CAC2S operational effectiveness and suitability in accordance with the CAC2S Phase 1 requirements and DOT&E-approved test plan.
- The CAC2S Phase 1 demonstrated an operational capability to support the Direct Air Support Center (DASC) mission, with limitations, in an environment of low to medium operational tempo and during periods of six to eight hours. Test data were not sufficient to determine operational capability for supporting the Tactical Air Operations Center (TAOC) mission or overall operational effectiveness.
- CAC2S Phase 1 demonstrated a capability to be sustained during short, non-continuous operations. Test data were not sufficient to fully assess reliability, availability, or maintainability measures or determine overall operational suitability.
- While the IOT&E had significant test adequacy limitations, it did reveal several effectiveness and suitability deficiencies. Additional operational testing is required to assess the overall operational effectiveness and suitability of the CAC2S, Increment I, Phase 1.

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 I, Phase I

- CAC2S Increment I is comprised of three functional subsystems, to be delivered in two phases.
  - Phase 1
    - 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. The PDS includes an operations support trailer and operations facility.
    - Communication Subsystem (CS) – Provides the capability to interface with internal and external communication assets and the means to control their operation.
  - Phase 2
    - 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 I, Phase 1 will include the PDS and CS to establish the baseline DASC aviation command and control system for the Marine Air Support Squadron and augment the current TAOC mission capability for the Marine Air Control Squadron. 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.
- The MAGTF commander will use CAC2S Phase 1 to execute command and control of assigned assets afloat and ashore in joint, allied, or coalition operational environments and to provide a display of a common, non-real-time, and 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 – Scottsdale, Arizona
- Phase 2
  - Contract Award planned for 3QFY12

Activity
- The Marine Corps restructured the CAC2S program in 2008 and divided Increment I into two phases.
- MCOTEA conducted a dedicated CAC2S Phase 1 operational assessment in August 2010 that only assessed the DASC element operating the CAC2S; it did not assess the system employment in a TAOC configuration.
- The operational assessment results supported the Milestone C decision in November 2010 for acquisition and production of five Limited Deployment Units to support the IOT&E.
- The Marine Corps completed developmental testing of CAC2S Phase 1 in December 2010.
- DOT&E approved the CAC2S Phase 1 Test and Evaluation Master Plan and the MCOTEA IOT&E test plan in March 2011.
- In April 2011, MCOTEA conducted the IOT&E. The IOT&E was executed during the Weapons and Tactics Instructors' course live-flight exercise at Yuma, Arizona, to assess the capability of CAC2S in supporting the DASC and TAOC missions.
- MCOTEA reported the CAC2S as operationally effective, suitable, and survivable for the DASC mission. In addition, they reported that test execution was not sufficient to determine CAC2S's ability to effectively support the TAOC mission.
- DOT&E reported the IOT&E was not adequate to determine operational effectiveness or suitability for CAC2S Phase 1 and recommended additional operational testing to fully assess the system. DOT&E assessed that CAC2S was capable of supporting the DASC mission.
- In September 2011, the Assistant Secretary of the Navy (ASN), Research, Development, and Acquisition (RDA), as the Milestone Decision Authority, led the Full Deployment Decision Review and approved initial fielding of the CAC2S Phase 1 to the Marine Corps Communications Electronics School in 1QFY12. The program was directed to update ASN(RDA) prior to fielding the first operational unit in 2QFY12.
- The Marine Corps is required to execute additional operating hours on the system and collect reliability data to improve the mean time between critical failure threshold confidence level from 40 percent reported by MCOTEA, to 80 percent. The CAC2S program manager must report the results of this effort to the Milestone Decision Authority prior to fielding the CAC2S to the first operational unit.
- The Marine Corps is also required to provide a schedule and plan for conducting further system testing, to evaluate the required system capabilities that were not assessed during IOT&E, and to verify corrections to system deficiencies highlighted during IOT&E, and recommended by DOT&E.

Assessment
- Based on the August 2011 operational assessment results, DOT&E recommended the Marine Corps complete the following:
  - Perform a risk assessment to determine if the system would meet the reliability requirement during IOT&E.
  - Conduct additional testing prior to IOT&E to gain further reliability data and to assess the system capability to support the TAOC mission.
  - Conduct additional testing prior to IOT&E to correct deficiencies and verify system capabilities to include the Advanced Field Artillery Tactical Data System interface, the Joint Range Extension Application Protocol A/B/C interface, and the system's capacity to process 2,000 near-real time tracks.
- The developmental testing conducted just prior to IOT&E did not have sufficient hours to characterize the risk in meeting the reliability requirement during IOT&E. MCOTEA and DOT&E assessed the risk to meeting reliability during IOT&E as high. The Marine Corps did not test the operational capability of the CAC2S Phase 1 with the TAOC until IOT&E and no critical system deficiencies were reported following developmental testing that prevented the program from approving the system ready for IOT&E.
- DOT&E assessed the IOT&E was not adequate due to limitations that arose during test execution. Many important measures of operational capability could not be adequately assessed because of test venue limitations and insufficient data collection. This prevented DOT&E from conducting a full assessment of the CAC2S operational effectiveness and suitability in accordance with the CAC2S Phase 1 requirements and the DOT&E-approved test plan. Several

of the same discrepancies noted during the August 2010 operational assessment were also identified during the IOT&E.
- The CAC2S Phase 1 demonstrated an operational capability to support the DASC mission, with limitations, in an environment of low to medium operational tempo and during relatively short periods of six to eight hours. DASC operators maintain radio communications with aircraft, joint service agencies, and higher headquarters, and use a graphic representation of the battlespace provided by CAC2S, called a Common Tactical Picture (CTP), in order to control aircraft and support the MAGTF. Testing was not adequate to determine whether CAC2S can provide users with an accurate and timely CTP. Test data were not sufficient to determine CAC2S operational capability to support the TAOC mission.
- CAC2S Phase 1 demonstrated a capability to be sustained during short, non-continuous operations. Test data were not sufficient to fully assess reliability, availability, maintainability measures, or to determine overall operational suitability.
- While the IOT&E had significant test adequacy limitations, it did reveal several effectiveness and suitability deficiencies. Major deficiencies included the system's inability to process and correctly display mission-critical information in the required military standard format (MIL STD 2525) and to automatically display gun target lines, which are lines connecting the point of origin of a fire mission to the target. In addition, the system documentation, to include training and technical publications, were not representative of the production system. To mitigate the system deficiencies, DASC operators employed manual workarounds to meet mission requirements.
- The following additional system deficiencies found during IOT&E should have been found in developmental testing:
  - Ability to receive data via Joint Range Extension Application Protocol A and B and provide an accurate and timely air picture from these sources
  - Ability to interface with Theater Battle Management Core System and access web-based applications via the system hyperlink functionality
  - Ability of net time server to synchronize time with the GPS through the CAC2S Defense Advanced GPS Receiver
- Additional operational testing is required to adequately assess the overall operational effectiveness and suitability of the CAC2S, Increment 1, Phase 1.

Recommendations
- Status of Previous Recommendations. The Marine Corps addressed one of the three previous FY10 recommendations when they completed the CAC2S Phase 1 Test and Evaluation Master Plan in March 2011. The following recommendations were not addressed.
  - The Marine Corps should conduct an additional event prior to IOT&E to test the operational functionality, integration, and employment of the CAC2S with both the DASC and TAOC.
  - The Marine Corps should plan and resource an alternate IOT&E test venue and the live exercise test venue should provide the requisite environment to fully execute IOT&E.
- FY11 Recommendations. The Marine Corps should conduct additional operational testing in accordance with the recommendations described below in order to demonstrate those capabilities not evaluated in an operational environment during IOT&E, to verify corrections of discovered deficiencies, and to fully assess CAC2S Phase 1 operational effectiveness and suitability.

  Capabilities Requiring Operational Test
  - Support the TAOC mission.
  - Provide an accurate and timely fused CTP display of friendly, enemy, and neutral information on any workstation.
  - Integrate and display automated Advanced Field Artillery Tactical Data System and Global Command and Control System data.
  - Process near-real-time data for 2,000 (threshold) or 4,000 (objective) air, land, surface, and space tracks under realistic operational conditions and verify there is no degradation in system performance or impact to operator workload.
  - Support continuous operations during DASC displacement to a new operating location.
  - Receive data via Joint Range Extension Application Protocol A and B and provide an accurate and timely air picture from these sources.
  - Reliability, maintainability, and availability under realistic operating conditions, in particular, long-term continuous operations. The test should include adequate system operating hours to resolve the reliability requirement of 90 percent with mean time between operational mission failure of 228 hours for 24-hour operations.

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

Executive Summary

- The Electro-Magnetic Aircraft Launch System (EMALS) conducted successful Phase I Aircraft Compatibility Testing on F/A-18, T-45, E-2D, and C-2A aircraft.
- Advanced Arresting Gear (AAG) is a Naval Air Systems Command Acquisition Category II Program of Record that will be installed on CVN 78. It is currently undergoing system redesign for the Cable Shock Absorber (CSA) assembly. Testing is scheduled to resume in December 2011.
- The Navy has implemented a plan to re-start testing at the Wallops Island Dual Band Radar (DBR) test site in FY12 to complete DBR element-level testing to support installation in CVN 78.
- The Navy continues to work on integration deficiencies related to the F-35 Joint Strike Fighter (JSF) and its fleet of aircraft carriers, including CVN 78.
- The Navy has not funded the LFT&E program adequately. To address the funding shortfall, the Navy is proposing to defer key events to the second ship of the class. This would result in an inadequate test. DOT&E is working with Navy leadership to resolve these concerns.

System

- The CVN 78 *Gerald R. Ford* Class Nuclear Aircraft Carrier program is designing and building the new class of nuclear powered aircraft carriers. The CVN 78 *Gerald R. Ford* Class program name replaces the previous CVN 21 program designation. It has the same hull form as the CVN 68 *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 DBR (a phased array radar which replaces/combines five legacy radars used on current aircraft carriers).
- The Navy's intention is that the Integrated Warfare System will be adaptable to technology upgrades and varied missions throughout the ship's projected operating life including increased self-defense capabilities when compared to current aircraft carriers.

- The Navy redesigned weapons stowage, handling spaces, and elevators to reduce manning, increase safety, and increase throughput of weapons.
- CVN 78 is designed to increase the sortie generation capability of embarked aircraft to 160 sorties per day (12-hour fly day) and to surge to 270 sorties per day (24-hour fly day) as compared to the CVN 68 *Nimitz* Class sortie generation rate demonstration of 120 sorties per day/240 sorties for 24-hour surge.
- Initial Operational Capability for CVN 78 is planned for FY17. Full Operational Capability is planned for FY18 after the Milestone C decision.

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

Huntington Ingalls Industries – Newport News Shipbuilding, Newport News, Virginia

Activity

- The Navy continues to develop plans to evaluate Sortie Generation Rate (SGR) (number of aircraft sorties per day). Discussions have focused on the specific details of live testing (e.g., which test ranges to use, how many aircraft, which weapons). DOT&E concurs with the proposed 6 consecutive 12-hour fly days followed by 2 consecutive 24-hour fly days. Live testing will be supplemented with modeling and simulation from the Virtual Carrier model to extrapolate results to the 30-day SGR requirement.

- The EMALS system functional design test site at Joint Base McGuire-Dix-Lakehurst, New Jersey, continues to test the new electromagnetic catapult system. This year, testing has focused on Phase I of Aircraft Compatibility Testing and included successful launches of the Navy's F/A-18 (with and without external stores), T-45, E-2D, and C-2 aircraft. The EMALS program conducted a total of 133 aircraft launches in FY11.
- The Navy is performing testing of the AAG on a jet car track at Joint Base McGuire-Dix-Lakehurst, New Jersey. The Navy conducted 12 dead-load arrestments out of several hundred scheduled prior to suspending test. The site is currently undergoing system design modifications to the CSA following discovery of significant metal-metal scoring on several components during dead-load testing. Initial component redesign is complete and installation of redesigned components is expected for completion in December 2011.
- The Navy initiated land-based JSF testing associated with the Jet Blast Deflector (JBD). The JBD is designed to deflect engine exhaust during engine runs and catapult launches. The testing is examining cooling of the JBD, noise for flight deck personnel, and the exhaust effects from JSF on nearby aircraft on the flight deck.
- The Navy has a plan to re-start DBR element testing at the Surface Combat Systems Center in Wallops Island, Virginia, in FY12; this test site is required for critical testing of the carrier's radar to mitigate risk before installation and testing in CVN 78.
- The Preliminary Ship's Manning Document (PSMD) was partially validated during Naval Aviation Enterprise Manning Wargame II in September 2011. The preliminary war game assessment revealed that for the seven departments analyzed, the ship can perform its operational mission when operated at 100 percent manning. Reductions below 85 percent Navy Enlisted Classification (NEC) fit/fill requirements and/or surge operations may be problematic with respect to operational effectiveness.
- The CVN 78 *Gerald R. Ford* Class Carrier program office is revising the Test and Evaluation Master Plan in an effort to align planned developmental tests with corresponding operational test phases.
- The Navy conducted tests related to the detection and suppression of fires in the weapons magazines. Magazine sprinkling systems are required to perform two functions: (1) to prevent ordnance cook-off in the event of an adjacent space fire; and (2) to extinguish incipient fires within the magazine. The fire detection system must provide sufficient warning of a fire for actions to be taken to avoid ordnance cook-off. The objectives of the two test series were to evaluate the performance characteristics of the new detector system, and to quantify the fire suppression and boundary cooling capabilities of the two water delivery systems installed in the magazines on the CVN 78. The analyses of the test results and development of the test reports are in progress.
- The Navy began the damage scenario-based engineering analysis for one threat scenario to support a vulnerability assessment report planned for completion in FY14. The Navy has indicated that funding limitations will permit only one additional scenario to be examined for this assessment.

Assessment

- The Navy began CVN 78 construction in 2008 and plans to deliver the ship in September 2015. Current progress supports this plan; however the EMALS, AAG, DBR, and Integrated Warfare Systems remain pacing items for successful delivery of the ship.
- The CVN 78 program (similar to the CVN 68 class program) continues to work through challenges with F-35 JSF aircraft/ship integration. These challenges have the Naval Sea Systems Command's and Naval Air Systems Command's significant attention and priority. The Navy has not completed its analysis of the test data to determine whether design changes are required for the jet blast deflectors and/or flight deck. Problems remain outstanding regarding JSF data flow aboard ship via the Autonomic Logistics Information System; JSF engine replacement logistics; lithium-ion battery stowage and operations; and low observable material maintenance procedures.
- EMALS developmental testing continues within timelines required to meet shipyard Required in Yard Dates (RIYD) for various EMALS components. Developmental test progress continues, although continued discovery of deficiencies (necessitating a re-design of the launch armature and rough acceleration characteristics on initial Aircraft Compatibility Testing aircraft launches) indicates a still maturing system. DOT&E holds moderate concern regarding the performance risk generated by the inability to test the full, four catapult electrical distribution system prior to initial trials aboard ship. This is mitigated somewhat by the conduct of system electrical fault testing during FY12, which will replicate some level of the electrical distribution fault tree.
- AAG testing was halted following the discovery of metal scoring of the CSA during initial dead-load testing requiring component redesign and software modifications. Testing should resume in December 2011 and still supports RIYD for AAG components barring significant additional redesign.
- The Navy will re-start DBR testing at Wallops Island in FY12. Based on these tests, if additional DBR testing is required, there will likely be cost growth in software development and required testing and a slip in completion of the post-delivery testing and trials of the DBR. Numerous integrated warfare system items are of concern, including:
  - Historically the ship self-defense combat systems on aircraft carriers have had reliability, weapon, and radar system integration shortcomings. While the Navy has made efforts, it has not yet developed a detailed plan to address these concerns on CVN 78.

- Navy development of a new anti-ship ballistic missile target and obtainment of a capability to launch multiple simultaneous supersonic sea-skimming targets lags behind CVN 78 testing need dates. Both are required to fully assess the effectiveness of the ship self-defense systems.
- CVN 78 will use DBR continuously and simultaneously for both air traffic control and to support other warfare areas including ship self-defense, whereas separate legacy systems perform these missions individually. Merging these previously separate missions into a single system requires significant testing and integration. Portions of this testing are currently scheduled shipboard, instead of making more complete use of the land-based Wallops Island facility; this complicates the test-fix-test timeline. RIYD for these systems continues to drive the development schedule; however, to date, development and testing remains on track.

- The PSMD was partially validated during Naval Aviation Enterprise Manning War-game II in September 2011. In order to reduce Total Ownership Costs (TOC) the ship's overall manning (not including embarked air wing and staffs) was reduced by 663 billets from current aircraft carrier requirements. In light of these forced manning reductions, the Navy specifically designed CVN 78 to operate at 100 percent manning on a continual basis, a level which the current manning construct and personnel policies of the Navy do not support. The war-game validated the CVN 78 manning requirements for operating during normal peacetime conditions; however during surge operations or at less than 85 percent NEC fit/fill requirements there is risk as to whether the ship can operate effectively. In order to ensure the ship's operational effectiveness the Navy will have to develop a manning construct which supports the 100 percent NEC fit/fill manning requirement for CVN 78.
- 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 and equipment/aircraft availability. Spiral development of the Virtual Carrier model is continuing in order to ensure that the required fidelity will be available to support SGR testing during IOT&E.
- DOT&E has requested the Navy adequately fund and complete the actions necessary to conduct the TSST and the FSST on the CVN 78. This includes updating the Damage Scenario Based Engineering Analyses (DSBEA) from prior Vulnerability Assessment Reports (VARs) and enough new DSBEAs, including machinery spaces, to conduct an adequately scoped TSST. DOT&E expects this will require five or six TSST drills.
- Because of the two-month delay required to perform the FSST, the Navy proposes delaying the shock trial by 5-7 years in order to complete it on CVN 79 (instead of CVN 78). The two-month delay is not sufficient reason to postpone the shock trial for so long, as it could reveal valuable lessons, including previously unknown vulnerabilities.
- The current TEMP and proposed revisions do not adequately address whole-platform level developmental testing. The strategy leverages the testing being conducted by contracted organizations on their associated systems and sub-systems but does not stipulate any additional integrated platform-level CVN 78 class specific developmental tests. Lack of platform-level developmental testing significantly raises the likelihood of platform-level discovery during operational test.

Recommendations

- Status of Previous Recommendations. All FY10 recommendations remain valid and are updated below. The Navy should:
  1. Adequately test and address integration challenges with JSF; specifically logistics (storage of spare parts and engines, transport of support equipment and spares to/from the carrier), changes (if any) required to JBD's, changes (due to heat and or noise) to flight deck procedures, and Autonomic Logistics Information System integration.
  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 that adequately emulates the self-defense portions of the threat trajectory, and pursue test range upgrades to allow up to four supersonic sea-skimming targets to be launched simultaneously.
  4. Continue aggressive EMALS and AAG risk-reduction efforts to maximize opportunity for successful system design and test completion in time to meet RIYD for ship-board installation of components.
  5. Continue development of a realistic model for determining the sortie generation rate, while utilizing realistic assumptions regarding equipment availability, manning, and weather conditions. Obtain acknowledgement and concurrence from Navy leadership on scheduling, funding, and execution plan for conducting a live SGR test event.
- FY11 Recommendations.
  1. Develop and codify a formal manning construct through the Navy's Bureau of Personnel to ensure adequate depth and breadth of required personnel to ensure that the 100 percent NEC fit/fill manning requirements of CVN 78 are met.
  2. Conduct platform-level developmental testing to preclude discovery of operational effectiveness deficiencies during IOT&E.
  3. Plan and budget for an adequate Full-Ship Shock Trial and Total Ship Survivability Trial on CVN 78.

E-2D Advanced Hawkeye

Executive Summary
- The E-2D completed an Operational Assessment (OA) in December 2010 to support a decision to procure the next two lots of low-rate production aircraft.
- E-2D overland radar performance deficiencies may preclude successful assessment of the Theater Air Missile Defense/ Anti-Air Warfare mission area during IOT&E.
- Cooperative Engagement Capability (CEC) test schedule delays may delay the start of IOT&E.
- Weapon system suitability metrics currently do not meet requirements although recent software upgrades should provide improvement to these metrics.

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, the mission computer, and the incorporation of an all-glass cockpit.
- The radar upgrade replaces the E-2C mechanical scan radar with a phased radar array that has combined mechanical and electronic scan capabilities.
- The upgraded radar is intended to provide significant improvement in Hawkeye littoral and overland detection performance, 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
- The Navy's operational test organization for the E-2D program, Air Test and Evaluation Squadron One (VX-1), conducted an OA in accordance with the DOT&E-approved test plan from July 22 to December 3, 2010, during operations at Naval Air Station (NAS), Jacksonville, Florida; NAS Fallon, Nevada; and NAS Point Mugu, California. Their test report was completed on February 25, 2011, and supported the acquisition decision in 2QFY11 for E-2D Low-Rate Initial Production Lots 3 and 4. DOT&E delivered an operational test memorandum, which was supportive of VX-1's conclusions developed from the OA data, and identified potential radar performance deficiencies in the overland arena.
- CEC developmental testing began July 2011 and CEC engineering testing concluded in June 2011 with the exception of two flight events; these events will be completed as a part of developmental testing. As of December 2011, 93 percent of CEC test points are complete. Carrier suitability testing and the initial cadre of pilots completed carrier qualification in January, August, and September 2011, to support upcoming IOT&E.
- VX-1 took custody of three aircraft in anticipation of IOT&E (two from the Navy's test program and one from Northrop Grumman). VX-1 maintenance and aircrew training for IOT&E commenced in 3QFY11 and will continue until IOT&E commences in 2QFY12. One aircraft delivery remains (from Northrop Grumman in October 2011) to fulfill VX-1's full complement of four aircraft for IOT&E.
- The E-2D program developed a radar reliability growth program and growth curves. The test program has incorporated three software updates, which together reduced the number of outstanding Discrepancy Reports from 61 to 5.
- Operational Test Readiness Review is scheduled for January 2012.

Assessment
- Based on OA and developmental test data, DOT&E identified potentially inadequate overland performance of the E-2D radar system as a risk to a successful Theater Air Missile Defense/

Anti-Air Warfare mission effectiveness assessment during IOT&E.
- Discovery of hardware and software integration discrepancies significantly delayed E-2D/CEC integration and testing in FY11. The engineering test originally scheduled to conclude in February 2011 was not substantially complete until June 2011. Developmental testing was scheduled for completion by August 2011; however, it now appears CEC developmental testing will complete in 1QFY12 and is the pacing event for execution of the Operational Test Readiness Review and commencement of IOT&E. The IOT&E for the E-2D is also the IOT&E for new CEC aircraft hardware (AN/USG-3B) under development by the Navy. Further discovery of significant CEC-related problems will most likely delay the start of IOT&E and could result in a deferral of the AN/USG-3B IOT&E. CEC is necessary for E-2D to demonstrate its Net-Ready Key Performance Parameter.
- The radar system reliability, specifically radar mean time between failures, does not currently meet established requirements of 81 hours. While low radar mean time between failures has been a concern for the last two years, it has steadily improved and was 64.3 hours as of July 2011. However, it must continue to improve to meet the threshold requirement during IOT&E.
- During the recent OA, radar Mean Time Between Operational Mission Failure was 14.2 hours versus a requirement of 25 hours, while weapon system Mean Flight Hours Between Failure was 1.7 hours, versus a threshold of 0.8, and weapons system's Mean Flight Hours Between Operation Failure was 4.7 hours versus a 3.5-hour requirement. These data are based on the relatively small sample size collected during the OA and therefore have a large uncertainty. In contrast to program office metrics, the OA data were gathered under more operationally representative conditions consistent with the upcoming IOT&E. Because of three recent radar software updates, improvements in these metrics are expected prior to IOT&E.
- As a result of the delivery schedules for the Hawkeye Integrated Training System for Aircrew and Maintenance, operational test personnel will not be able to completely resolve the Maintainability and Training Critical Operational Issues during IOT&E. However, the Hawkeye Integrated Training System for Aircrew and Maintenance will be available for operational evaluation during FOT&E.

Recommendations

- Status of Previous Recommendations. The Navy satisfactorily addressed all FY10 recommendations.
- FY11 Recommendations.
  1. The Navy and E-2D program should investigate the potential radar performance benefits of a post IOT&E processor upgrade to buttress system performance in the challenging overland arena.
  2. The Navy and E-2D program office should take all necessary steps to ensure CEC integration testing is successfully completed in time to support IOT&E commencement.
  3. The E-2D program office should continue to improve radar reliability.

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

Executive Summary

- DOT&E completed its EA-18G IOT&E Report in September 2009, assessing the EA-18G as operationally effective, but not operationally suitable based upon poor maintainability and built-in test performance, as well as system integration challenges with the legacy ALQ-99 jamming pods.
- During the 2011 FOT&E for Software Configuration Set (SCS) H6E, the Navy flew 115.2 EA-18G flight hours over 69 test sorties.
- Emerging 2011 FOT&E results suggest the EA-18G remains operationally effective, while operational suitability has notably improved. DOT&E analysis of test data is ongoing and a complete operational assessment will be published in early FY12.
- The Navy conducted testing in accordance with the DOT&E-approved Test and Evaluation Master Plan (TEMP) and test plan.

System

- The EA-18G Growler is a land- and carrier-based, radar and communication jamming 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:
  - APG-79 AESA radar
  - Joint Helmet-Mounted Cueing System
  - High-Speed Anti-Radiation Missile (HARM)
  - AIM-120 radar-guided missiles

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 the AIM-120

Major Contractor

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

Activity

- The Navy FOT&E for SCS H6E on the Growler occurred between November 2010 and June 2011. During the FOT&E, the Navy flew 115.2 EA-18G flight hours over 69 test sorties. This testing included the evaluation of the Civilian Instrument Landing System integration into the EA-18G, a capability that enhances mobility in the expeditionary (non-aircraft carrier) operating environment.
- The Navy conducted testing in accordance with the DOT&E approved TEMP and test plan.

Assessment

- Emerging 2011 FOT&E results suggest the EA-18G remains operationally effective, while operational suitability has notably improved. Emerging results suggest the EA-18G system met the threshold for operational availability. The point value for reliability met the 14-hour threshold, but the 80 percent confidence level (lower bound) fell below the threshold. Maintainability did not meet the threshold level but only by a small measure, and built-in test performance was largely improved since IOT&E. Maintenance documentation was improved from IOT&E, but Navy personnel still rated the system as difficult to use and incomplete in some areas.
- DOT&E analysis of test data is still ongoing and a complete assessment will be published in early FY12.

Recommendations

- Status of Previous Recommendations. The Navy is satisfactorily addressing the previous nine EA-18G recommendations, to include continued testing to resolve EA-18G maintainability shortfalls. However, DOT&E analysis of 2011 FOT&E is ongoing to confirm whether the problems have been resolved. Recommendations for improving electronic warfare remain from FY09 as well.
- FY11 Recommendations. The Navy should:

EA-18G Aircraft

1. Continue to improve maintainability and built-in test software maturity by evaluating key suitability parameters during future FOT&E, such as Mean Flight Hours Between Operational Mission Failures and Mean Corrective Maintenance Time for Operational Mission Failures.
2. Continue to improve maintenance documentation and diagnostic tools to assess the ALQ-218 and ALQ-99 pod health.
3. Conduct a program "deep-dive" assessment of AEA maintainability and supportability problems using experience and lessons learned from recent operational deployments.
4. Evaluate the EA-18G AEA system performance in support of strike aircraft in accordance with the joint AEA framework.

Electronic Warfare Warfighting Improvements

5. Continue to support ongoing DoD efforts to investigate, evaluate, and make recommendations to improve Enterprise Electronic Warfare test capabilities associated with open-air ranges, T&E facilities, concepts, processes, and procedures.
6. 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.
7. Continue to assess the need for and benefits of building a more capable threat range at Naval Air Station (NAS) Whidbey Island, Washington.

Enhanced Combat Helmet (ECH)

Executive Summary

- During the initial ballistic First Article Test (FAT) of the Enhanced Combat Helmet (ECH), the ECH did not meet the requirements for maximum shell deformation when impacted by a ballistic threat. The failure to meet the shell deformation requirement was attributed to differences in test procedures used during developmental testing and the FAT.
- Following additional ballistic testing, the Marine Corps, in coordination with DOT&E and the Army, established new test procedures for assessing ECH ballistic performance. The procedure led to accurate control of the helmet position on the headform and, as a consequence, reduced variation in measurements of the ECH shell deformation. DOT&E updated the DoD combat helmet test protocol to reflect these procedures.
- The Marine Corps began another FAT in November 2011 and plans to begin a full-up system-level test of the ECH beginning December 2011.

System

- The ECH was developed in response to a 2009 Urgent Statement of Need (USON) to produce a helmet that provides ballistic protection from selected small arms ammunition and fragmentation, yet maintains all other characteristics of the Marine Corps' LightWeight Helmet (LWH) and the Army's Advanced Combat Helmet (ACH).
- The ECH is compatible with and is typically worn in conjunction with other components of infantry combat equipment such as body armor systems, protective goggles, night vision equipment, and a camouflage fabric helmet cover. This new helmet is intended to provide Marines and Soldiers improved protection compared to the currently fielded LWH and ACH helmets.
- The ECH consists of a ballistic protective shell, a pad suspension system, and a 4-point chin strap/nape strap retention system. Unlike the ACH and LWH, which are constructed with aramid fibers, the ECH is constructed using ultra-high-molecular-weight polyethylene fibers.

Mission

Forces equipped with the ECH will rely on the helmet to provide ballistic protection from selected small arms ammunition and fragmentation when engaged with enemy combatants during tactical operations in accordance with applicable tactics, techniques, and procedures.

Major Contractor

Ceradyne, Inc. – Costa Mesa, California

Activity

- During initial first article live fire testing in FY11, the ECH exceeded the allowed shell deformation when impacted by a ballistic threat at different locations on the helmet. The helmet also failed other non-ballistic requirements and the vendor has introduced manufacturing changes to address the causes of the non-ballistic FAT failures.
- The ballistic failure was attributed to differences between the test procedures used during developmental testing and the procedures used during the ballistic portion of the FAT. At the direction of the ECH Program Office, Ceradyne produced more ECH for additional ballistic testing to better characterize and understand ECH performance.
- The Marine Corps Program Manager for Individual Combat Equipment, the Army's Product Manager for Soldier Protective Equipment, the Army's Aberdeen Test Center, and commercial test laboratories participated in the additional testing. The Marine Corps and Army used the test results to refine their test methodology to minimize test-induced deviations in ECH performance.

- The Marine Corps also tested the ECH at the Army Research Laboratory using digital imaging correlation. This testing measured ECH deformation when the helmet was not constrained by the clay-filled aluminum headform normally used during testing. Digital imaging correlation tests revealed the ECH sustained more permanent deformation from a shot than was previously known; this affected the helmet's ballistic performance on subsequent shots to the same helmet.
- Data analysis of the additional ballistic testing revealed that the ECH position on the headform significantly affected the results. The Marine Corps, in coordination with DOT&E and the Army, established a new test procedure to better control the helmet position; data obtained using this new procedure showed considerably reduced variability in deformation measurements. DOT&E incorporated these procedures into the DoD combat helmet testing protocol for use when testing ultra-high-molecular-weight polyethylene-based helmets.
- The Marine Corps began a second FAT in November 2011 is scheduled to conduct a full-up system-level test beginning in December 2011 to demonstrate whether the ECH meets its ballistic protection requirements.

Assessment

DOT&E will assess ECH performance when testing concludes in FY12 and the data analysis is complete. DOT&E will provide recommendations as part of its ECH live fire beyond low-rate initial production report to Congress in FY12.

Recommendations

- Status of Previous Recommendations. This is the first annual report for the ECH program.
- FY11 Recommendations. None.

F/A-18E/F Super Hornet Naval Strike Fighter

Executive Summary

- Between November 2010 and June 2011, the Navy conducted APG-79 Active Electronically Scanned Array (AESA) radar FOT&E, concurrent with Software Qualification Testing (SQT) for System Configuration Set (SCS) H6E and 23X software. Major upgrades tested during this period included APG-79 radar software anomaly report fixes, Joint Standoff Weapon (Block III) integration, Joint Helmet-Mounted Cueing System (JHMCS) enhancements, and Air Intercept Missile (AIM)-120 capability improvements, including high off-boresight targeting.
- Emerging APG-79 radar FOT&E results indicate marginal improvements since the previous FOT&E period with significant deficiencies remaining in performance, particularly regarding short-range air combat maneuvering engagements, failure to meet reliability requirements, and poor built-in test (BIT) functionality.
- Emerging SQT results indicate the H6E and 23X SCSs are stable and reliable.
- DOT&E will complete its analysis of test data in early FY12 and subsequently report its full findings.

System

- The Super Hornet is the Navy's premier strike-fighter aircraft that replaces earlier F/A-18 variants in carrier air wings. The F/A-18E is a single-seat aircraft while the F model has two seats.
- The operational software for the Super Hornet, or SCS, includes major combat capabilities. Newer Block 2 aircraft with updated processors use "H-series" software, while aircraft prior to Block 26 and legacy F/A-18 A/B/C/D aircraft use "X-series" SCS. The current fleet release software are H5E and 21X, respectively.
- F/A-18E/F Lot 26+ aircraft provide functionality essential for integrating all Super Hornet Block 2 hardware upgrades, which include:
  - Single pass multiple targeting for GPS-guided weapons
  - Use of off-board target designation
  - Improved datalink target coordination precision
  - Implementation of air-to-ground target points
- Additional systems include:
  - APG-73 or APG-79 radar
  - Advanced Targeting and Designation Forward-Looking Infrared System
  - AIM-9 infrared-guided missiles and AIM-120 and AIM-7 radar-guided missiles
  - Shared Reconnaissance Pod
  - Multi-functional Information Distribution System for Link 16 tactical datalink connectivity
  - JHMCS
  - Integrated Defensive Electronic Countermeasures

Mission

- Combatant Commanders use the F/A-18E/F to:
  - Conduct offensive and defensive air combat missions
  - Attack ground targets with most of the U.S. inventory of precision and non-precision weapon stores
  - Provide in-flight refueling for other tactical aircraft
  - Provide the fleet with an organic tactical reconnaissance capability

Major Contractor

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

Activity

- DOT&E reported on APG-79 radar IOT&E in FY07, assessing it as neither operationally effective nor suitable due to significant deficiencies in tactical performance, reliability, and BIT functionality.
- The Navy conducted APG-79 radar FOT&E in FY09 in conjunction with SCS H4E SQT. The Navy's Commander, Operational Test and Evaluation Force subsequently reported

that significant deficiencies remained for both APG-79 performance and suitability; DOT&E concurred with this assessment.
- Between November 2010 and June 2011, the Navy conducted a second APG-79 radar FOT&E period, concurrent with SQT for SCS H6E and 23X. Major upgrades tested during this period included APG-79 radar software anomaly report fixes, Joint Standoff Weapon (Block III) integration, JHMCS enhancements, and AIM-120 capability improvements, including high off-boresight targeting.
- The Navy executed 999.3 Super Hornet flight hours over 739 sorties during SCS H6E SQT.
- The Navy executed an additional 447.3 Super Hornet and legacy F/A-18 flight hours over 366 sorties for SCS 23X SQT.
- The Navy executed a mix of 591.6 Super Hornet and EA-18G (electronic attack variant of the F/A-18) flight hours conducting APG-79 radar FOT&E.
- DOT&E analysis of APG-79 FOT&E and SCSs H6E and 23X SQT data is ongoing.
- The Navy conducted all testing in accordance with DOT&E-approved Test and Evaluation Master Plans and operational test plans.

Assessment
- The APG-79 radar FOT&E period did not include an end-to-end multi-AIM-120 missile shot. This capability is a Navy operational requirement not previously demonstrated or successfully tested.
- Full development of APG-79 electronic warfare capability remains deferred to later software builds.
- Overall, the APG-79 radar demonstrates improved capability over the legacy APG-73 radar, providing longer-range detections for air-to-air operations and improved synthetic aperture radar performance for air-to-ground operations.
- Emerging APG-79 radar FOT&E results indicate marginal improvements since the previous FOT&E period with significant deficiencies remaining in performance, particularly regarding short-range air combat maneuvering engagements, failure to meet reliability requirements, and poor BIT functionality.
- Emerging SQT results indicate H6E and 23X SCSs are stable and reliable.
- DOT&E will complete its analysis of test data in early FY12 and subsequently publish an in-depth operational assessment.

Recommendations
- Status of Previous Recommendations. The Navy made progress addressing one FY09 recommendation (there was no FY10 report). The recommendations to continue to improve APG-79 AESA reliability, to conduct an operationally representative end-to-end missile shot to demonstrate APG-79 radar and current SCS ability to support multi-AIM-120 engagement, and to develop and characterize the APG-79 AESA's full electronic warfare capability remain valid.
- FY11 Recommendations. None.

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

Executive Summary

- The Navy's Commander, Operational Test and Evaluation Force (COTF) conducted IOT&E of the Global Command and Control System – Maritime (GCCS-M) Release v4.1 Force Level variant onboard the USS *Boxer* (one of the Navy's Landing Helicopter Dock ships) from November 3-19, 2010, and from May 1-10, 2011. DOT&E determined that the Force Level variant of the GCCS-M v4.1 system is operationally effective and suitable with limitations. Following our determination, the program manager corrected identified limitations and COTF independently validated corrections on September 15, 2011.
- COTF conducted the IOT&E of GCCS-M v4.l Unit Level variant onboard the USS *Carr* (one of the Navy's Guided Missile Frigates) from March 30 through April 6, 2011. The USS *Carr* was conducting Surface Warfare, Undersea Warfare, littoral, and counter-drug operation exercises in the Virginia Capes Operations Area. DOT&E determined that the Unit Level variant of the GCCS-M v4.1 system is operationally effective and suitable.
- The Navy Information Operations Command (NIOC) Red Team identified and attempted to penetrate and exploit system information assurance (IA) vulnerabilities during each IOT&E.

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 Tactical Networks 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 infrastructure.
- The Navy is developing GCCS-M Increment 2 at the Force, Group, and Unit Levels. Force Level includes aircraft carrier (CVN), amphibious assault (LHA and/or LHD), and command ships (LCC). Group Level includes guided missile cruisers (CG), destroyers (DDG), and submarines. 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:
  - Aircraft carrier, amphibious command ship (LCC), and amphibious assault ship capability based on the GCCS-Joint (GCCS-J) software baseline.
  - Guided missile cruiser and below capability based on the eXtensible Common Operational Picture software baseline.
- The Navy intends to release the Group and Unit Level solution in a three configuration phased approach, starting with 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:
  - Integrate scalable command and control, communications, and intelligence capabilities.
  - 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

- COTF conducted the IOT&E of GCCS-M v4.l Force Level variant onboard the USS *Boxer* from November 3-19, 2010, and from May 1-10, 2011. USS *Boxer* was underway conducting exercises in the Southern California Operations Area acting as Top Common Operational Picture (COP), Common Tactical Picture Manager, and Air Operations Center while Commander Third Fleet GCCS-J systems were unavailable.
- COTF conducted the IOT&E of GCCS-M v4.l Unit Level variant onboard the USS *Carr* from March 30 through April 6, 2011. The USS *Carr* was conducting Surface Warfare, Undersea Warfare, littoral, and counter-drug operation exercises in the Virginia Capes Operations Area.
- Concurrently with IOT&E, a NIOC Red Team performed an IA assessment that included system scans, penetration testing, and malicious insider analysis.
- COTF performed all testing in accordance with the DOT&E-approved Test and Evaluation Master Plan and operational test plans.

Assessment

- The Force Level variant of the GCCS-M v4.1 system is operationally effective and suitable with limitations. Overall, the GCCS-M v4.1 system demonstrated improved tactical decision aids, track capacity, and security. However, COTF identified a number of limitations during testing. Operators and system administrators were not properly trained to handle Air Tasking Orders and Airspace Control Orders, nor did the GCCS-M v4.l online help function contain adequate details to guide operators through the Air Tasking Order/Air Control Order handling processes. The program manager corrected all portions of this deficiency and COTF independently validated this correction on September 15, 2011.
- The COP Synchronization Tools (CST) function randomly switched from normal mode to maintenance mode daily during the IOT&E, for a total of 16 occurrences. The program manager corrected the deficiency and COTF confirmed that there were no further instances during the second test period. The GCCS-M v4.1 system met threshold reliability requirements when DOT&E excluded the CST random switching faults. COTF identified six minor IA deficiencies during testing that require correction.
- The Unit Level variant of the GCCS-M v4.1 system is operationally effective and suitable. The GCCS-M v4.1 system met or exceeded all threshold requirements and satisfied all tested Critical Operational Issues. The GCCS-M v4.1 system supported user tactical assessment and decision making by providing an integrated COP with near-real-time tracks, link tracks, and imagery; access to historical, current, and future positional data; and mission specific overlays and templates. NIOC provided IA test data showing that the system can preclude unauthorized access to information, although deficiencies attributed to surrounding network components could make the system vulnerable. The Navy should correct these deficiencies as soon as practical.

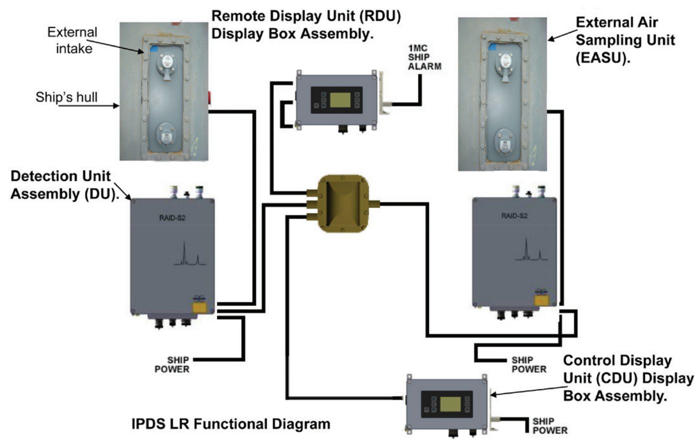
Recommendations

- Status of Previous Recommendations. The Navy addressed all previous recommendations.
- FY11 Recommendation.
  1. The program manager, in coordination with Navy Enterprise leadership, should correct the IA deficiencies identified during GCCS-M v4.1 Force Level and Unit Level operational testing.

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

Executive Summary
- The Navy completed integrated testing and FOT&E of the Improved (Chemical Agent) Point Detection System – Lifecycle Replacement (IPDS-LR) in September 2010.
- The system meets key requirements for reliability, availability, and false alarms.
- DOT&E published a classified IPDS-LR Beyond Low-Rate Initial Production (BLRIP) report in April 2011.

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. The Next Generation Chemical Point Detection System, which is still under development, is projected to replace the IPDS-LR in FY18.
- The commercially-available detector unit is designed to automatically detect and identify CWA vapors by agent class (nerve, blister, and blood) and type agent 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, the IPDS-LR Performance Specification, and the latest toxicological guidance provided by the U.S. Army Center for Health Promotion and Preventive Medicine.
- The IPDS-LR can be integrated into the Main Circuit 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 near each bridge wing, port, and starboard side, the DUs sample air for the presence of CWA vapors and provide 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. Located in Damage Control Central, 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. 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 CWA. The system is required to detect and alert ship personnel to the onset of CWA vapor hazards.
- Successful detection of a CWA at the required threshold concentration 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 integrated testing and FOT&E in September 2010. Integrated testing and FOT&E were conducted in accordance with a DOT&E-approved test plan.
- DOT&E published a classified IPDS-LR BLRIP report in April 2011.

- With the completion of the FOT&E and BLRIP report, DOT&E removed IPDS-LR from oversight.

Assessment

Based on the system performance in integrated testing and FOT&E:

- IPDS-LR was able to detect 7 of 10 CWAs tested. IPDS-LR detects vaporized agents; therefore, it does not perform well against agents that do not readily vaporize.
- IPDS-LR has a comparable detection performance to the legacy system it replaced; it met or exceeded reliability, maintainability, and availability requirements. In exceeding its false alarm requirement, the IPDS-LR demonstrated significant improvement in false alarm performance compared to the legacy IPDS.
- IPDS-LR was found to be operationally effective and suitable.

Recommendations

- Status of Previous Recommendations. The Joint Program Executive Officer for Chemical and Biological Defense and the Navy addressed all previous recommendations.
- FY11 Recommendations. None.

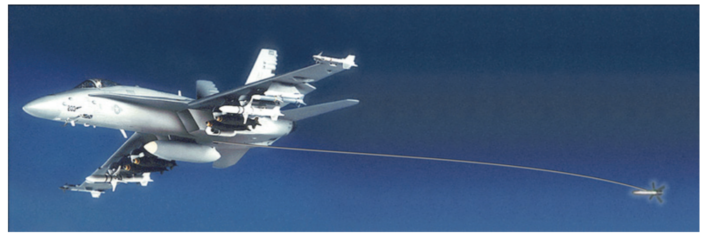
Integrated Defensive Electronic Countermeasures (IDECM)

Executive Summary

- In October 2010, DOT&E approved an updated Integrated Defensive Electronic Countermeasures (IDECM) Block 3 test plan to support correction of deficiencies testing in early FY11.
- In March 2011, the Navy completed testing to confirm the correction of deficiencies in IDECM Block 3 performance discovered during the 2008 IOT&E.
- DOT&E completed its IDECM Block 3 IOT&E Report in June 2011, assessing the system as operationally effective and operationally suitable for combat. The system significantly reduces aircraft susceptibility and provides enhanced self-protection against radio frequency-guided surface-to-air and air-to-air threats. Additionally, IDECM Block 3 provides adequate reliability, availability, and maintainability to support mission accomplishment.
- Although the IDECM Block 3 is suitable, testing confirmed a previously identified compatibility shortfall associated with wingman APG-79 Active Electronically Scanned Array radars. Although some work has occurred to address this problem, the Navy will require a collaborative effort across the F/A-18 program community to identify fixes and/or mitigations to this shortfall.
- The Navy authorized IDECM Block 3 full-rate production in July 2011.
- IDECM Block 4 hardware and software delivery to the government began in 3QFY11. A revised Test and Evaluation Master Plan (TEMP) is scheduled for completion prior to the start of the Navy Operational Assessment in FY12.

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.



  - 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.
- 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.

Mission

- Combatant commanders will use IDECM to improve the survivability of Navy F/A-18 strike aircraft against radio frequency-guided threats while on air-to-air and air-to-ground missions.
- The Navy intends 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

- The Navy postponed the IB-3 full-rate production decision to 4QFY11 to allow time to test and evaluate fixes to the suitability and safety deficiencies identified during the 2008 IOT&E.
- In October 2010, DOT&E approved an updated IDECM Block 3 test plan to support correction of deficiencies testing in early FY11.

- The Navy completed laboratory and developmental flight testing to confirm the correction of deficiencies in the IB-3 performance found during the 2008 IOT&E.
- In March 2011, the Navy completed operational testing to confirm the correction of deficiencies in IDECM Block 3 performance discovered during the 2008 IOT&E.
- DOT&E completed its IDECM Block 3 IOT&E Report in June 2011.
- The Navy authorized the IDECM Block 3 full-rate production in July 2011.
- The Navy conducted testing in accordance with the DOT&E approved TEMP and test plan.

IDECM Block 4

- The IDECM Block 4 hardware and software delivery to the government began in 3QFY11. Contractor and government laboratory testing is underway.
- The IDECM Block 4 TEMP update is scheduled for completion prior to the start of the Navy Operational Assessment testing in FY12.

Assessment

IDECM Block 3

- DOT&E concluded in its IOT&E report that the IDECM Block 3 was adequately tested. Testing followed the DoD electronic warfare test process, including several laboratory hardware and software tests and flight testing. The 139 hours of flight testing, which included 19 decoy deployments, provided high-confidence answers to the suitability assessment.
- The IDECM Block 3 is operationally effective for combat. The system met or exceeded its operational requirement under all test conditions, while significantly reducing aircraft susceptibility and providing enhanced self-protection against radio frequency-guided surface-to-air and air-to-air threats.
- The IDECM Block 3 is operationally suitable for combat. Testing confirmed with high confidence that safety deficiencies observed during the 2008 IOT&E were corrected; the system was reliable and maintainable. There were an excessive number of unscheduled maintenance actions, but most were brief, and often involved simple reseating or cleaning of connections. The built-in test false alarm rate was improved, but was still above the threshold requirement level, which affected unscheduled maintenance.
- Testing did show the importance of aircrew and maintenance personnel proficiency with the system. Thus, the Navy should establish a training concept that includes the employment of simulated and actual ALE-55 decoys during training exercises. Although the 2011 testing showed no repeat of the safety-related decoy deficiencies, the Navy should develop hardware and/or software changes to provide pilots with correct indications of whether a decoy was completely severed.
- Testing confirmed a previously identified compatibility shortfall associated with wingman APG-79 Active Electronically Scanned Array radars. Although some work has occurred to address this problem, the Navy will require a collaborative effort across the F/A-18 program community to identify fixes and/or mitigations to this shortfall. System effectiveness was not significantly degraded by this problem.

Recommendations

- Status of Previous Recommendations. The Navy addressed the prime recommendations from FY10 by completing testing to confirm IB-3 deficiencies were corrected, and there are ongoing efforts to develop new and improved tactics, training, and countermeasure techniques. One recommendation from FY10 to develop hardware and/or software changes to provide pilots with correct indications of deployed decoy status remains. Of the two FY10 recommendations that were related to Electronic Warfare Warfighting Improvements, one is still outstanding and it is repeated below.
- FY11 Recommendations.

IDECM System

1. The Navy should collaborate across the F/A-18 program community to identify fixes and/or mitigations to the compatibility shortfalls with APG-79 fire control radars.
2. The Navy should continue to improve maintenance procedures and documentation and develop an IDECM Block 3 training concept that includes employment of simulated and actual ALE-55 decoys during training.
3. The Navy should continue to reduce the built-in test false alarm rate, improve the reliability of decoys while they are being deployed, and confirm that each new procurement lot of decoys is reliable through laboratory and flight tests of lot samples.

Electronic Warfare Warfighting Improvements

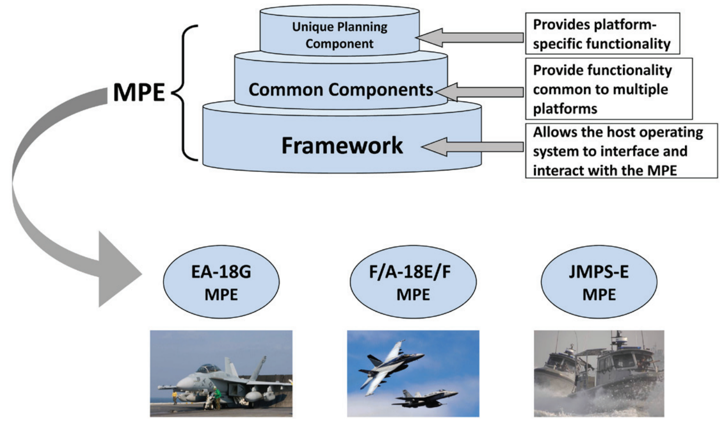
4. In coordination with the Defense Intelligence Agency, the Navy should update the threat lethal radii and/or the evaluation processes that are used to determine whether simulated shots are hits or misses.

Joint Mission Planning System – Maritime (JMPS-M)

Executive Summary

- The Navy Joint Mission Planning System – Maritime (JMPS-M) Program Manager, PMA-281, is deploying JMPS Framework 1.3.5, which will replace Framework 1.2 to enable JMPS-M software to transition to Windows 7.
- Operational testing of the F/A-18E/F portion of the JMPS-M Mission Planning Environment (MPE) version 2.3.1 demonstrated that the MPE was operationally effective and suitable.
- Operational testing of the EA-18G portion of MPE version 2.3.1 demonstrated that the MPE was operationally suitable, but not effective for operational planning and reconstruction in support of the aircraft's mission.
- Operational testing of the Joint Mission Planning System – Expeditionary (JMPS-E) MPE indicated that it was operationally effective and suitable for supporting expeditionary and amphibious operations.

JMPS-M Mission Planning Environments (MPEs)



System

- JMPS-M is a Windows XP, PC-based common approach for aircraft mission planning. It is a system of common and host-platform-unique mission planning applications for Navy and Marine Corps aircraft.
- Using a "building block" approach, developers integrate and assemble a JMPS-M MPE from a set of software sub-components to meet the needs of a particular aircraft type. An MPE consists of a framework, one or more common components/federated applications, and then a Unique Planning Component (UPC).
  - The foundation of an MPE is the framework, which allows the host operating system to interface and interact with the MPE.
  - The second level of an MPE consists of the common components and/or federated applications; these applications provide functionality that is common to multiple aircraft platforms (i.e. weather or GPS munitions).
  - The final level of software is the UPC, which provides platform-specific functionality and integrates the common component functions and the framework interface to produce the overall mission planning software environment for the platform.
  - When bundled, the three levels of software become an MPE that is specific to a single aircraft type. 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 1.3.5 corrects defects in Framework 1.2, and will transition both the Navy and Air Force to Windows 7. Windows XP support expires in April 2014.
- Although portions of the JMPS-M software are being co-developed among DoD components, JMPS-M is not a joint program.
- JMPS-E is a unique MPE, developed by the Navy, which uses JMPS-M functionality to support Navy and Marine Corps amphibious planning.

Mission

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

Major Contractors

- Framework 1.4 / JMPS-E: BAE Systems – San Diego, California
- Framework 1.3.5: Northrop Grumman – Carson City, California
- FA-18E/F UPC: Boeing – St. Louis, Missouri

Activity

- The Navy conducted all MPE operational testing in accordance with the DOT&E-approved Test and Evaluation Master Plans and operational test plans.

Framework 1.2

- The Naval Air Warfare Center Weapons Division at Point Mugu, California, conducted developmental testing of the F/A-18E/F and EA-18G JMPS-M MPE version 2.4.0.2. This testing was conducted to assess the current state of MPE development and to reduce risk in moving forward towards future operational testing.
- Commander, Operational Test and Evaluation Force (COTF) conducted operational testing on MPE version 2.3.1 in December 2010 through March 2011 at Naval Air Weapon Station, China Lake, in conjunction with operational testing of platform System Configuration Set H6E.
- PMA-281 conducted (and COTF monitored) enhanced developmental testing of the JMPS-E MPE version 1.0.0.7 at a contractor facility in San Diego, California, in January 2011. DOT&E approved the COTF JMPS-E IOT&E test plan in March 2011.
- The Navy Information Operations Command completed Gold Disk and Retina Scans on JMPS-E in February 2010 and penetration testing on JMPS-E aboard the USS *Bataan* in March 2011. COTF conducted the JMPS-E IOT&E aboard the USS *Bataan* in March 2011. Real-world events in the U.S. Africa Command Area of Operations dictated the USS *Bataan* deployment shift from the original plan of July 2011 to April 2011. This schedule shift truncated the test period; however, COTF collected sufficient data to support the DOT&E-approved test plan.
- The Navy released JMPS-E to the Fleet in July 2011 and it is currently being employed aboard the USS *Bataan* in support of real-world operations.

Framework 1.3.5

- JMPS-M is transitioning to Windows 7. Framework 1.3.5 will be used by the Navy to transition their aircraft to a Windows 7 Framework.

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.

Assessment

Framework 1.2

- The Take-Off and Landing Data (TOLD) modules in the Navy MPEs evaluated to date do not generate accurate data and are not certified for flight use. Planners are required to revert to paper manuals or legacy mission planning systems to calculate TOLD data. Inability to calculate TOLD data negatively affects the operational effectiveness of the various MPEs.
- Developmental testing of MPE version 2.4.0.2 highlighted that the increasing capabilities of the F/A-18 and EA-18 platforms are resulting in increased mission planning complexity. Users experienced multiple errors in attempting to download mission data from the planning computer to a Data Transfer Device. Downloading Standoff Land Attack Missile - Expanded Response Automatic Target Acquisition images from the Precision Targeting Workstation was slow and unreliable. The High-speed Anti-Radiation Missile (HARM) UPC does not contain all needed planning parameters. Users encountered numerous software errors, particularly when planning Airborne Electronic Attack missions.
- Operational testing of the F/A-18E/F portion of the MPE version 2.3.1 demonstrated that the MPE was operationally effective and suitable. Users experienced no significant difficulties in planning their missions, transferring the mission data to data transfer devices, and then loading the data into the aircraft. The average time to complete this process was 0.94 hours, which was well within the 6-hour requirement. One mission failure occurred during 74 hours of testing versus a user requirement of 30 hours. The TOLD functionality remains inoperative in MPE 2.3.1, as it has in all Navy and Marine Corps aircraft MPE 2.XX series of JMPS software.
- During operational testing, the EA-18G portion of MPE version 2.3.1 was operationally suitable, but was not effective for operational planning and reconstruction in support of the aircraft's mission. The average time to plan a multi-platform interdiction mission was 7.3 hours, which exceeded the 6-hour requirement. Suitable electronic intelligence information was not available for some threats. User selection of the HARM's Unique Planning Component, with other mission planning files open, caused mission planning failures. Opening an F/A-18 Mission Load file, with an open Airborne Electronic Attack Mission File, corrupted the Mission Load file, and electrostatic discharge can cause the JMPS-M computer to crash during the loading of a Data Transfer Device. JMPS-M does not collect and store all data required for full HARM post-flight mission analysis. The TOLD functionality remains inoperative in MPE 2.3.1, as it has in all MPE 2.XX series of JMPS software.
- Because the IOT&E was compressed, there were not enough test hours to calculate JMPS-E reliability with 80 percent confidence from IOT&E data alone. However, if integrated testing is included in the reliability calculations, then JMPS-E met the 72-hour mean time between operational mission failure requirement with 97 percent confidence.
- JMPS-E was effective for supporting expeditionary and amphibious operations. Fleet operators were successfully able to use JMPS-E to produce amphibious operations tasking messages, graphical representations of the operations areas and the possible effects of different types of supporting fire on battlespace geometry, and courses of action briefings for senior leadership. Planners used these products in daily briefings to senior leadership aboard the USS *Bataan*.
- JMPS-E is suitable for supporting expeditionary and amphibious operations. During the course of operational

testing, JMPS-E experienced no operational mission failures during more than 257 hours of testing for an operational availability of 99.96 percent. It also met or exceeded all maintainability requirements. There were minor human factors interface problems revolving around MPE access to aeronautical database information (Digital Aeronautical Flight Information File data) as well as outdated documentation for utilizing the software.
- COTF determined that JMPS-E did not have any major information assurance deficiencies and was capable in the areas of protecting fleet planners' data and information; detecting and reacting to threats to that data; and restoring fleet planners' data and information following a cyber-attack.

Recommendations

- Status of Previous Recommendations. The Navy is satisfactorily addressing the FY10 recommendations.
- FY11 Recommendations. The Navy should:
  1. Demonstrate that users can transfer mission planning data from JMPS computers to powered F/A-18 and EA-18 platform flight computers during developmental testing prior to entrance into operational testing.
  2. The Navy should develop and implement a dedicated process to implement required fixes to flight performance and monitor TOLD data within all MPEs in order to eliminate delays with certification/de-certification of TOLD data for operational use.
  3. Before allowing fleet release of the EA-18G portion of MPE 2.3.1, conduct Verification of Correction of Deficiencies testing on the MPE to demonstrate that problems identified during the operational test have been corrected.
  4. Incorporate all Digital Aeronautical Flight Information File information into the JMPS-E MPE.
  5. Continue to monitor mean time between operational mission failures aboard the USS *Bataan* to ensure that JMPS-E continues to meet required reliability.
  6. Update the JMPS-E MPE system documentation to support V1.0.0.7.

Light Armored Vehicle (LAV) Upgrade

Executive Summary
- The Marine Corps has developed a special purpose kit to improve protection from under vehicle attacks. This kit (known as the D-Kit) is designed to work with the ballistic protection upgrade package (BPUP) and is installed at the discretion of the operational commander.
- The Marine Corps began system-level underbody blast testing in June 2011 at Aberdeen Proving Ground, Maryland, and they have completed six shots; the data indicate that the D-kit has increased crew protection.

System
- The Family of Light Armored Vehicles shares a common base platform configuration (eight-wheels, armored hull, suspension, power plant, drive train, and auxiliary automotive subsystem) among eight mission role variants. The LAV-25 personnel carrier is the predominant variant.
- A Service Life Extension Program was initiated by the Marine Corps in FY05 primarily to address obsolescence deficiencies. The Marine Corps undertook the Survivability Upgrade I program based on an Urgent Need Statement from the operating forces. This upgrade became the LAV A2 configuration standard, and involved developing and installing a BPUP, power pack enhancements, upgraded suspension, and other modifications.
- The BPUP system consists of three kits, two of which provide additional protection against threats, while the third provides an internal and external stowage system.
- In 2007, the Program Management LAV Office internally designed an underbody kit (known as a D-Kit) that can be incorporated to counteract under-vehicle strikes. The D-kit has been fielded since 2009.

LAV-25A2 Variant

Mission
Marine Corps commanders will use LAVs to provide combined arms reconnaissance, security missions, and mobile electronic support.

Major Contractors
- General Dynamics Land Systems – Canada
- Conversion of a LAV A1 to a LAV A2 is conducted at Marine Corps Logistics Base – Albany, Georgia, and Marine Corps Logistics Base –Barstow, California

Activity
- DOT&E approved the LFT&E Strategy and the Event Design Plan for the Follow-On System-Level Ballistic Testing of the LAV Survivability Upgrade I in June 2011.
- Follow-on system-level underbody testing began in June 2011 at Aberdeen Proving Ground, Maryland. The LAV program office provided two fully armored LAV-25A2 assets to explore and characterize the force protection capabilities and vehicle vulnerability against underbody blast threats. Mine Resistant Ambush Protected All Terrain Vehicle level threats are also being tested.
- The first test event on each vehicle was a full-up system-level test. The test plan includes eight events with threat placement varying from underbody to under wheel; the Marine Corps has completed four events.
- Damage Assessment Meetings conducted after each event aid the working group in the determination of the next threat size and system-level event. Based on emerging test data, the Army Research Lab, Aberdeen, Maryland, produces a crew casualty report for each meeting.

Assessment
- The LAV A2 D-Kit is designed to work with the previously installed BPUP system and is a special purpose mission kit used in theatre at the discretion of the operational commander. The BPUP provides armor protection to the sides and roof of the vehicle, whereas the D-Kit provides additional armor protection with a V-shaped hull under the vehicle.

- Emerging results indicate that the LAV-25A2 D-Kit increases crew protection against under-vehicle strikes.
- The location of the LAV-25A2 fuel cell, which is centered under the rear of the vehicle, increases crew vulnerability to some under-vehicle threats.
- Analysis indicates the D-Kit has the ability to increase crew protection to some IED threats.
- Testing will continue through 2QFY12. DOT&E will publish a report at that time.

Recommendations

- Status of Previous Recommendations. This is the first annual report for this program.
- FY11 Recommendations. The Marine Corps should:
  1. Pursue additional LAV survivability upgrades, particularly blast mitigation seats, 5-point harness seat belts, and advanced suspension designs.
  2. Consider relocating the fuel cell of the LAV-25A2 at the next survivability upgrade.

Littoral Combat Ship (LCS)


LCS 1


LCS 2

Executive Summary

- The Navy plans to acquire a total of 55 Littoral Combat Ships (LCSs). In early FY11, the USD(AT&L) authorized the purchase of hulls 3 through 22 (10 of each ship design; LCS 1 class is a monohull constructed of steel and aluminum and LCS 2 class is an all aluminum trimaran design) versus the original intent of procuring just the down-selected design.
- LCS 1 completed a 3 to 4 week shipyard maintenance period to repair an underwater hull crack that had curtailed seakeeping and human factors trials.
- LCS 2 experienced major disruptions and delays caused by problems with core systems and Mine Countermeasures (MCM) mission modules, principally the Twin Boom Extendible Crane, the lift platform, and the Remote Multi-Mission Vehicle (RMMV). LCS 2 also experienced underwater hull damage in the area of the waterjet propulsors caused by bimetallic corrosion.
- The Navy announced that Raytheon's Griffin missile system will provide an interim replacement for the canceled Army Non-Line-of-Sight Launching System and Precision Attack Missile for later increments of Surface Warfare (SUW) mission packages.
- OSD approved the Navy's request to split the program into two separate acquisition programs – one for seaframes and the other for mission modules. The Navy also established a new Program Executive Officer for LCS Programs to oversee the seaframe and mission modules program offices and related mission system program offices.

System

- The LCS is designed to operate in the shallow waters of the littorals where larger ships cannot maneuver as well. It is intended to accommodate a variety of individual warfare systems (mission modules) assembled and integrated into interchangeable mission packages.
- The Navy currently plans to field MCM, SUW, and Anti-Submarine Warfare (ASW) mission packages.
- The Navy is buying two ship (seaframe) designs:
  - USS *Freedom* (LCS 1) class is a semi-planing monohull constructed of steel and aluminum.
  - USS *Independence* (LCS 2) class is an aluminum trimaran design.
- Common design characteristics:
  - Combined two diesel and gas turbine propulsion 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
  - Accommodations for up to 76 personnel (air detachment, mission module personnel, and core crew of no more than 40)
  - A Common Mission Package Computing Environment for mission package command and control
  - Hangars sized to embark MH-60R/S and Vertical Take-Off Unmanned Aerial Vehicles (VTUAVs)
  - 57 mm BOFORS Mk 3 gun
- The designs have different core combat systems to provide command and control, situational awareness, and self-defense against anti-ship cruise missiles and surface craft.
  - 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) system (one 21-cell launcher), and a DORNA (Spanish) Electro-Optical/Infrared 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 with the Close-In Weapons System (Mk 15) search and fire control radars (called SeaRAM), and Sea Star SAFIRE Electro-Optical/Infrared 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.
- The Navy plans to acquire a total of 55 LCSs. In early FY11, the USD(AT&L) authorized the purchase of hulls 3 through 22 (10 of each ship design) vice the original intent of procuring just the down-selected design.

Mission

- The Maritime Component Commander will employ LCS to conduct MCM, ASW, or SUW based on the mission package fitted into the seaframe. With the Maritime Security Module installed as part of the SUW mission package, the ship can conduct visit board search and seizure maritime interception operations. 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

- In early FY11, the USD(AT&L) authorized the Navy to implement a dual award acquisition strategy to award each prime contractor a 10-ship block buy contract for the period FY10-15; the Navy subsequently contracted to buy two ships from each contractor with funds appropriated for FY10 and FY11 (LCS 5-8).
- DOT&E approved changes to the LCS LFT&E Management Plan in February 2011. The changes reflect the Navy's decision to continue the procurement of both seaframe variants of the LCS Class and identify additional live fire testing and resources needed to adequately assess the survivability of both ship designs.
  - Management Plan designates LCS 3 and LCS 4 as the ships that will undergo shock trials in 2014.
  - The Navy is developing 57 mm and 30 mm ammunition LFT&E Management Plans to submit for approval in FY12.
- OSD approved the Navy's request to split the program into two separate acquisition programs – one for seaframes and the other for mission modules. The Navy also established a Program Executive Officer for LCS Programs to oversee the seaframe and mission modules program offices and related mission system program offices.
- The Navy announced that Raytheon's Griffin missile system will replace the cancelled Army Non-Line-of-Sight Launching System and Precision Attack Missile as an interim capability in a later increment of SUW mission packages. The Navy plans to conduct a new competition to select a missile system as a permanent solution to be incorporated into a post-FY16 increment.
- The Navy also announced that the ASW mission package (Increment II) will comprise a Variable Depth Sonar (VDS), the Fire Scout VTUAV, a Multi-Function Towed Array, Light Weight Tow (a torpedo decoy system), and the MH-60R helicopter and associated sensors and weapons.
- LCS 1:
  - Developmental T&E of core seaframe systems resumed in the first half of FY11 after pausing to allow the ship to participate in counter-narcotics operations and a major naval exercise in FY10. Events completed included air defense tracking, gun accuracy verification, signature measurements, and surface target tracking and engagement. Events that were only partially completed because of equipment/integration problems included seakeeping trials, evaluation of the effects of ship motion on crew performance and fatigue, evaluation of the WBR-2000 Electronics Support Measures systems performance, and VTUAV dynamic interface testing.
  - The ship completed a short industrial availability to repair an underwater hull crack that had curtailed seakeeping and human factors trials.
  - LCS 1 commenced a post shakedown availability in June and remained in the shipyard through the end of the fiscal year.
- LCS 2:
  - Developmental T&E of core seaframe systems commenced at the end of FY10 and continued throughout FY11. Events completed included combat systems alignment and characterization; basic surface and air target tracking; datalink performance checks; launch, handling, and recovery of rigid hull inflatable boats in moderate sea conditions; initial integration/performance testing of MCM mission modules; shipboard noise measurements; and radar cross section measurements. Events that were only partially completed because of equipment deficiencies included evaluation of the Identification Friend-or-Foe systems; seakeeping trials; evaluation of the effects of ship motion on crew performance and fatigue; and launch, handling, and recovery of the Remote Multi-Mission Vehicle (RMMV).

- LCS 2 completed a 3- to 4-week shipyard maintenance period to make interim repairs to underwater hull damage in the area of the waterjet propulsors caused by bimetallic corrosion.

Assessment

- This assessment is based on limited information from developmental test progress reports. The program offices have not released any formal developmental T&E reports.
- LCS 1:
  - While LCS 1 was not able to complete all planned developmental T&E in FY11, major portions of most events were completed, and the ship did not experience any major disruptions other than those caused by discovery and repair of the hull crack.
- LCS 2:
  - LCS 2 testing experienced major disruptions and delays caused by problems with the Twin Boom Extendible Crane used to launch, handle, and recover watercraft and the RMMV, which is still under development. Additional disruptions were caused by failure of the lift platform used to move mission systems and other equipment between the mission bay and hangar; the Multi-Vehicle Communications system; the Identification Friend-or-Foe systems; satellite communications systems; hull corrosion; and propulsion systems.
- Both developmental and operational testing of the AN/AQS-20A Sonar Mine Detecting Set, an Airborne Mine-countermeasures mission module system within the LCS MCM mission package, revealed the system is deficient in meeting required thresholds for False Classification Density (FCD) and Vertical Localization. These deficiencies may preclude the LCS MCM mission package from meeting its required threshold for Area Coverage Rate Sustained (ACRS). If the FCD and Vertical Localization deficiencies are not corrected prior to IOT&E, they may adversely affect the operational effectiveness of the LCS MCM Mission Package.
- Developmental testing of the Airborne Laser Mine Detection System (ALMDS), an Airborne Mine-countermeasures mission module system within the LCS MCM mission package, revealed the system is deficient in meeting the required threshold for FCD. This deficiency will likely preclude the LCS MCM mission package from meeting its required threshold for ACRS. If the ALMDS FCD deficiency is not corrected prior to IOT&E, it will adversely affect the operational effectiveness of the LCS MCM Mission Package.
- LCS is not expected to be survivable in a hostile combat environment. This assessment is based primarily on a review of LCS design requirements, which do not require the inclusion of the survivability features necessary to conduct sustained operations in its expected combat environment. Even though two ships are already operational and two more are under construction, DOT&E cannot provide additional insight into the survivability of the class, or better assess the extent of their vulnerability to expected threats because the Navy has significantly delayed the release of their Detail Design Integrated Survivability Assessment Reports for both designs.

Recommendations

- Status of Previous Recommendations. Two recommendations from FY05 and FY06 remain that involve 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. Both of the FY10 recommendations remain valid. The Navy should implement all recommendations from DOT&E's Combined Operational and Live Fire Early Fielding Report and address all deficiencies noted in the Navy's Board of Inspection and Survey Acceptance Trials report.
- FY11 Recommendations.
  1. The Navy should investigate solutions and correct AN/AQS-20A FCD and Vertical Localization deficiencies prior to the LCS MCM Mission Package IOT&E.
  2. The Navy should investigate solutions and correct the ALMDS FCD deficiency prior to the LCS MCM Mission Package IOT&E.
  3. While the final survivability assessment of LCS cannot be made until the full ship shock trials and total ship survivability trials are completed, the Navy should continue to report vulnerabilities discovered during live fire tests and analyses. Doing so will inform acquisition decisions as soon as possible in the procurement of the LCS class.

LHA-6 New Amphibious Assault Ship
(formerly LHA(R))

Executive Summary

- LHA-6 will likely meet its Key Performance Parameters for vehicular stowage space, Joint Strike Fighter capacity, vertical take-off and landing spots, cargo space, and troop accommodations. However, as the ship does not have a well deck, its capability to carry vehicles and cargo will be limited to those that can be air lifted off the ship, which ultimately will limit the capability of the Amphibious Ready Group (ARG) to support the Marine Expeditionary Unit (MEU).
- The Navy has not produced a concept of operations or concept of employment that accounts for the ship's lack of a well deck or that takes advantage of its enhanced aviation capability.
- Based on combat systems testing on other platforms, it is unlikely that LHA-6's Ship Self-Defense System (SSDS) Mk 2-based combat system will meet the ship's Probability of Raid Annihilation (PRA) requirement against anti-ship cruise missiles (ASCMs).
- LFT&E analysis completed to date identified potential problems in susceptibility and vulnerability that would likely result in the LHA-6 being unable to maintain or recover mission capability following a hit by certain threat weapons, the details of which are classified.

System

LHA-6 is a large-deck amphibious ship designed to support a notional mix of fixed-wing and rotary-wing aircraft consisting of 12 MV-22s, 6 F-35B Joint Strike Fighters (Short Take-Off/ Vertical Landing variant), 4 CH-53Es, 7 AH-1s/UH-1s, and 2 embarked H-60 Search and Rescue (SAR) aircraft, or a load-out of 20 F-35Bs and 2 embarked H-60 SAR aircraft. The ship has several characteristics, including:

- It does not have a well deck, which is traditionally used for amphibious operations. Instead, the ship has greater aviation storage capacity and an increase in the size of the hangar bay, which is necessary to accommodate the increased maintenance requirements of the F-35B and the MV-22. Additionally, two maintenance areas with high overhead clearance are incorporated into the design of the ship to accommodate wings-open MV-22 maintenance. Shipboard medical spaces were reduced by approximately two-thirds compared to contemporary LHDs to expand the hangar bay.
- The combat system includes the SSDS Mk 2 and the Close-In Weapon System Block 1B for defense against air threats and small surface craft. The SSDS Mk 2 integrates the AN/SPS-48E long-range air search radar, AN/SPQ-9B horizon search radar, Cooperative Engagement Capability, Rolling Airframe Missiles (RAMs), Evolved SeaSparrow Missiles (ESSMs), and AN/SLQ-32B(V)2 electronic warfare systems with the Nulka-equipped Mk 53 Decoy Launching System into a single command and control system for both hard and soft kill.
- Propulsion is provided by two marine gas turbine engines, two electric auxiliary propulsion motors, and two controllable pitch propellers. Six diesel generators provide electric power.
- Command, Control, Communications, Computers, and Intelligence (C4I) facilities and equipment to support Marine Corps Landing Force operations are part of the program of record.

Mission

The Joint Maritime Component Commander will employ LHA-6 to:

- Act as the centerpiece ship of an ARG; it will be the primary aviation platform with space and accommodations for Marine Corps vehicles, cargo, ammunition, and more than 1,600 troops
- Serve as an afloat headquarters for an MEU, Amphibious Squadron, or other Joint Force commands using its C4I facilities and equipment
- Accommodate elements of a Marine Expeditionary Brigade when part of a larger amphibious task force
- Carry and discharge combat service support elements and cargo to sustain the landing force
- Conduct non-combatant evacuation operations and other crisis response missions such as humanitarian assistance/disaster relief

Major Contractor

Huntington Ingalls – Pascagoula, Mississippi

Activity

- The Navy conducted an operational assessment from June to August 2008 in accordance with the DOT&E-approved test plan. Experienced fleet operators (Navy and Marine Corps) reviewed ship plans and specifications, data on fielded systems, and previous testing conducted on systems that will be installed on LHA-6. Since that time, no specific operational testing has occurred with the exception of enterprise testing on the Self-Defense Test Ship (SDTS). Further information on the SDTS can be found in the Ship Self Defense report.
- The Navy has conducted a variety of LFT&E testing and analyses using surrogate ship platforms (including the ex-Saipan (LHA-2) and scale models to develop an understanding of vulnerabilities of LHA-6 design against typical weapons effects. The Navy will prepare a survivability assessment report in FY12.
- The Test and Evaluation Master Plan (TEMP) is under revision

Assessment

- LHA-6 will likely meet its Key Performance Parameters for vehicular stowage space, Joint Strike Fighter capacity, vertical take-off and landing spots, cargo space, and troop accommodations, but because the ship does not have a well deck, its capability to carry vehicles and cargo will be limited to those that can be air lifted off the ship. This ultimately will limit the capability of the ARG to support the MEU.
- The Navy and Marine Corps have not produced a concept of operations or concept of employment that accounts for the ship's lack of a well deck or that takes advantage of its enhanced aviation capability.
- LHA-6 provides substantially reduced medical capabilities as compared to current LHA and LHD-class ships.
- SSDS Mk 2-based combat systems testing revealed deficiencies and limitations that make it unlikely that LHA-6 will meet its PRA requirements. Specific deficiencies and limitations include the following:
  - ESSM has not demonstrated capability against the three classes of ASCM threats that justified its development.
  - RAM's performance is degraded against certain threat profiles.
  - Due to long-standing and previously identified legacy sensor limitations, LHA-6 may be vulnerable to certain airborne threat flight profiles.
  - Nulka's flight profile, during recent test events, deviated from expectations significantly enough to degrade its effectiveness against some threats. Additionally, the time required to deploy Nulka was longer than allowed by standard Navy tactics, which reduces its effectiveness.
  - Training deficiencies with SSDS Mk 2-based combat systems continue to degrade the system's effectiveness.
  - Nulka and SLQ-32's capability is substantially degraded against a certain type of modern ASCM threats.
  - To date, ESSM and RAM have only had limited amount of testing against Low Velocity Air Threats under operationally-realistic conditions.
- The ship's Collective Protection System (CPS) is not designed to protect critical operational and medical spaces and provides less coverage then the CPS being retrofitted to the LHD-1 class.
- Jet blast from the F-35Bs is expected to produce unsafe forces on flight deck personnel up to 75 feet from the short take-off line.
- MV-22 operations produce heat levels that might damage the flight deck and overwhelm the environmental controls in the spaces immediately below the flight deck.
- The vehicle ramp for moving equipment from the hangar deck to the flight deck is limited to 12,000 pounds and cannot handle the weight of armored High Mobility Multi-purpose Wheeled Vehicles (HMMWVs)
- LFT&E analysis completed to date identified potential problems in susceptibility and vulnerability that would likely result in the LHA-6 being unable to maintain or recover mission capability following a hit by threat weapons.
  - Some fluid systems need additional isolation valves, sensors and remote operators to allow rapid identification and isolation of damage and reconfiguration for restoration of the mission capability they support.
  - Electrical power continuity following damage to critical C4I and self defense systems needs to be improved.
  - The hangar bay needs a divisional door to limit damage from fire and smoke.
- Planned flight deck manning is insufficient to support the surge flight deck operations at the level required by the CDD.

Recommendations

- Status of Previous Recommendations. In response to the FY08 recommendations, the Navy conducted a study to re-affirm their decision to remove two Nulka launchers, and partially addressed the recommendation to add an AN/SPA-48E radar to the SDTS, but still needs adequate resources to procure enough targets for IOT&E. The five remaining FY08 recommendations are still valid. Additionally, one FY05 recommendation remains regarding the need to conduct detailed analyses to understand cargo, vehicle, and passenger flow routes throughout the ship to support troop embarkation, debarkation, and backload.
- FY11 Recommendations. The Navy should:
  1. Conduct an end-to-end analysis to discover–
     - How the ARG will compensate for the lost surface connector capability
     - If the medical spaces will be adequate to support the MEU needs
     - If an LHA-6-centered ARG can support the rapid buildup of forces ashore
  2. Develop a concept of operations or concept of employment to describe LHA-6 employment.
  3. Alter the vehicle ramp from the hangar bay to the flight deck to accommodate the up-armored HMMWV.

4. Ensure that systems engineering deficiencies related to SSDS Mk 2-based combat systems and other combat system deficiencies are corrected so that LHA-6 can satisfy its PRA requirement.
5. Back-fit the alterations to the LHD-1 CPS into LHA-6 and program them for LHA-7 to improve and expand the protected area.
6. Consider the use of solid state automatic bus transfer switches to improve the survivability of electrical power to vital C4I and self-defense systems to improve survivability.
7. Consider hangar bay divisional doors for LHA-7 to improve the ability to contain a fire and limit the spread of smoke and damage to improve survivability.
8. Provide improved isolation valves and pressure transducers to enable the crew to isolate damage and restore vital fluid systems to improve survivability.
9. Study flight deck manning needs to support surge operations. Mitigation plans should be demonstrated during IOT&E.
10. Determine mitigations for safe operations of the F-35B and MV-22 from the flight deck.
11. The survivability improvement recommendations resulting from the analysis of the LHA-6 design should be evaluated for incorporation into the LHA-7 design.

LPD-17 *San Antonio* Class Amphibious Transport Dock

Executive Summary

- The Navy has indicated that many deficiencies identified in IOT&E have been corrected, but they have yet to demonstrate these corrections in an operationally-realistic environment during FOT&E.
- The Navy's Board of Inspection and Survey assessed the material condition of LPD-21 as satisfactory.

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 (SSDS) Mk 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 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

Huntington Ingalls – Pascagoula, Mississippi

Activity

The Total Ship Survivability Trial and Full Ship Shock Trial, completed in FY08, are the primary sources of data for DOT&E's survivability assessment. The Navy completed their final Vulnerability Assessment Report in FY11.

Assessment

- In the June 2010 DOT&E Combined Operational and Live Fire Test Report, LPD-17 was assessed as capable of conducting amphibious operations in a benign environment, but not operationally effective, suitable, or survivable in a hostile environment due to significant reliability deficiencies on major systems affecting communications, propulsion, and self defense. The Navy still has several deferred test events to complete during FOT&E including: chemical/biological/radiological defense, information assurance, and vulnerability against enemy mines.
- The Navy has made progress in improving reliability and availability of critical ship systems affecting communications and propulsion; however, the Navy has not yet demonstrated the systems' performance in an operationally-realistic environment.
- Additionally, the LPD-17 self-defense system did not demonstrate adequate capability to defend the ship against the threats it is likely to encounter.

- 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, but was granted a six month interim Joint Certification that expires January 31, 2012.
- Probability of Raid Annihilation test bed events and the Self-Defense Test Ship events revealed 13 combat systems deficiencies and underscored 5 previously known deficiencies the details of which are classified. While some potential improvements have been made to RAM Block II; RAM Helicopter, Aircraft, Ship mode; SPS-48E and the Advanced Electronic Mast System; SPQ-9B and SSDS Mk 2 software upgrades; the Navy has not conducted FOT&E to verify the effectiveness of these changes.
- Unlike the first four ships of the class, the Board of Inspection and Survey assessed the material condition of LPD-21 as satisfactory.

Recommendations

- Status of Previous Recommendations. The Navy has satisfactorily addressed the ship's interoperability with AV-8 aircraft and completed Probability of Raid Annihilation modeling and simulation efforts. All additional recommendations made in FY07, FY08, FY09, and FY10 remain valid.
- The Navy has made reliability improvements to the Ship Wide Area Network, Interior Voice Communications System, Engineering Control System, Cargo Ammunition Magazine elevators, vehicle ramps, main propulsion diesel engines, and electrical distribution systems and steering systems consistent with previous year's recommendations, but they have yet to demonstrate these improvements in operationally-realistic environments during FOT&E.
- FY11 Recommendations. The Navy should:
  1. Complete deferred test events to include chemical/biological/radiological defense, information assurance, and Vulnerability against enemy mines using the Advanced Mine Simulation System.
  2. Correct deficiencies identified in the Naval Sea Systems Command Total Ship Survivability Trial and Full Ship Shock Trial reports.
  3. 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 FY13. The first phase of P3I components completed operational testing in September 2009. The second phase of P3I components began operational testing in 2QFY11 and is anticipated to complete in 1QFY12. The third phase of P3I components is expected to begin operational testing in 2QFY12.
- DOT&E issued a combined FOT&E report in November 2010 assessing the first phase of P3I implemented on the MH-60R and the MH-60S with the following findings:
  - The MH-60R, as tested with the first phase of P3I components, is operationally effective for all missions with the exception of Surface Warfare (SUW).
  - The MH-60R, as tested with the first phase of P3I components, is operationally suitable for all missions.
  - The MH-60R is survivable for all missions.
- The analysis of test data collected during combined MH-60R/S FOT&E of the second phase of P3I components is still in progress. No preliminary evaluation is available. DOT&E expects to issue a formal test report in 2QFY12.

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, Area Surveillance, Combat Identification, and Naval Surface Fire Support missions previously provided by two different helicopters (SH-60B and SH-60F)
- 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

- DOT&E issued a combined FOT&E report in November 2010 assessing the first phase of P3I implemented on the MH-60R and the MH-60S.
- Commander, Operational Test and Evaluation Force (COTF) commenced the second phase of P3I combined MH-60R/S FOT&E on the Integrated Maintenance Diagnostic System and the Ground Proximity Warning System in 2QFY11; testing is anticipated to complete in 1QFY12. COTF conducted the testing in accordance with the DOT&E-approved test plan.
- All LFT&E activities have been completed and reported in the LFT&E Report to Congress in 2008.

Assessment

- The MH-60R Multi-Mission Helicopter, tested with the first phase of P3I components, is operationally effective for all missions with the following exception: the MH-60R with Multi-spectral Targeting System is not operationally effective to conduct SUW missions.
- The MH-60R, tested with the first phase of P3I components, is operationally suitable for all missions. P3I testing identified suitability deficiencies with Link 16 that did not diminish the overall suitability of the aircraft.
- The MH-60R is survivable for all missions. The incorporation of the first phase of P3I components in MH-60R aircraft did

not alter the survivability of the aircraft. No dedicated LFT&E events were conducted in support of the MH-60R P3I testing.
- The analysis of test data collected during combined MH-60R/S FOT&E of the Integrated Maintenance Diagnostic System and the Ground Proximity Warning System is still in progress. No preliminary evaluation is available. DOT&E expects to issue a formal test report in 2QFY12.

Recommendations

- Status of Previous Recommendations. The Navy did not address any of the four previous recommendations. The Navy should still:
  1. Identify the cause and corrective action to resolve the frequent failures of the Airborne Low Frequency Sonar reel and cable assembly.
  2. 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.
  3. Correct and test deficiencies revealed in SUW testing.
  4. Investigate and apply corrections to the APX-118 Transponder aircraft track angle information disparity deficiency and verify corrections in FOT&E.
- FY11 Recommendations. None.

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 FY13. The first phase of P3I components completed operational testing in September 2009. The second phase of P3I components began operational testing 2QFY11 and is anticipated to complete in 1QFY12. The third phase of P3I components is expected to begin operational testing in 2QFY12.
- DOT&E issued a combined FOT&E report in November 2010 assessing the first phase of P3I implemented on the MH-60R and the MH-60S. The report rendered the following findings:
  - The MH-60S, as tested with the first phase of P3I components, is operationally effective for all missions with the exception of Surface Warfare (SUW) and Combat Search and Rescue (CSAR).
  - The MH-60S, as tested with the first phase of P3I components, is operationally suitable for all missions.
  - The MH-60S is survivable for all missions.
- The analysis of test data collected during combined MH-60R/S FOT&E of the second phase of P3I components is still in progress. No preliminary evaluation is available. DOT&E expects to issue a formal test report in 2QFY12.
- The analysis of test data collected during the operational assessment (OA) of the MH-60S Block 2A Airborne Mine Countermeasures (AMCM) System and the AN/AQS-20A Sonar Mine Detecting Set is still in progress. No preliminary evaluation is available. DOT&E expects to issue a formal test report in 2QFY12.

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 – AMCM. AMCM systems operator workstation, tether/towing system, any one of five mine countermeasure (MCM) systems currently under development (including the AN/AQS-20A Sonar Mine Detecting Set and the Airborne Laser Mine Detection System (ALMDS))
  - 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 datalink (Link 16)
- Pre-Planned Product Improvement (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 – 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
- Raytheon Company, Integrated Defense Systems – Tewksbury, Massachusetts
- Northrop Grumman Corporation – Melbourne, Florida

Activity

- DOT&E issued a combined FOT&E report in November 2010 assessing the first phase of P3I implemented on the MH-60R and the MH-60S.
- Commander, Operational Test and Evaluation Force (COTF) commenced combined MH-60R/S FOT&E on the following three P3I components: Integrated Maintenance Diagnostic System, the Ground Proximity Warning System, and the Active Vibration Control system (MH-60S only). This second phase of P3I testing commenced in 2QFY11 and is anticipated to complete in 1QFY12. COTF conducted the testing in accordance with the DOT&E-approved test plan.
- All LFT&E activities have been completed and reported in the LFT&E Report to Congress in 2008.
- COTF conducted Phase A (Shore-based and Training Phase) of the planned OA of the MH-60S Block 2 AMCM System and the AN/AQS-20A Sonar Mine Detecting Set in FY11. COTF conducted the testing in accordance with the DOT&E-approved test plan. COTF conducted the OA in lieu of the IOT&E originally planned for early FY11.
- Phase B (Littoral Combat Ship (LCS) Ship-based Phase) of the planned OA is expected to be conducted in FY12, pending the availability of an LCS to support the testing.
- COTF planned the FY12 OA of the MH-60S Block 2 AMCM System and the Airborne Laser Mine Detection System (ALMDS). This OA will be conducted in lieu of the IOT&E originally planned for early FY11.
- The Navy rescheduled the IOT&Es to allow the additional time to correct deficiencies and change the test articles to the current production configuration; the tests will now coincide with the IOT&E of MCM Mission Package on the LCS in FY13.

Assessment

- The MH-60S, as tested with the first phase of P3I components, is operationally effective for all missions with the following exception: the MH-60S with Multi-spectral Targeting System is not operationally effective to conduct SUW and CSAR missions.
- The MH-60S, as tested with the first phase of P3I components, is operationally suitable for all missions. P3I testing identified suitability deficiencies with Link 16 and the Downed Aircrew Locator System (DALS) that did not diminish the overall suitability of the aircraft.
- The MH-60S is survivable for all missions.
- The incorporation of the first phase of P3I components in MH-60S aircraft did not alter the survivability of the aircraft. No dedicated LFT&E events were conducted in support of the MH-60S P3I testing.
- The analysis of test data collected during combined MH-60R/S FOT&E of the Integrated Maintenance Diagnostic System, the Ground Proximity Warning System and the Active Vibration Control system is still in progress. No preliminary evaluation is available. DOT&E expects to issue a formal test report in 2QFY12.
- The analysis of test data collected during Phase A of the MH-60S Block 2A AMCM and the AN/AQS-20A Sonar Mine Detecting Set OA is still in progress. No preliminary evaluation is available. DOT&E expects to issue a formal test report in 2QFY12.
- Both developmental and operational testing of the AN/AQS-20A revealed the system is deficient in meeting required thresholds for False Classification Density (FCD) and Vertical Localization Accuracy in some modes. If the FCD and Vertical Localization deficiencies are not corrected prior to IOT&E they will adversely affect the operational effectiveness of AN/AQS-20A.
- Developmental testing of the ALMDS revealed the system is deficient in meeting the required threshold for FCD. If the FCD deficiency is not corrected prior to IOT&E it will adversely affect the operational effectiveness of ALMDS.

Recommendations

- Status of Previous Recommendations. The Navy has not satisfactorily addressed any of the eight previous recommendations. The Navy should still:
  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 Armed Helicopter Weapons System kit components when not installed and in use on the aircraft.
  3. Determine aircraft carrier (CVN) 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.
  5. 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.
  6. Correct SUW deficiencies and verify correction through subsequent testing.
  7. 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 Combat Survivor Evader Locator AN/PRQ-7 hand-held radio with DALS; and electromagnetic interference from the DALS infrared searchlight that induces navigational bearing errors.
  8. Investigate and apply corrections to APX-118 Transponder aircraft track angle information disparity deficiency and verify corrections in future OT&E.

- FY11 Recommendations. The Navy should:
  1. Investigate solutions and correct AN/AQS-20A FCD and Vertical Localization deficiencies prior to IOT&E.
  2. Investigate solutions and correct the ALMDS FCD deficiency prior to IOT&E.
  3. Conduct LCS Ship-based phases of the planned OAs of the MH-60S Block 2 and AN/AQS-20A, and of the MH-60S Block 2 and ALMDS MCM systems to reduce risk to the LCS MCM Mission Package IOT&E.

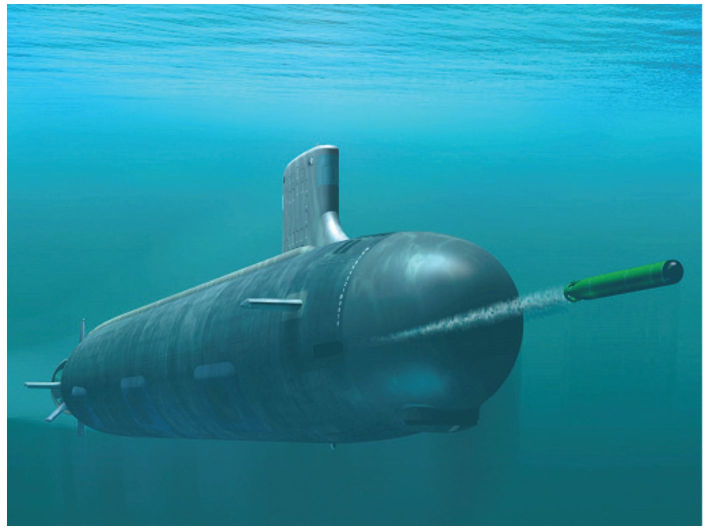
Mk 48 Advanced Capability (ADCAP) Torpedo Modifications

Executive Summary

- In FY11, the Navy began operational testing of the Advanced Processor Build 4's (APB4) tactical software for the Mk 48 Advanced Capability (ADCAP) Mod 7 Common Broadband Advanced Sonar System (CBASS) torpedo and Mk 48 ADCAP Mod 6 Advanced Common Torpedo (ACOT). OT&E is expected to continue through the end of FY12.
- From January to February 2011, the Navy conducted a Quick Reaction Assessment (QRA) of the Mk 48 APB4 to evaluate the torpedo's capability against an emerging submarine threat. In March 2011, the Navy's Program Executive Officer authorized a limited early fleet fielding of the Mk 48 APB4 torpedo to deploying submarines.
- On March 18, 2011, DOT&E delivered an Early Fielding Report on the Mk 48 APB4 torpedo to the congressional defense committees. DOT&E assessed that testing to date indicated the Mk 48 APB4 has a limited capability against the threat identified in the Urgent Operational Needs Statement (UONS) under certain operational conditions; however, the Navy did not have adequate threat surrogates for the evaluation. DOT&E's assessment also reported that the APB4 torpedo did not demonstrate improvements over the legacy torpedo, and may degrade current capabilities in certain warfare scenarios.

System

- The Mk 48 ADCAP torpedo is the primary anti-submarine warfare and anti-surface ship warfare weapon used by U.S. submarines. Mk 48 ADCAP torpedo modifications are a series of hardware and software upgrades to the weapon.
- Mk 48 Mod 5, Mod 6, Mod 6 Spiral 1, Mod 6 Advanced Common Torpedo – Guidance and Control Box (ACOT), and Mod 7 CBASS Phase I are fielded torpedoes.
- Mk 48 Mod 7 CBASS upgrades the Mk 48 ACOT with new sonar designed to improve torpedo effectiveness through future software upgrades. Phase 1 torpedoes deliver the initial hardware and software; Phase 2 torpedoes are required to deliver full capability.



- The software developed for CBASS Phase 2 is designated APB4. The Navy subsequently determined that APB 4 software can run on ACOT weapons as well. As a result, APB4 is being tested on both CBASS and ACOT weapons. The Navy has authorized the limited fielding of Mk 48 APB4 torpedoes.
- CBASS is a co-development program with the Royal Australian Navy.

Mission

The Submarine Force employs the Mk 48 ADCAP torpedo as a long-range, heavy-weight weapon:

- For destroying surface ships or submarines
- In both deep-water open-ocean and shallow-water littoral environments

Major Contractor

Lockheed Martin Sippican Inc. – Marion, Massachusetts

Activity

- The Navy's Fifth Fleet issued a UONS in March 2010 requesting solutions to address an emerging submarine threat; the Navy identified the Mk 48 ADCAP with APB4 software as a solution. In November 2010, the Navy tasked the Commander, Operational Test and Evaluation Force (COTF), to conduct a QRA to support the early fielding of the Mk 48 APB4 to address the emerging threat. COTF observed and analyzed the results of the program office and fleet in-water Mk 48 APB4 exercises and developmental testing from January to February 2011. In addition, COTF conducted modeling and simulation assessments, using the Weapons Analysis Facility (WAF) located at the Naval Undersea Warfare Center, Newport, Rhode Island, to examine Mk 48 APB4 performance in baseline warfare scenarios.

- The Navy released the Mk 48 APB4 torpedo for limited operational use in March 2011.
- DOT&E delivered a report of early operational fielding to the congressional defense committees in March 2011. DOT&E considered test data and reporting from Mk 48 APB4's developmental testing, the QRA, and the performance of legacy Mk 48 torpedoes in preparing the Early Fielding Report.
- The Navy updated the Joint Test and Evaluation Master Plan to cover the APB4 with Mk 48 ADCAP CBASS and Mk 48 ADCAP ACOT, and to address the UONS threat. The Test and Evaluation Master Plan is being routed for Navy approval signatures.
- The Navy developed a Submarine Launched Countermeasure Emulator (SLACE) to support Mk 48 APB4 testing. The SLACE emulator enables the Navy to conduct realistic torpedo operational testing against threat submarine surrogates that can employ mobile countermeasures. The Navy also developed a Steel Diesel Electric Submarine surrogate to evaluate torpedo performance against submarine threats in limited operational scenarios.
- The Navy's program office fired 33 Mk 48 APB4 weapons between May and August 2010 as part of the shallow water technical evaluation. Between January and September 2011, the Navy fired over 70 additional Mk 48 APB4 weapons during fleet training events and the Navy's QRA. These torpedo shots supported the completion of developmental testing as well as operationally realistic regression testing.
- In August 2011, DOT&E directed the Navy to submit for approval Operational Test Authority-developed test plans for QRAs planned to support a fielding decision for programs on the DOT&E oversight list.
- DOT&E approved the OT&E test plan for Mk 48 APB4 on July 14, 2011. DOT&E agreed to use operationally realistic test and exercise data collected during the Mk 48 APB4 QRA and technical evaluation to examine the new UONS threat and to use operationally realistic fleet Mk 48 APB4 torpedo firings for regression testing in order to reduce the torpedo test resources required for OT&E. COTF and DOT&E selected at-sea test events to focus on the new capabilities identified in the Mk 48 requirements documents. Dedicated Mk 48 APB4 testing is expected to continue through the summer of CY12.
- In September 2011, the Navy conducted 10 Mk 48 APB4 torpedo events using the Steel Diesel Electric Submarine target surrogate at a shallow water site off the Virginia coast. The purpose was to gain additional torpedo performance information against stationary submarine threats.
- In December 2011, the Navy proposed several Mk 48 APB4 torpedo software changes to correct problems identified in completed testing and by fleet operators. The Navy's testers are evaluating possible revisions to operational testing.
- The Navy conducted two successful Mk 48 Mod 6 Service Weapons Test events in FY10 and FY11, using torpedoes selected from the warshot inventory. These test events confirmed the warhead performance of in-service and stored Mk 48 torpedoes.

Assessment

- The Navy's QRA and WAF testing of the Mk 48 APB4 torpedo enabled a limited assessment of its performance. DOT&E assessed that testing to date indicated the Mk 48 APB4 has a limited capability, under certain operational conditions, against the threat identified in the UONS; however, the Navy did not have adequate threat surrogates for the evaluation. DOT&E's assessment also reported that the APB4 torpedo did not demonstrate expected improvements over the legacy torpedo, and may degrade current capability in certain warfare scenarios.
- Additional information on Mk 48 APB4 performance can be found in DOT&E's classified Mk 48 ACOT and CBASS APB4 Early Fielding Report dated March 18, 2011.
- The completed Mk 48 APB4 test events are being assessed for operational realism and validity incrementally as the fleet training and test events are completed. Due to delays in completing the development of the SLACE mobile countermeasure surrogate, some important operational testing to confirm performance has not begun. DOT&E assesses that Mk 48 APB4 performance against SLACE-like threats is high risk because the program office completed little in-water developmental testing. DOT&E expects the SLACE testing, and the remainder of the dedicated testing, will complete in FY12. Initial regression testing results indicate performance in deep water areas has not substantially changed; however, insufficient testing has been completed in other areas to allow assessment.

Recommendations

- Status of Previous Recommendations. The Navy has addressed six of the eight previous recommendations. The Navy continues to experience test delays, as fleet submarine assets are not available for conducting operational testing. Some improvements have been made by conducting regression testing in conjunction with scheduled fleet training events and by using WAF simulations; the Navy should continue to address reducing test delays and improve these simulations (FY05). The Navy conducts limited torpedo training and testing in shallow waters because they do not have adequate shallow water ranges or methods to expeditiously locate and recover exercise torpedoes. Locating and recovering a torpedo in open-ocean requires dedicated and expensive air and surface assets. The Navy should develop shallow-water test and training areas and modernize the exercise torpedo locating and recovery systems (FY08).
- FY11 Recommendations. The Navy should:
  1. Complete development of threat representative target and countermeasure surrogates for torpedo testing. In addition to representing the physical and signature characteristics of the threat, the surrogate should be capable of emulating appropriate operational profiles of the threat.
  2. Continue conducting the Mk 48 APB4 torpedo testing in FY12. Testing should include the evaluation of torpedo performance against submarine surrogates that employ the SLACE countermeasure.

Mk 54 Lightweight Torpedo

Executive Summary

- The Navy's Fifth Fleet issued an Urgent Operational Need Statement (UONS) in March 2010 requesting solutions to address an emerging submarine threat. The Navy identified the Mk 54 Block Upgrade (BUG) software as a solution.
- In August to September 2011, for the Quick Reaction Assessment (QRA), the fleet fired 22 Mk 54 BUG torpedoes against a Steel Diesel Electric Submarine surrogate target and against U.S. attack submarine targets. Based on preliminary results of this test, the Navy scheduled an additional phase of in-water QRA in November 2011 and delayed the planned early fielding until January 2012.
- The Navy did not complete adequate in-water or modeling and simulation developmental testing of the Mk 54 BUG. As the program office shifted resources to demonstrate that the Mk 54 BUG has a capability against the UONS emerging submarine threat, testing focused on the UONS threat scenarios vice the operational scenarios for which the Mk 54 BUG was originally intended.

System

- The Mk 54 Lightweight Torpedo is the primary Anti-Submarine Warfare weapon used by U.S. surface ships, fixed-wing aircraft, and helicopters.
- The Mk 54 combines the advanced sonar transceiver of the Mk 50 torpedo with the legacy warhead and propulsion system of the older Mk 46. An Mk 46 torpedo and Mk 50 torpedo can be converted to an Mk 54 via an upgrade kit.
- The Mk 54 sonar processing is an expandable open architecture system. It combines algorithms from the Mk 50 and Mk 48 torpedo programs with the latest commercial off-the-shelf technology.
- The Navy designed the Mk 54 sonar processing to operate in shallow-water environments and in the presence of sonar countermeasures.
- The Navy has designated the Mk 54 torpedo to replace the Mk 46 torpedo as the payload section for the Vertical Launched Anti-Submarine Rocket for rapid employment by surface ships.

- The High-Altitude Anti-submarine Warfare Weapons Capability program will provide an adapter kit to permit long-range, high-altitude, GPS-guided deployment of the Mk 54 by a P-8A Maritime Patrol Aircraft.
- The Mk 54 BUG is a software upgrade to the Mk 54 baseline torpedo designed to correct deficiencies identified during the 2004 Mk 54 IOT&E.
- The Navy is planning a series of near-term improvements to the Mk 54, including an improved sonar array and block upgrades to the tactical software.

Mission

The Navy surface and air elements employ the Mk 54 torpedo as their primary anti-submarine weapon:

- For offensive purposes, when deployed by Anti-Submarine Warfare aircraft and helicopters
- For defensive purposes, when deployed by surface ships
- In both deep-water open-ocean and shallow-water littoral environments
- Against fast, deep-diving nuclear submarines, and slow moving, quiet, diesel-electric submarines

Major Contractor

- Raytheon Integrated Defense Systems – Tewksbury, Massachusetts

Activity

- The Navy's Fifth Fleet issued an UONS in March 2010 requesting solutions to address an emerging submarine threat. The Navy identified the Mk 54 BUG software as a solution. In February 2011, the Navy tasked the Commander, Operational Test and Evaluation Force (COTF) to conduct a QRA to support the early fielding of the Mk 54 BUG to address the emerging threat.
- COTF observed and analyzed the results of program office and fleet in-water Mk 54 exercises and developmental testing from January to September 2011. In addition, COTF conducted a modeling and simulation assessment using the Weapons Analysis Facility located at the Naval Undersea Warfare Center, Newport, Rhode Island, to examine Mk 54 BUG performance in baseline warfare scenarios.

- In August to September 2011, for the QRA, the fleet fired 22 Mk 54 BUG torpedoes against a Steel Diesel Electric Submarine surrogate target and against U.S. attack submarine targets. Based on preliminary results of this test, the Navy scheduled an additional phase of in-water QRA in November 2011 and delayed the planned early fielding until January 2012. The Navy also changed to Mk 54 BUG software to correct some identified performance problems.
- In August 2011, DOT&E directed the Navy to submit for approval Operational Test Authority-developed test plans for QRAs planned to support a fielding decision for programs on the DOT&E oversight list.
- DOT&E is assessing the Mk 54 BUG torpedo's performance as the developmental testing, fleet training, and QRA events are completed. DOT&E plans to submit an Early Fielding Report in early 2012 once all available test data are analyzed.
- The Navy is drafting a Test and Evaluation Master Plan revision for Mk 54 BUG. The revision includes additional testing to address the UONS emerging threat and to address major deficiencies identified during the 2004 IOT&E.
- The Navy developed a Submarine Launched Countermeasure Emulator to support torpedo testing. The emulator enables the Navy to conduct realistic torpedo operational testing against threat submarine surrogates that can employ mobile countermeasures. The Navy also developed a Steel Diesel Electric Submarine surrogate to evaluate torpedo performance against stationary submarine threats in limited operational scenarios.
- The Mk 54 was placed on LFT&E oversight for lethality in January 2010. The lethality strategy is currently under development and will focus on the Technology Insertion 1 hardware upgrade and BUG software capabilities that were not tested during the FY11 QRA. The QRA did not have any lethality testing elements.
- In September 2010, the Navy conducted a single Mk 54 firing under the Lightweight Data Gathering Program (LDGP). The objective of the LDGP was to validate arming capability, and verify exploder performance in both impact and proximity modes. The Navy conducted the test as a set-to-hit firing against the Expendable Influence Target on an instrumented range in Nanoose, British Columbia. The weapon impacted the target and demonstrated both impact and magnetic influence fuzing. The tested weapon was a modified fleet exercise weapon running baseline software, not the BUG software.

Assessment

- The Navy originally planned the Mk 54 BUG software to improve Mk 54 classifier and tracker performance and to resolve IOT&E Mk 54 deficiencies. The UONS emerging threat provided the incentive for the Navy to accelerate the development and fielding of the Mk 54 BUG software.
- The operational profile of the UONS emerging threat and the resulting changes to the torpedo's final homing software and exploder requires further testing to confirm Mk 54 performance, to include additional target operational scenarios, additional submarine target types, and assessing the torpedo's final terminal homing and impact of the target (set-to-hit).
- Since safety concerns prevent using manned submarines for set-to-hit testing, the Navy developed an unmanned Steel Diesel Electric Submarine target. The Navy is using this surrogate for both set-to-hit and set-not-to-hit testing. The Steel Diesel Electric Submarine target has different signature characteristics than the UONS emerging threat, thus this surrogate is of limited utility in assessing torpedo operational performance for the UONS. However, completing set-to-hit terminal homing testing may address some unresolved test scenarios identified in the IOT&E. Mk 54 BUG performance in these previously unresolved test areas will affect the overall effectiveness and suitability of the torpedo against other submarine threats.
- The Navy did not complete adequate in-water or model and simulation developmental testing of the Mk 54 BUG. As the program office shifted resources to demonstrate that the Mk 54 BUG has a capability against the UONS emerging submarine threat, testing focused on the UONS threat scenarios vice the operational scenarios for which the Mk 54 BUG was originally intended.
- To date, the Navy's emerging threat test scenario execution was structured and attacking crews had perfect knowledge of the target's location. Also, the Navy conducted testing in a relatively benign area where torpedo interactions with the bottom or false contacts were minimized. Testing in these structured scenarios indicates the Mk 54 BUG likely has a limited capability against the Steel Diesel Electric Submarine surrogate target. The Mk 54 BUG performance in other environmental areas and against operationally realistic target scenarios is unresolved.
- The Navy is using a 1995 Operational Requirements Document, supplemented with sponsor clarification letters, as the reference to develop improvements and to test the Mk 54 torpedo upgrades. These documents are out of date and do not reflect the current threats, the current threat capabilities, or the current or desired torpedo performance. The Navy should update the Mk 54 requirements to identify the capabilities needed.
- The single LDGP test event demonstrated successful impact and influence fuzing and full detonator functionality. The bulk explosive components were not demonstrated.

Recommendations

- Status of Previous Recommendations. The Navy is making progress in addressing the five previous recommendations. The unresolved IOT&E of the Mk 54 terminal homing is superseded by changes to the Mk 54 BUG software; thus, the updated terminal homing software will require a set-to-hit testing evaluation to resolve torpedo effectiveness.
- FY11 Recommendations. The Navy should:
  1. Continue conducting Mk 54 BUG OT&E during 2012. The testing should include scenarios against representative surrogates employing current threats, tactics, and torpedo countermeasures.

2. Obtain an operationally realistic set-to-hit target and complete the terminal homing testing of the Mk 54 torpedo.
3. Generate a new Capability Development Document for future Mk 54 hardware and software upgrades
4. The Navy should continue to develop a lethality strategy that includes the firing of the MK 54 against appropriate targets.
5. The Navy should expand the LDGP to include weapons upgraded to address the UONS scenario.

MV-22 Osprey

Executive Summary

- The Navy's OT&E Force/Marine VMX-22 Tiltrotor Test Squadron conducted an FOT&E (OT-IIIG) from August 12 to November 8, 2011. This dedicated test was preceded by two years of integrated developmental/operational testing (IT-IIID) from May 1, 2009, to May 31, 2011. The purpose of OT-IIIG was to evaluate the effectiveness and suitability of new software version B4.01, Blue Force Tracker, Netted Weather, and the defensive weapon systems.
- New software performed largely as expected, thus maintaining all the previous capabilities of the MV-22 aircraft fleet. Software enhancements were modest, but provided new piloting options and power margins, thus increasing safety and reducing pilot workload.
- OT-IIIG demonstrated the utility of Netted Weather and Blue Force Tracker.
- OT-IIIG illustrated the limited utility of the Interim Defensive Weapon System (IDWS).
- Crews operating the Ramp-Mounted Weapon System demonstrated the ability to place suppressive .50 caliber fire on targets to the rear of the aircraft and imposed no significant limitations on troop or cargo missions.
- Reliability, availability, and maintainability data were not available in time for this report.

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-Boeing Joint Venture comprising:
  - Bell Helicopter – Amarillo, Texas
  - The Boeing Company – Ridley Township, Pennsylvania

Activity

- The Navy's OT&E Force/Marine Tiltrotor Test Squadron VMX-22 conducted an FOT&E (OT-IIIG) from August 12 to November 8, 2011. This dedicated test was preceded by two years of integrated developmental/operational testing (IT-IIID) from May 1, 2009, to May 31, 2011. During IT-IIID, MV-22s accumulated 419 flight hours and during OT-IIIG, aircraft accumulated approximately 100 flight hours. We expect to receive all the data and complete the analysis by December 2011.
- OT-IIIG was conducted in accordance with the DOT&E-approved Test and Evaluation Master Plan and operational test plan.
- The purpose of OT-IIIG was to evaluate the effectiveness and suitability of new software version B4.01, Blue Force Tracker, Netted Weather, and the defensive weapon systems. This software suite includes modest enhancements in aircraft performance, correction of existing deficiencies, and reliability improvements. Blue Force Tracker provides cockpit and cabin connectivity to a world-wide digital network of joint forces enabling digital messaging and near-real-time sharing of friendly and enemy unit locations. Netted Weather provides map-based overlays to the pilots and embarked troops on

the location of significant weather (clouds, winds, rain, and thunderstorms).
- VMX-22 deployed three production-representative aircraft from Marine Corps Air Station New River, North Carolina, to Cannon Air Force Base, New Mexico, where the majority of OT-IIIG missions were performed. Due in part to a hurricane on the East Coast, VMX-22 returned to New River earlier than planned and completed the final missions in North Carolina. DOT&E observed as passengers on most of the OT-IIIG missions.

Assessment

- The new software version B4.01 performed largely as expected, thus maintaining all the previous capabilities of the MV-22 aircraft fleet. Software enhancements were modest, but provide meaningful new piloting options and power margins, thus increasing safety and reducing pilot workload. Among the new capabilities are:
  - Increased Interim Power – maximum power setting is now 117 percent versus 109 percent in low-speed flight regimes. This permits faster airfield departure and/or increased payload.
  - Directional Trim Backdrive – commands pedal position to enhance heading hold in hover and turn coordination in forward flight. This reduces pilot workload and improves handling qualities.
  - Opposed Lateral Cyclic – 4 degrees of inboard lateral cyclic provides additional hover payload (up to 400 pounds) by alleviating download on the wing.
  - Increased Flight Director Coupled Mode capabilities – allows additional flight profiles on tactical approaches and corrects minor deficiencies from previous testing.
  - Mission Management – Improvements to the performance and mission management calculators reduces crew workload.
  - Feed Tank Autoboost – Restores active fuel feed tank control and reduces crew workload.
- OT-IIIG demonstrated the utility of Netted Weather and Blue Force Tracker. The Netted Weather system provided accurate and current overlays of rain and thunderstorm activity, allowing MV-22 crews to avoid these weather systems during self-deployment to and from New Mexico. The Blue Force Tracker provided connectivity to the joint digital data network, allowing crews and embarked troops to see the location of ground units, each MV-22 aircraft, and the VMX-22 tactical operation center on a map. The Blue Force Tracker provided own-ship location on a map, enabling embarked troops to be informed throughout the flight of their own location and time of arrival on the planned mission objective. The Blue Force Tracker enabled crews and embarked troops to send and receive digital text messages to/from other entities on the Blue Force Tracker network.
- OT-IIIG illustrated the limited utility of the IDWS. The IDWS worked as designed, but has a limited field of fire during aircraft approach to landing. Employment of the IDWS requires extensive verbal coordination between copilot and gunner to confirm target location while both pilots are engaged in other piloting duties during the final seconds prior to landing. Against the few targets the IDWS could safely engage, its firepower was accurate and effective. Installation of the IDWS reduces the capability of the MV-22 to carry troops and cargo.
- Crews operating the Ramp-Mounted Weapon System demonstrated the ability to place suppressive .50 caliber fire on targets to the rear of the aircraft and imposed no significant limitations on troop or cargo missions.
- Reliability, availability, and maintainability data were not available in time for this report.
- During OT-IIIG, aircraft were generally available for planned missions but exhibited the reliability and maintainability challenges evident in the fielded MV-22 fleet. Across the fleet, the MV-22 generally meets reliability and maintainability requirements, but the average mission capable rate of 53 percent (from June 2007 to May 2010) is below the required rate of 82 percent.

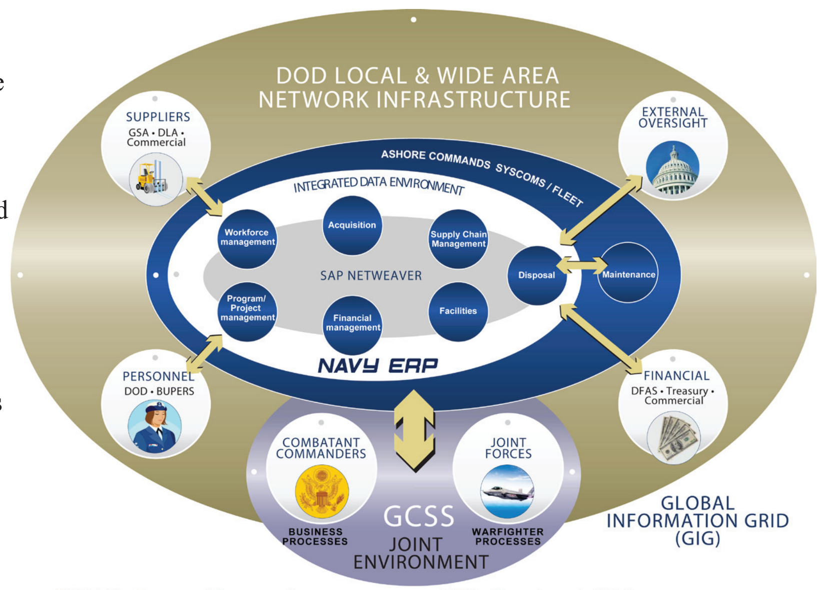
Recommendations

- Status of Previous Recommendations. The Navy has satisfactorily addressed earlier recommendations to provide current weather overlays to the cockpit. The program has addressed some of the known reliability, maintainability, and parts availability challenges, but more work is needed to improve mission capable rates.
- FY11 Recommendation.
  1. The Navy should continue development and testing to improve overall MV-22 reliability and availability with particular emphasis on the ice protection system, engine air particulate system, nacelle, and drive-train subsystems.

Navy Enterprise Resource Planning (ERP) Program

Executive Summary

- The Commander, Operational Test and Evaluation Force (COTF) conducted an IOT&E of Navy Enterprise Resource Planning (ERP) Single Supply Solution Release 1.1 September 22 to November 5, 2010, with actual users in a live environment.
- A Naval Information Operations Command (NIOC) Red Team identified and attempted to penetrate and exploit system information assurance (IA) vulnerabilities during IOT&E.
- DOT&E determined that Release 1.1 is operationally suitable with limitations and that operational effectiveness cannot be resolved until the system attains a greater degree of maturity and stabilization.
- The Navy ERP Program Manager developed a plan of action and milestones to resolve deficiencies and scheduled an FOT&E for May 2012 that will include testing of the critical Initial Source Processing Time (ISPT) Key Performance Parameter (KPP) and several new capabilities.



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

System

- 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 Navy will use the system to manage more than one-half of their Total Obligation Authority.
- 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 has implemented the system in two releases: (1) Financial and Acquisition Management and (2) the Single Supply Solution. The system will serve more than 71,000 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 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 Component Commander 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 conducted an IOT&E of Navy ERP Single Supply Solution Release 1.1 from September 22 through November 5, 2010. The evaluators observed live business operations at Naval Supply Systems Command (NAVSUP) depots in Philadelphia and Mechanicsburg, Pennsylvania.
- COTF also monitored a Continuity of Operations exercise at the Navy ERP alternate data center at China Lake, California.
- During IOT&E, the NIOC Red Team performed IA system scans, penetration testing, and malicious insider analysis. COTF conducted all testing in accordance with

the DOT&E-approved Test and Evaluation Master Plan and operational test plan.
- The Navy began deployment of Navy ERP Release 1.1 to Fleet and Industrial Supply Centers in July 2011. The first Fleet and Industrial Supply Center deployment added an additional 311 users to Navy ERP, representing 8 percent of the total Single Supply Solution users.

Assessment
- DOT&E determined that Release 1.1 is operationally suitable with limitations and that operational effectiveness cannot be resolved until the system attains a greater degree of maturity and stabilization.
- The Navy ERP system had gone through a six-month stabilization period prior to entering IOT&E, yet the system was still too immature for a complete assessment. COTF could not meaningfully measure the principal objective criterion, the ISPT KPP, because only one of three material groups had migrated to the new system.
- The system was able to achieve 18 of 22 NAVSUP stabilization conditions, as well as provide new functionality to conduct supply business; however, there were some capabilities that had significant problems or were not available. A combined Navy ERP/NAVSUP Business Office employed excellent change management techniques, but ERP data conversion still proved to be a challenge that required substantial manual effort.
- Navy ERP uses a standard Intermediate Document (IDOC) format to exchange transactions between Navy ERP and external customer systems. To protect against populating the system with bad information, Navy ERP performs a validity check on all incoming transactions. NAVSUP subject matter experts researched IDOCs that failed validation to determine the reason for failure and how to correct them. Although this is a desired, normal part of the business process, the approximate 9 percent failure rate was high enough to produce a backlog of failed IDOCs that remained steady at 40,000 throughout IOT&E. This IDOC backlog significantly increased NAVSUP workload.
- While the process to manage defects and trouble tickets was sound, the large volume of trouble reports, coupled with system complexity, created a backlog of open defects that the Navy was not able to work through during the evaluation period. The defect backlog remained steady at just over 500 throughout IOT&E. The program manager was able to reduce the backlog to fewer than 300 defects following the IOT&E; however, the backlog has increased to 500 defects, as of September 2011, following the deployment of Navy ERP to the Fleet and Industrial Supply Centers in July 2011.
- Reliability, availability, and maintainability metrics easily met their thresholds. Furthermore, NIOC Red Team testing showed that Navy ERP maintained a very good security posture with no significant vulnerabilities found.
- The Navy ERP Program Manager developed a plan of action and milestones to resolve deficiencies and scheduled an FOT&E for May 2012 that will include testing of the critical ISPT KPP and several new capabilities.

Recommendations
- Status of Previous Recommendations. The program office corrected many deficiencies found during the integrated developmental/operational testing prior to IOT&E and is currently working to stabilize the system and correct additional deficiencies noted during the IOT&E.
- FY11 Recommendation.
  1. The scheduled FOT&E should proceed once the program manager has corrected identified deficiencies, the Navy has deployed the rest of the Single Supply Solution capabilities, and the system is stable enough to continue operational testing.

Navy Multiband Terminal (NMT)

Executive Summary

- DOT&E completed an Early Fielding Report in April 2011. The Navy deployed an operational Navy Multiband Terminal (NMT) on the USS *Roosevelt* (DDG 80) prior to IOT&E.
- The Navy completed integrated testing in June 2011 and operational testing in August 2011 to inform the full-rate production decision.
- Preliminary tests results indicate that the NMT is capable of providing multi-band satellite communications, but is not reliable.

System

- The NMT system is the next-generation maritime military satellite communications terminal for the Navy and its coalition partners; it is used for enhancing protected and survivable satellite communications.
- The NMT is interoperable with the legacy service satellite communications terminals, including the Follow-on Terminal and Navy Extremely High Frequency (EHF) Satellite Program.
- 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
  - 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.
- 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 Component Commander 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

- The Commander, Operational Test and Evaluation Force conducted an operational assessment in FY10 to support a low-rate initial production decision. DOT&E completed an Early Fielding Report in April 2011 since the Navy deployed an operational NMT on the USS *Roosevelt* (DDG 80) prior to the IOT&E.
- The NMT program manager planned for an IOT&E with Milstar, Wideband Global Satellite (WGS), and Advanced Extremely High Frequency (AEHF) satellites.
- The 14-month delay in the AEHF-1 satellite reaching its orbital position and the need to maintain schedule required the NMT program manager to alter the T&E strategy.
- The revised plan called for an IOT&E using Milstar II satellites instead of the planned AEHF satellites to inform the full-rate production decision planned in 1QFY12. The program manager added an FOT&E in FY12 with on-orbit AEHF satellites to support fielding of NMT's AEHF capability. DOT&E approved the updated Test and Evaluation

Master Plan (TEMP) describing the new test strategy in 4QFY11.
- The program manager planned for 10,000 cumulative test hours for the Reliability Growth Test (RGT) at the contractor facility. The program office conducted the RGT from March 23 to May 26, 2011. The program office terminated the test after 4,461 hours.
- The Navy commenced integrated testing of the NMT on May 1 and concluded testing on June 30, 2011. The testing included two surface ships, one submarine, and one shore site, operating under realistic conditions. The Navy executed the test in preparation for the IOT&E and in accordance with the DOT&E-approved TEMP.
- The Navy conducted the NMT IOT&E from July 20 to August 19, 2011, on two surface ships: one submarine, a shore site, and various supporting sites. The Commander, Operational Test and Evaluation Force, executed the test in accordance with the DOT&E-approved TEMP and test plan.

Assessment

Although analysis of the operational test data is ongoing, integrated developmental testing and preliminary analysis of operational testing suggest the following:
- NMT can meet requirements to provide legacy EHF communications over Milstar and Ultra High Frequency Follow-On EHF Enhanced payloads, X-band over the legacy Defense Satellite Communication System and WGS, and Ka-Band over WGS. NMT also demonstrated the capability to receive Global Broadcast System broadcasts over WGS.
- The antenna handover problem experienced during the previous operational test has been resolved.
- Although the program manager knew during the RGT that NMT was not going to meet the reliability requirement, he elected to stop testing and forgo thorough failure analysis and corrective action before starting the integrated test and IOT&E in order to meet the schedule.
- During the RGT, the NMT demonstrated a Mean Time Between Critical Failure (MTBCF) of 892 hours against a 1,400-hour requirement; during the integrated testing, NMT demonstrated a MTBCF of 338 hours. The NMT system may have performed better in the RGT because the NMTs being tested did not include the full suite of antenna subsystems and they operated in single band mode rather than multiband mode.
- The IOT&E confirmed the NMT is not reliable. While the full failure analysis is ongoing, current results from the operational test have revealed that the MTBCF is comparable to that of the integrated test.
- If the program manager does not conduct failure mode analysis and perform corrective actions, the NMT will not meet its reliability requirement by the FY13 FOT&E.
- Additional risks, other than those observed during the IOT&E, may not become apparent until FOT&E when AEHF modes of operation, including Extended Data Rate and the new Mission Planning System, will be tested. These capabilities were not evaluated during the IOT&E because they depend on capabilities being delivered to the AEHF program on a different timeline.

Recommendations

- Status of Previous Recommendations. The Navy has made satisfactory progress on all previous recommendations.
- FY11 Recommendation.
  1. The Navy should perform reliability failure analysis on the NMT and develop a plan of action to correct the deficiencies prior to verification in a future test event.

P-8A Poseidon

Executive Summary

- The integrated test team is currently conducting 10 to 14 test flights of the P-8A Poseidon per week. This pace is greater than the eight test flights per week in the original test plan.
- The first production-representative test aircraft flew in June 2011.
- The P-8A cleared flight envelope does not currently allow for conduct of operationally realistic missions and maneuvering utilizing flight profiles required during the IOT&E.
- Priority 1 and 2 software problems should be closed before IOT&E. The current closure rate is not sufficient to have all the software problems resolved prior to the start of IOT&E in June 2012.
- The program completed limited LFT&E in FY11 and updated plans for a Live Fire Test series scheduled for late FY12 and early FY13.
- The Navy decided to provide the S-1 structural test article, a Live Fire test asset, to the Advanced Airborne Sensor program for development of that system. This decision delays planned FY12 LFT&E of the S-1 for the P-8A, and puts completion of LFT&E prior to the scheduled full-rate production date at risk. DOT&E is working with the program to resolve this scheduling problem.

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.
- The P-8 is designed to carry and employ anti-ship missiles, air-to-surface weapons, torpedoes, sonobuoys, and other expendables.
- The P-8A onboard sensors include acoustics 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, missile warning system, 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 integrated test team is currently conducting 10 to 14 test flights per week. This pace is greater than the eight test flights per week in the original test plan. At the beginning of the flight test program, the Navy conducted significantly less than the planned eight test flights per week due to limitations with test instrumentation.
- 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. The primary purpose of the airworthiness testing with T-1

is to clear the entire flight envelope for safe operation. Flight testing of T-1 began in October 2009. As of September 28, 2011, the integrated test team conducted 118 test flights (428.9 flight test hours). Airworthiness testing has consisted of flutter, loads, and flying qualities testing. Data have been collected for 2,926 test points of the total 6,048 test points planned to complete the aircraft systems testing.
  - The T-2 test aircraft has the full mission equipment (e.g., sensors, onboard computers, aircrew workstations) integrated onboard. The primary purpose of testing with T-2 is to evaluate the performance of the onboard mission equipment such as the radar, acoustics system, and computers. Flight testing of T-2 began in June 2010. As of September 28, 2011, the integrated test team conducted 94 test flights (407.0 flight test hours). To date, flight testing has focused on testing the acoustics system and radar. Data have been collected for 855 test points out of the total 1,204 test points for mission systems testing.
  - The T-3 test aircraft has the full mission equipment onboard. The primary purpose of testing with T-3 is to ensure the safe separation of weapons and buoys from the aircraft. As such, the instrumentation onboard the T-3 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 28, 2011, the integrated test team conducted 73 test flights (304.3 flight test hours).
- Three production-representative test aircraft (T-4, T-5, and T-6) will fly during the IOT&E in FY12. The first production-representative test aircraft, T-4, flew in June 2011.
- As of September 28, 2011, the integrated test team has flown 25 test flights (102.0 flight test hours) using T-4.
- The Navy is tracking system deficiencies discovered in all phases of integrated flight, ground, and laboratory testing. The P-8A Combined Reliability Board regularly reviews reliability data.
- The Navy continues to use the Weapons System Integration Lab to test software upgrades, tactics, and interfaces with other systems such as the tactical/mobile ground station.
- The Navy conducted three limited Live Fire Test series in FY11 to support the vulnerability assessment:
  - Simulated engine nacelle fire extinguishing performance testing in the presence of ballistic damage.
  - Ballistic testing of the P-8A In-Flight Refueling piping to assess vulnerabilities related to fire and explosion.
  - Fuel vapor sensor tests to evaluate the capabilities of sensors to detect the presence of explosive fuel mixtures in the lower lobe of the P-8A fuselage.
- The Navy decided to provide the S-1 structural test article, a Live Fire test asset, to the Advanced Airborne Sensor program for development of that system, delaying planned FY12 LFT&E of the S-1 for the P-8A.

Assessment
- The integrated test team identified the following risk areas for entering and completing a successful IOT&E.
  - Currently, the P-8A has an operational flight envelope limit that precludes it from flying at a bank angle greater than 48 degrees when maneuvering. In order to fly operationally realistic tactics during anti-submarine warfare missions, the aircraft will have to fly maneuvers that require a bank angle of 53 degrees. The P-8A full flight envelope should be cleared for flight to conduct operationally realistic missions and maneuvering flight profiles during the IOT&E.
  - Priority 1 and 2 software problems that will affect IOT&E remain open. Although 92 percent of the priority 1 and 2 software problems have been closed, the current closure rate is not sufficient to have all the software problems resolved by the start of IOT&E. Priority 1 software problems prevent a mission-essential capability from being performed. Priority 2 software problems affect mission-essential capabilities, and there is no acceptable workaround for these problems onboard the P-8A. There are 369 priority 1 and 2 software problems as of September 21, 2011. Software problems discovered during the later stages of the integrated testing may not be fixed in the software version that is currently planned for IOT&E, and may require additional software upgrades prior to starting IOT&E to ensure the software is production-representative.
  - The immaturity of the mission systems degrades mission effectiveness and suitability. Reliability is currently below the system requirement due to discovery of software problems in the mission systems, such as the acoustics system, that prevent essential capabilities required of the systems.
- Although the Navy is tracking reliability to date, the sample size (number of test hours) is still too small to fully assess whether the P-8A will meet its reliability, maintainability, and sustainment requirements. The current point-estimate reliability is 7.45 mean flight hours between mission aborts, compared to a system requirement of 11.7 hours.
- The Navy is approximately two months behind schedule in collecting test point data based on their re-baselined schedule constructed in January 2011. The primary reasons for the delay have been early-on instrumentation problems on the test aircraft, shortfalls in mission systems maturity, unanticipated delays due to software and hardware upgrades, and delays in the engineering analysis of flight test data. The instrumentation problems experienced early in the flight test program have been resolved. The delay in collecting test point data will probably delay completing the airworthiness testing to clear the entire flight envelope for safe flight.
- The horizontal tail pitch control is vulnerable to the armor piercing incendiary threats tested. The larger armor piercing

incendiary threat severed the horizontal tail pitch control, resulting in loss of aircraft flight control. However, the pitch control's cross-sectional area is small and surrounded by internal components that provide shielding against threats, thus its susceptibility to threats is small.

- The limited FY11 Live Fire Test series demonstrated that:
  - The engine nacelle fire extinguisher system is effective against fires in the presence of nacelle damage up to the specification level of ballistic projectile threats.
  - In-flight refueling plumbing does not significantly contribute to P-8 vulnerability to ballistic threats.
  - Fuel vapor sensors that will be installed in the P-8 to detect the presence of fuel leaking from tanks in the fuselage lower lobe were sufficiently sensitive to detect such leakage well before explosive mixtures could develop.
- The LFT&E program is adequate to assess the vulnerability and survivability of the P-8A. However, currently there is significant risk in completing LFT&E prior to full-rate production because the Navy has given the Advanced Airborne Sensor program priority for the Live Fire S-1 static test asset, delaying scheduled completion of P-8A LFT&E.

Recommendations

- Status of Previous Recommendations. In order to reduce the risk of an unsuccessful IOT&E, the Navy needs to resolve the FY10 recommendation to fix the system shortfalls discovered during the operational assessment that degrade the mission, have no operator workaround, and have no current corrective plan in place.
- FY11 Recommendations. The Navy:
  1. Should clear the P-8A operational flight envelope so that operationally realistic and representative missions can be flown during IOT&E.
  2. Should resolve all priority 1 and 2 software problems discovered during the integrated test phase before starting IOT&E.
  3. Must deliver the S-1 static test article for LFT&E earlier than the revised schedule in order to complete testing before the scheduled full-rate production date.

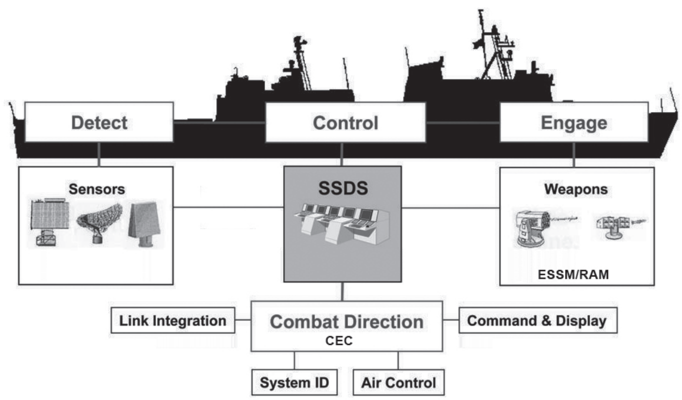
Ship Self-Defense

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.
- DOT&E issued a classified report to Congress in March 2011 entitled "Ship Self-Defense Operational Mission Capability Assessment Report."
- 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 testing to demonstrate the correction of significant deficiencies with SSDS Mark 2, RAM, ESSM, CEC, and legacy ship self defense combat system elements.

System
- Surface ship self-defense is addressed by several legacy combat system elements (ship class-dependent) and four 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 weapons 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).



- 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 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 ASCM, surface, and low velocity air threats. The ESSM is currently installed on DDG-51 Flight IIA Destroyers as well as CVN 68 class aircraft carriers and LHD-1 class amphibious ships 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, CVN 78 Class Aircraft Carriers, 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, which collects and fuses radar data, and the Data Distribution System, which

exchanges the Cooperative Engagement Processor data. CEC is an integrated component of, and serves as the primary air tracker for, SSDS Mk 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 Component Commanders 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 and ESSM: Raytheon – Tucson, Arizona
- CEC: Raytheon – St. Petersburg, Florida

Activity

- DOT&E issued a classified report to Congress on the ship self-defense mission area in March 2011. The report covers ship self-defense related operational testing conducted from January 2008 through March 2010 aboard USS *Ronald Reagan* (CVN 76), USS *San Antonio* (LPD-17), USS *New Orleans* (LPD-18), USS *Makin Island* (LHD-8), and the Self-Defense Test Ship (SDTS).
- The Commander, Operational Test and Evaluation Force continued planning for operational testing of the ship self-defense mission area during FOT&E of the SSDS Mark 2 Mod 1 and ESSM on the SDTS. Testing is scheduled to continue in November 2011.
- The Commander, Operational Test and Evaluation Force continued planning for IOT&E testing of the LHA-6 class ship self-defense combat system on the SDTS. Testing is scheduled to commence in August 2012.

Assessment

- The DOT&E March 2011 ship self-defense mission area report includes the following assessments:
  - The LPD-17 and CVN 68 ship class combat systems continue to have difficulty defeating certain ASCM raid types. In particular, the legacy combat system sensor elements have limited capability against the threat surrogates used in those raid types.
  - Some elements of the LHD-8 ship class combat system continue to have reliability problems. In addition, the LHD-8 combat system has difficulty engaging certain classes of asymmetric threats.
  - The CVN 68 ship class combat system has several problems that keep it from successfully completing the ship self-defense mission. Specific problems include deficiencies in weapon employment timelines, sensor coverage, system track management, and North Atlantic Treaty Organization (NATO) SeaSparrow Missile System performance, as well as deficiencies with the recommended engagement tactics provided for use against multiple ASCM threat classes.
  - Due to the similarities between the CVN 68, LPD-17, and LHD-8 ship self-defense combat system elements and software commonality, most of the specific ship class combat system assessments are applicable to all CVN 68, LHD-1, and LPD-17 ship class combat systems.
- Further ship self-defense mission area assessments are classified and are contained in the March 2011 DOT&E report to Congress on the ship self-defense mission area.

Recommendations

- Status of Previous Recommendations. The Navy has not resolved the following previous annual report recommendations:
  1. Optimize SSDS Mark 2 weapon employment timelines to maximize weapon probability of kill.
  2. Acquire range-safe supersonic sea-skimming ASCM surrogate targets for ESSM FOT&E with the Aegis Combat System.
  3. Ensure availability of a credible open-loop seeker subsonic ASCM surrogate target for ship self-defense combat system operational tests.
  4. Correct the identified SSDS Mark 2 software reliability deficiencies.
  5. Correct the identified SSDS Mark 2 training deficiencies.
  6. 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.
  7. 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.

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 Test and Evaluation Master Plan-approved Air Warfare/Ship Self-Defense Enterprise testing planned for FY16.
9. 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.

- FY11 Recommendations. The Navy should:
  1. Ensure required missile assets are available for all planned FY12 ship self-defense operational testing.
  2. Improve the ability of legacy ship self defense combat system sensor elements to detect threat surrogates used in specific ASCM raid types.
  3. Ensure availability of adequate and credible target resources for ship self-defense and electronic warfare operational testing as well as the classified recommendations contained in the March 2011 DOT&E report to Congress on the ship self-defense mission area.

SSN 774 *Virginia* Class Submarine

Executive Summary

- Two FOT&E events occurred in FY11. The first event examined the *Virginia* class' ability to conduct under-ice Arctic operations including Anti-Submarine Warfare (ASW) and the second event examined the *Virginia* class' performance equipped with a recently modernized combat system and sonar suite.
- The Navy had planned to update the TEMP by March 2011. However, the Navy requested, and DOT&E agreed, to postpone the update to allow for additional test planning. The revised TEMP is planned to be signed in mid-FY12 and will include plans for testing the next variant of the class, called Block III.
- FOT&E continues to reveal that *Virgini*a class performance is dependent on the performance of separately managed sub-systems that are integrated into *Virginia's* Non-Propulsion Electronics Systems (NPES). Preliminary results from FOT&E show that DOT&E's original assessments from IOT&E regarding mission effectiveness remain unchanged, despite the upgrades to many NPES programs.

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 (ADCAP) 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 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 approved the *Virginia* TEMP Revision F in November 2009 to include FOT&E. Two FOT&E events occurred in FY11 in accordance with DOT&E-approved test plans on two different *Virginia* class submarines.
  - The first FOT&E event occurred in March 2011 and examined the *Virginia* class's ability to conduct under-ice and Arctic operations, as well as the ability to conduct ASW in the Arctic. This was the second time a *Virginia* class submarine operated under-ice. As part of the transit to northern latitudes, testers also examined the *Virginia* class' susceptibility to fixed passive sonar arrays.
  - The second FOT&E period consisted of a series of events to examine the modernization of the *Virginia* class submarines' combat control system. These tests were combined with the operational evaluations of the latest variants of the Acoustic Rapid Commercial Off-the-Shelf Insertion (A-RCI) Sonar System, the AN/BYG-1 Combat Control System, and the Mk 48 ADCAP torpedo. Testing examined *Virginia's* ability to conduct ASW, Mine Detection and Avoidance, Strike, Information Assurance, and Contact Management in areas of high-density surface ship traffic.
- The Navy planned to update the TEMP by March 2011 per the Milestone III Acquisition Decision Memorandum. However, DOT&E agreed to postpone the update to allow for additional test planning. The revised TEMP is planned to be signed in mid-FY12 and will include plans to test deferred capabilities and planned upgrades, particularly the Block III variant of the submarine.
- Because Navy security rules prevent the ability to collect useful operational test data from *Virginia* when conducting exercises with foreign ASW capable platforms, the Navy finished IOT&E without testing the *Virginia* class submarine against one of its primary threats, the foreign diesel electric submarine (SSK). The Navy is investigating alternative test strategies and will provide an update in the next revision of the TEMP. DOT&E has already provided a partial assessment in the Beyond Low-Rate Initial Production (BLRIP) report issued in November 2009. Additional testing, if any, will be documented in the TEMP update.
- The Block III design will require shock testing of the Common Weapons Launcher and the *Virginia* Payload Tube hatch. The hatch shock qualification test series is scheduled for spring of 2012 to support the first Block III delivery in August 2014.
- The Navy is performing a verification and validation of the Transient Shock Analysis modeling method used for the design of *Virginia* Class Block III items. The Transient Shock Analysis modeling method is scheduled to be accredited in January 2013.

Assessment

- The Navy achieved testing efficiencies by combining operational testing of several programs into coordinated test events. Since testing is interdependent, the consolidation of the *Virginia*, A-RCI, acoustic arrays, other sensors, 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.
- An FOT&E event was conducted at the end of FY10 to examine *Virginia's* susceptibility to low-frequency active sonar and the ship's ability to conduct ASUW in a low-frequency active environment. This test event was not adequate due to last minute changes in the Fleet Exercise that prevented *Virginia* from conducting any ASUW operations. Additionally, differences in the transmit power of the low-frequency active source precluded an accurate comparison of susceptibility between the *Los Angeles* class and the *Virginia* class submarines present. Additional testing will be required to complete the FOT&E requirements in this area.
- The FOT&E event in the Arctic was adequate. DOT&E's assessment of *Virginia's* effectiveness in the Arctic environment and *Virginia's* susceptibility to low-frequency fixed passive sonar arrays will be contained in a classified report, expected to be issued in early FY12.
- The FOT&E event that examined the modernization of the *Virginia* class submarine's NPES were adequate with one exception. Testing to examine *Virginia's* susceptibility to some mine types must be repeated.
- Since *Virginia's* mission performance is significantly dependent on supporting acquisition programs that make up the *Virginia* combat and weapons systems, *Virginia* inherits the performance capabilities of these systems. The A-RCI sonar, the AN/BYG-1 Combat Control System, and the Mk 48 ADCAP torpedo are examples of systems with known performance limitations or reliability problems that affected *Virginia's* performance during FOT&E.

Recommendations

- Status of Previous Recommendations. The Navy has made progress in addressing 17 of the 33 recommendations contained in the November 2009 classified BLRIP report. Eight of the outstanding recommendations are classified. Of the remaining eight unclassified comments, the key recommendations are:
  1. Test against an SSK threat surrogate in order to evaluate *Virginia's* capability, detectability, and survivability against modern diesel-electric submarines.
  2. Conduct ASW-search testing to assess *Virginia's* capability with other towed arrays (i.e., TB-16 and TB-23).
  3. Complete ASUW testing and investigate alternatives to the Atlantic Undersea Test Evaluation Center for ASW and ASUW testing.
  4. Measure the ISR-intercept metrics with a deployment-outfitted *Virginia* class submarine and with realistic threat signals.
  5. Conduct FOT&E to examine *Virginia's* susceptibility to airborne ASW threats such as Maritime Patrol Aircraft and helicopters.

- FY11 Recommendations. The Navy should:
  1. Consolidate the *Virginia*, A-RCI, and AN/BYG-1 TEMPs into an Undersea Enterprise Capstone document.
  2. Complete the verification,validation, and accreditation of the Transient Shock Analysis method used for *Virginia* Class Block III items.
  3. Repeat the FOT&E event to determine *Virginia's* susceptibility to low-frequency active sonar and *Virginia's* ability to conduct ASUW in a low-frequency active environment. This testing should include a *Los Angeles* class submarine operating in the same environment to enable comparison with the *Virginia* class.

Standard Missile-6 (SM-6)

Executive Summary

- The Navy completed the remaining FY10 missions during combined developmental/operational testing of the Standard Missile-6 (SM-6) in January 2011.
- The Navy completed SM-6 IOT&E flight testing in July 2011. In IOT&E, SM-6 demonstrated significant new capabilities against maneuvering targets, low-altitude targets, and targets with electronic countermeasures, successfully completing 7 of 12 intercept attempts. SM-6 also demonstrated the longest engagement range for a Standard Missile to-date. Nonetheless, the results of testing currently available do not yet demonstrate the SM-6 is operationally effective or suitable. During 12 attempted missions, initial analysis indicates seven missions were successful. Two missions failed due to fuze-related anomalies, two missions failed due to in-flight material (hardware) failures, and another mission failed due to improper functioning of the missile navigation system. A thirteenth mission was a no-test due to a target failure.
- The Navy is conducting failure analysis and determining the corrective action needed to address the failures. Re-testing to verify the corrective actions has not been scheduled.
- The SM-6 program is in low-rate initial production.

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 program. SM-6 retains the legacy Standard Missile semi-active radar homing capability.
- SM-6 receives midcourse flight control from the Aegis combat system via ship's radar; terminal flight control is autonomous via the missile's active seeker or supported by the Aegis combat system via the ship's illuminator.

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

- DOT&E approved the operational test plan in June 2011.
- In January 2011, the Navy completed at-sea developmental testing/operational testing (DT/OT) at the Pacific Missile Range Facility, Kauai, Hawaii. The Navy successfully executed two of the three planned missions. The Navy carried the failed mission forward to the IOT&E.
- In July 2011, the Navy completed the IOT&E Phase 1, at-sea live missile firing, at the Pacific Missile Range Facility, Kauai, Hawaii. This phase of testing consisted of 13 planned missions. The Navy conducted 12 flight missions. The thirteenth mission was a no-test due to a target failure prior to intercept. The Navy will conduct the remaining mission during FOT&E.
- The Navy plans to complete Phase 2 of the IOT&E in April 2012. Phase 2 is an extensive modeling and simulation effort that intends to explore fully the SM-6 battlespace within the performance demonstrated in Phase 1.

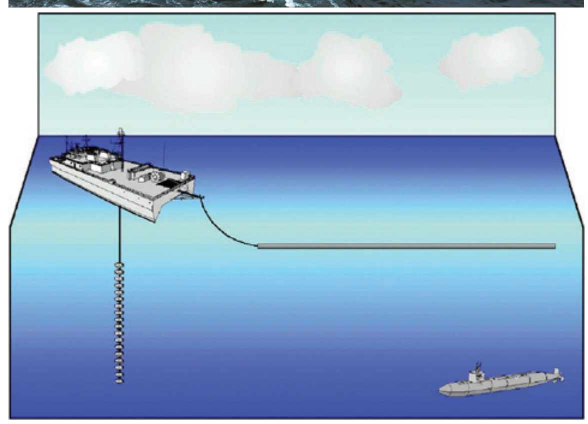
Assessment

- In IOT&E, SM-6 demonstrated significant new capabilities against maneuvering targets, low-altitude targets, and targets with electronic countermeasures, successfully completing 7 of 12 intercept attempts. SM-6 also demonstrated the longest downrange engagement range for a Standard Missile to-date.
- The results of testing currently available do not yet demonstrate SM-6 is operationally effective and suitable. In the IOT&E, several anomalies occurred that influence SM-6 effectiveness and suitability assessments. Based upon combined data from the IOT&E and DT/OT flight tests, the SM-6 does not meet the flight reliability criteria established by USD(AT&L) for full-rate production.
- The continuing discovery of performance and reliability issues at IOT&E is a concern. Overall, these results reinforce the importance of a reliability growth program during development.
  - There were two performance anomalies in IOT&E that a more rigorous developmental testing program may have discovered earlier.
  - One anomaly discovered in developmental testing (uplink/downlink antenna insulation debris) carried forward to IOT&E without corrective action fully implemented on all missiles; there were additional occurrences during IOT&E on this configuration.
  - One anomaly discovered in developmental testing (Mk 54 Safe-Arm Device) carried forward into IOT&E and remains under investigation; additional occurrences were experienced during IOT&E. This anomaly could degrade SM-6 lethality.
- The Navy has not tested the SM-6 in its objective operational environment. Because of employment limitations of the current Aegis "legacy" baseline, the IOT&E did not address the full capability of SM-6 as outlined in its validated requirements; the Naval Integrated Fire Control-Counter Air (NIFC-CA) capability will be required to fully demonstrate SM-6 requirements. In this "legacy" mode, SM-6, engagements are limited to being conducted within the firing ship's radar horizon. The full over-the-horizon capability of SM-6 will not be demonstrated until Aegis Capability Baseline 12 and the NIFC-CA sensors are fielded after FY14.

Recommendations

- Status of Previous Recommendations. The Navy is addressing the previous recommendations to develop a test strategy for the SM-6 in the NIFC-CA role and to accelerate testing against the full anti-ship cruise missile set in order to address the gap in the fleet's ability to defend itself against fielded anti-ship cruise missiles.
- FY11 Recommendations. The Navy should:
  1. Prior to fielding the SM-6, conduct additional flight testing to demonstrate corrective actions for the anomalies that occurred during the IOT&E.
  2. Develop an IOT&E-level test strategy for NIFC-CA capability to assess fully the effectiveness and suitability of SM-6 in its objective operational environment.
  3. Investigate and identify the root cause of the Safe-Arm Device anomaly and take corrective measures to eliminate it.

Surveillance Towed Array Sensor System (SURTASS) and Compact Low Frequency Active (CLFA)



Executive Summary

- The Navy completed an operational assessment of the Surveillance Towed Array Sensor System (SURTASS) Compact Low Frequency Active (CLFA) during FY11. The operational assessment identified some deficiencies with the CLFA detection algorithms and with some components' software and hardware reliability.
- DOT&E assessed that the system could meet its technical specifications based upon the laboratory analysis of the collected data.
- DOT&E produced a classified SURTASS/CLFA Operational Assessment report and provided it to the Navy on October 20, 2011.
- IOT&E is scheduled for FY12.

System

- SURTASS/CLFA is a low frequency, passive and active acoustic surveillance system installed on Tactical Auxiliary General Ocean Surveillance Ships (T-AGOS) as a component of the Integrated Undersea Surveillance System.
- SURTASS provides passive detection of quiet nuclear and diesel submarines and enables real-time reporting of surveillance information to Anti-Submarine Warfare (ASW) commanders.
- CLFA is a low frequency active sonar system developed to provide an active detection capability of quiet submarines operating in environments that support active sonar detection.
- The system consists of:
  - A T-AGOS host ship with array handling equipment
  - A towed vertical string of active acoustic projectors
  - A towed horizontal Twin Line (TL-29A) acoustic array
  - An Integrated Common Processor for processing active and passive acoustic data
  - A communications segment to provide connectivity to shore-based Integrated Undersea Surveillance System processing facilities and to fleet ASW commanders

Mission

- Crews of T-AGOS ships equipped with SURTASS/CLFA systems provide active and passive acoustic sensors for long-range ASW detection, classification, and tracking of submarines in support of theater naval operations.
- SURTASS/CLFA is a component of the theater's ASW strategy to protect naval ships from threat submarines while providing accurate targeting information to other ASW forces to prosecute the threat submarines.

Major Contractors

- Overall Integrator: Maritime Surveillance Systems Program Office (PMS 485)
- ICP: Lockheed Martin – Manassas, Virginia
- CLFA Projectors: BAE – Nashua, New Hampshire
- CLFA Handling System: Naval Facilities ESC (Government Lab) – Port Hueneme, California
- High Frequency Marine Mammal Monitoring Sonar: SSI – Nashua, New Hampshire
- TL-29A Towed Arrays: Lockheed Martin – Syracuse, New York

Activity

- The Navy conducted a System Certification Test (SCT) of the SURTASS/CLFA system installed on USNS *Able* (T-AGOS-20) in August 2010. Following the SCT, USNS *Able* participated in the fleet exercise Valiant Shield 10. The Navy's Commander, Operational Test and Evaluation Force (COTF) and DOT&E utilized the SCT and the Valiant Shield exercise to conduct an operational assessment of the SURTASS/CLFA system. The operational assessment was conducted in accordance with a DOT&E-approved test plan.
- DOT&E delivered a report on the operational assessment to the Navy on October 20, 2011.
- The Navy acquired one engineering developmental model and two production CLFA systems and is installing them on three of the five Western Pacific-based T-AGOS ships during planned maintenance availabilities.

Assessment

- The SCT allowed the developer's technicians operational time, in the Western Pacific, to verify the system's technical specifications and to gather detection data on cooperative submarines targets. The SCT also allowed the Navy's operators time to train on the CLFA system. DOT&E assessed that the system could meet its technical specifications based upon the laboratory analysis of the collected data.
- Unfortunately, during Exercise Valiant Shield, an interfering U.S. Air Force missile test separated the SURTASS/CLFA test ship from other theater ASW assets, and the failure of SURTASS/CLFA test ship's towed array heading sensors minimized the value of the CLFA data to the theater's ASW commander. These test problems prevented the assessment of CLFA's operational performance and the value of the CLFA system to theater ASW commanders during the exercise; however, laboratory analysis of taped CLFA data allowed DOT&E to assess the CLFA system's performance potential.
- The operational assessment identified some reliability deficiencies with SURTASS/CLFA hardware and software, and some deficiencies with CLFA algorithms that could affect detection, classification, and tracking performance.
- More information on the performance of SURTASS/CLFA system can be found in DOT&E's classified Operational Assessment report dated October 20, 2011.
- The Navy's program office is aware of the deficiencies identified during the operational assessment and is executing plans to fix both the reliability and performance problems. The problems must be corrected prior to IOT&E in FY12.

Recommendations

- Status of Previous Recommendations. There were no previous recommendations for this program.
- FY11 Recommendations.
  1. The Navy should conduct the IOT&E in conjunction with a fleet exercise. The fleet exercise would allow the ASW commander to utilize SURTASS/CLFA with other ASW assets, to protect surface ships, and to prosecute the SURTASS/CLFA contact reports.
  2. The program office should correct the deficiencies identified during the operational assessment and implement the recommendations in COTF's and DOT&E's Operational Assessments before the IOT&E.

Tomahawk Missile and Weapon System

Executive Summary

- The Navy continues to conduct Operational Test Launches to verify reliability and performance of fielded Block 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 FY11 test flights, the Tomahawk Weapon System continues to meet Navy standards for reliability and performance.
- Based on the FY11 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 three fielded variants: a nuclear warhead (Block II only, not deployed), a conventional warhead, and a conventional warhead with submunitions.
- Tactical Tomahawk (Block IV) is 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 Tomahawk Weapon System also includes the Tomahawk Command and Control System (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 employs the Tomahawk Weapon System for long-range, precision strikes against land targets.

Major Contractor

Raytheon Missile Systems – Tucson, Arizona

Activity

- DOT&E approved the operational test plan for the operational test IT-CF test phase.
- The Navy completed the IT-CF test phase in accordance with the DOT&E-approved test plan. This phase of test evaluated upgrades to the TWCS for surface ships.
- The Navy continued to conduct FOT&E Operational Test Launches to verify reliability and performance of fielded Block III and IV Tomahawk missiles, their associated weapon control systems, and the TC2S. The Navy conducted a total of nine Tomahawk missile test launches in FY11.
- DOT&E continues its participation in the Tomahawk program's T&E Working Integrated Product Team to update the Test and Evaluation Master Plan and develop test plans to support the next phases of Tomahawk Weapon System FOT&E (OT-IIIG and OT-IIIH). These phases include improvements to TWCS, as well as correction of deficiencies remaining from OT-IIIE.

Assessment

- As demonstrated during FY11 test flights, the Tomahawk Weapon System continues to meet Navy standards for reliability and performance. As demonstrated by the FY11 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 III test launches after FY11. 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.

- Based on IT-CF results, hardware and software updates to the TWCS provided accelerated mission planning and execution from firing units in surface vessels. However, particular tasks, such as post-launch retargeting of missiles from the firing unit, continue to be problematic.

Recommendations

- Status of Previous Recommendations. The Navy has addressed all previous recommendations.
- FY11 Recommendations. None.

Vertical Take-Off and Landing Unmanned Aerial Vehicle (VTUAV) (Fire Scout)

Executive Summary

- The program delayed the planned IOT&E from June 2009 to FY12.
- The program deployed two systems aboard Navy frigates USS *McInerney* in 2010 and USS *Halyburton* in 2011 to conduct Military Utility Assessments. The USS *Halyburton* deployment supported counter-piracy operations off the Horn of Africa and NATO operations in Libya. One MQ-8B was lost to enemy fire while operating over Libya.
- In May 2011, the Navy deployed a land-based Vertical Take-Off and Landing Unmanned Aerial Vehicle (VTUAV) system to Afghanistan in support of ongoing Army operations.
- The time spent training additional operators and maintainers, modifying air vehicles, integrating non-program of record payloads, and a requirement to provide spare parts to three operating locations, delayed the program's efforts to address those deficiencies most likely to threaten successful completion of IOT&E. The current plan is for IOT&E to begin in March 2012.
- Uncertainty between the future of the MQ-8B air vehicle and development of the MQ-8C air vehicle presents the program office with additional planning challenges. This uncertainty results in the lack of a coherent long-range schedule to be ready for IOT&E and field the system.
- The *McInerney* and *Halyburton* deployments identified system deficiencies that the program should correct before widely fielding the system. These deployments demonstrated that the system has potential to provide the commander with a valuable Information, Surveillance, and Reconnaissance (ISR) asset once the program addresses these shortcomings.
- DOT&E submitted an Early Fielding Report on the VTUAV program in June 2011.

System

- The VTUAV is a helicopter-based tactical Unmanned Aerial System comprised of up to three Fire Scout air vehicles with payloads, a shipboard integrated Ground Control Station with associated tactical datalinks, and the Unmanned Aerial Vehicle Common Automatic Recovery System.
- The VTUAV is intended to have the following capabilities:
  - Combat radius – 110 nautical miles
  - Endurance at combat radius – 3 hours on station
  - Target Identification – Small fast attack boats at 6 km range
  - Initial payload consists of the AN/AAQ-22D Bright Star II electro-optical and infrared imaging system with laser designator

Mission

Aviation detachments equipped with VTUAVs perform reconnaissance, surveillance, target acquisition, and communications relay missions in support of littoral anti-submarine warfare, anti-surface warfare, and mine warfare operations. System deployments during 2011 provided reconnaissance and surveillance to units conducting combat operations ashore.

Major Contractor

Northrop Grumman-Ryan Aeronautical – San Diego, California

Activity

- DOT&E submitted an Early Fielding Report on the VTUAV program in June 2011.
- The program delayed the planned IOT&E from June 2009 to FY12. The program delayed IOT&E because of poor reliability, excessive cautions, warnings, and advisories, and lack of required functionality (dual air vehicle operations and communications relay). The program has corrected the excessive warnings, cautions, and advisories deficiency.
- In September 2011, the VTUAV demonstrated the capability to conduct dual air vehicle operations. Challenges with system reliability and the lack of a dependable communications relay capability continue to delay the IOT&E.
- The program deployed two systems aboard Navy frigates USS *McInerney* in 2010 and USS *Halyburton* in 2011 to conduct Military Utility Assessments. The USS *Halyburton* deployment supported counter-piracy operations off the Horn

of Africa and NATO operations in Libya. One MQ-8B was lost to enemy fire while operating over Libya.
- In May 2011, the Navy deployed a land-based VTUAV system to Afghanistan in support of ongoing Army operations. This land-based system has flown 1,200 hours supporting units within its assigned area of operations.
- Developmental testing during 2011 assessed dual air vehicle operations, communications relay, and correction of the large target location errors that prevent the system from supporting precision targeting.

Assessment
- The *McInerney* and *Halyburton* deployments identified system deficiencies that the program should correct before widely fielding the system. These deficiencies include air vehicle and datalink reliability, incomplete technical publications, spare parts support, pre-deployment training, and the lack of spatial orientation data on payload imagery. These deployments demonstrated that the system has potential to provide the commander with a valuable ISR asset once the program addresses these shortcomings.
- Because of a lack of data, DOT&E cannot comment on the effectiveness or suitability of the VTUAV system in the performance of support operations in Afghanistan.
- Uncertainty between the future of the MQ-8B air vehicle and development of the MQ-8C air vehicle presents the program office with additional planning challenges. This uncertainty results in the lack of a coherent long-range schedule to be ready for IOT&E and field the system. The current plan is to proceed with the MQ-8B acquisition strategy. IOT&E is scheduled to begin March 2012.
- While the program office does not consider over-land operations to be a VTUAV mission, the two 2011 deployments focused on over-land operations. The lack of testing against a land-based target set and standardized tactics, techniques, and procedures within the training curriculum adversely affect system performance in the area of over-land operations in which it will be utilized in the foreseeable future.
- The Test and Evaluation Master Plan (TEMP) approved in 2007 is outdated and does not contain a clear path to successful completion of IOT&E. The TEMP does not clearly define the objectives of near-term testing nor prioritize future upgrades such as search radar and weapons integration.
- The lack of ability to disseminate VTUAV near-real-time imagery off the host frigate limits VTUAV effectiveness. In the foreseeable future, this problem is a function of the shipboard infrastructure and the Navy's overall command and control system. While not required as part of the program of record, it is an area that the Navy should address to maximize the utility of the VTUAV and other Unmanned Aerial Systems.
- The 2011 USS *Halyburton* military utility assessment and ongoing developmental testing identified the following areas of risk entering the March 2012 IOT&E:
  - The magnitude of the Target Location Error does not support precision attack missions.
  - The limited number of available frequencies and unreliable operation of the communications relay suite hinders conduct of communications relay missions.
  - The system failed to meet reliability and availability threshold values.
- Recent real-world operations demonstrate that VTUAV flight operations will be restricted when operating in other than a benign threat environment. Operations in such an environment require additional real-time intelligence support to increase air vehicle survivability.
- The focus on non-program of record activities between 2010 and 2011, such as the military utility assessments and Afghanistan deployment, slowed developmental testing. The time spent training additional operators and maintainers, modifying air vehicles, integrating non-program of record payloads, and a requirement to provide spare parts to three operating locations, delayed the program's efforts to address deficiencies.

Recommendations
- Status of Previous Recommendations. The program has successfully addressed, or begun to resolve, the previous recommendations.
- FY11 Recommendations. The Navy should:
  1. Develop and validate standard operating procedures and mission requirements for over-land ISR.
  2. Expand the scope of IOT&E significantly to include extensive over-land operations.
  3. Update the TEMP to re-baseline system development.
  4. Conduct an end-to-end review of its command and control network to facilitate the dissemination of near-real-time video.

Air Force Programs

Air Force Programs

Advanced Extremely High Frequency (AEHF) Satellite Communications System

Executive Summary

- The Advanced Extremely High Frequency (AEHF) satellite one (AEHF-1) reached its orbital position on October 24, 2011. AEHF-2 and AEHF-3 have been built and are in storage awaiting shipment for their planned launch dates in 2012.
- Air Force Space Command declared the AEHF Mission Control Segment (MCS) Increment 4 as their system of record and is using the MCS to plan Milstar communications and control the Milstar Constellation.
- The program has made significant progress; however, the quality of the complex mission control software has proved challenging. Air Force Operational Test and Evaluation Center (AFOTEC) is planning a 2QFY12 Operational Utility Evaluation (OUE) to support the fielding of the second release of MCS software supporting command and control of the hybrid Milstar–AEHF constellation.

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 10.
- The overall AEHF system has three segments:
  - Space segment – comprised of an integrated constellation of Milstar and AEHF satellites.
  - Mission 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 – includes ground-fixed, ground-mobile, man-portable, transportable, airborne, submarine, and shipboard configurations.
- The operational AEHF constellation is defined as four interconnected satellites per the AEHF Operational Requirements Document, dated October 2, 2000.

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

- The Defense Acquisition Executive authorized fabrication and assembly of the first four satellites and development of the Control and User segments. He also directed the Air Force to plan for the acquisition of satellite vehicles five and six. A block buy of satellites five and six is planned and funded for FY12.
- AEHF-1, launched on August 12, 2010, suffered a large apogee engine malfunction while trying to achieve geosynchronous orbit during the initial boost phase. This malfunction resulted in a reduced operational lifespan and a 14-month delay in AEHF-1 reaching its intended orbital position. The program manager has identified the root cause of the AEHF-1 large apogee engine malfunction, and AEHF-2 and AEHF-3 have been inspected and tested to mitigate the possibility of recurrence.
- AEHF-1 orbit raising maneuvers are progressing as planned, and AEHF-1 reached its orbital position on October 24, 2011. AEHF-2 and AEHF-3 have completed contractor testing and are in storage awaiting shipment for their planned launch dates in 2012.

- Air Force Space Command declared the MCS Increment 4 as its system of record for planning Milstar communications and controlling the Milstar Constellation in June 2011.
- AFOTEC is planning an OUE in FY12 to support fielding of the second release of the MCS supporting command and control of the hybrid Milstar–AEHF constellation. The updated Test and Evaluation Master Plan is in staffing to reflect this change in test strategy.
- AFOTEC has developed a plan to test the AEHF anti-jamming capability during the Multi-Service Operational Test and Evaluation.
- AFOTEC and the Arnold Engineering Center, Tullahoma, Tennessee, are developing a scintillation test capability. Scintillation is a fluctuation in radio wave propagation that can result from atmospheric effects or a nuclear detonation.
- The interim mobile command and control low-profile antenna and associated trailer are being redesigned to meet required road speed and transportation load requirements.

Assessment

- The program has made significant progress; however, the quality of the complex mission control software has proved challenging. The OUE planned for 2QFY12 may be delayed while the program manager addresses deficiencies in this software.
- The program manager is modifying the interim mobile command and control system to be a supportable operational system. He is doing this in order to meet near- and mid-term operational needs due to delays with the Family of Advanced Beyond-Line-of-Sight Terminal (FAB-T) program.
- The operational testers have made good progress in planning a modeling and simulation strategy to assess the nuller antenna anti-jamming performance. This testing is now funded and planned to occur during the FY13 IOT&E.
- The operational testers are on track to develop a scintillation simulator in time to support the FY13 IOT&E.

Recommendations

- Status of Previous Recommendations. The Air Force has made satisfactory progress on all previous recommendations.
- FY11 Recommendations. None

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

Executive Summary

- The next update to the AIM-120 Advanced Medium-Range Air-to-Air Missile (AMRAAM), the AIM-120D, is currently in developmental testing by both the Air Force and Navy at Eglin AFB, Florida, and China Lake Naval Weapons Station, California.
- Key stakeholders, including the program office and DOT&E, suspended AIM-120D progression to operational testing (OT), pending resolution of four key technical deficiencies. These deficiencies include missile lockup, built-in test (BIT) failures, aircraft integration problems, and poor GPS satellite acquisition.

System

- The AIM-120 AMRAAM is an all-weather, radar-guided air-to-air missile with capability in both the beyond-visual-range and within-visual-range arenas. A single launch aircraft can engage multiple targets with multiple missiles simultaneously when using AMRAAM.
- The AMRAAM program develops and incorporates phased upgrades periodically.
- The latest version, the AIM-120C-7, completed operational testing in August 2007. It incorporated an upgraded antenna, receiver, signal processor, and new software algorithms to counter new threats. The use of smaller system components creates room for future growth.
- The AIM-120D, the next upgrade to the AMRAAM, is currently in development and is intended to deliver performance improvements over the AIM-120C-7 through the use of an internal GPS, an enhanced datalink, and new software.

Mission

- The Air Force and Navy, as well as several foreign military forces, use various versions of the AIM-120 AMRAAM to shoot down enemy aircraft.
- All U.S. fighter aircraft use the AMRAAM as the primary beyond-visual-range air-to-air weapon to shoot down enemy aircraft.

Major Contractor

Raytheon Missile Systems – Tucson, Arizona

Activity

- Production of AIM-120D began in 2006, and developmental testing (DT) began in 2007.
- In 2009, key stakeholders, including the program office and DOT&E, suspended progression of the AIM-120D to OT due to four performance and reliability deficiencies, including missile lockup, BIT failures, aircraft integration problems, and poor GPS satellite acquisition.
- The Air Force accomplished the final DT/OT shot successfully in August 2011, but Raytheon has not yet resolved missile lockup or aircraft integration problems. The Air Force has not set a date for the Operational Test Readiness Review (OTRR).

Assessment

- The AIM-120D was originally scheduled to begin OT in 2008; it is now more than three years behind schedule.
- DOT&E's approval of the Test and Evaluation Master Plan and OT plan are pending resolution of the deficiencies that suspended OT in 2009. Raytheon has solved the BIT fail problem and has developed a pending solution to the GPS failure problem. Weapons failure and aircraft integration deficiencies remain; therefore, the AIM-120D is not production-representative with stable hardware and software.
- The program office is pursuing advancement to OT without solutions to two major technical problems: weapons failure and aircraft integration. The program office should address and produce adequate solutions to these deficiencies before commencing OT.

Recommendations

- Status of Previous Recommendations. The FY05 recommendation for the program office to include enough test missiles to adequately characterize effectiveness and suitability for the AIM-120D remains valid. The FY07 recommendation for the program office to seek changes to the Air Force's full-scale and sub-scale target programs to ensure proper target presentation, target reliability, and availability, also remains valid.

- FY11 Recommendation.
  1. The program office should produce adequate solutions to the identified technical deficiencies before initiating OT and should begin OT only when AIM-120D is production-representative, with stable hardware and software.

Air Operations Center – Weapon System (AOC-WS)

Executive Summary

- The Air Operations Center – Weapon System (AOC-WS) is the senior command and control element of the U.S. Air Force's Theater Air Control System and provides operational-level command and control of air, space, and cyberspace operations, as well as joint and combined air, space, and cyberspace operations.
- The AOC-WS Increment 10.1 is a system-of-systems that contains numerous third party software applications, including the Global Command and Control System – Joint (GCCS-J) and Theater Battle Management Core System – Force Level (TBMCS-FL).
- The Air Force conducted developmental testing of AOC-WS Increment 10.1 Recurring Event (RE)10 baseline upgrade in FY10. The results demonstrated that GCCS-J was not stable within the AOC-WS environment and could not support AOC-WS threshold stress levels. Due to system performance failures, the Air Force cancelled dedicated operational testing. The Air Force successfully conducted an integrated test of RE10 very-low-risk software updates.
- The Air Force conducted developmental testing of AOC-WS 10.1 out-of-cycle (OOC) 11-1 upgrade in 2QFY11. Due to the priority assigned to the broader GCCS-J upgrade in RE11, and a number of mission-critical problems not resolved by the end of the developmental testing period, further work on this upgrade was halted to prevent schedule impact to the RE11 baseline upgrade.
- The Air Force will conduct developmental testing of AOC-WS Increment 10.1 RE11 upgrade in 2QFY12. The RE11 will be a major baseline change, and dedicated operational testing is planned to begin in 2QFY12.
- The Air Force and Defense Information Systems Agency (DISA) collaborated on the development of GCCS-J versions 4.2.0.8 and 4.2.0.9 intending to address overall system performance problems for AOC-WS. As a result, most of these problems, together with a list of 15 top priority improvements coordinated by the AOC-WS user community, have been resolved prior to GCCS-J 4.2.0.9 entering operational testing in late November 2011. Additional fixes to the GCCS-J 4.2.0.9 baseline will be provided before RE11 enters operational testing, currently scheduled for March 2012.
- Assessments conducted during the U. S. European Command (USEUCOM) exercises Austere Challenge 2010 and 2011 identified a systemic lack of software baseline coordination associated with the GCCS-J and several other programs of record within the AOC-WS, resulting in operationally significant losses of data exchange in critical AOC systems. The RE11 baseline upgrade is designed to address the major AOC-WS findings identified from the Austere Challenge exercises.

System

- The AOC-WS is the senior command and control element of the U.S. Air Force's Theater Air Control System and provides operational-level command and control of air, space, and cyberspace operations, as well as joint and combined air, space, and cyberspace operations. Capabilities include command and control of joint theater air and missile defense; time-sensitive targeting; and intelligence, surveillance, and reconnaissance management.
- The AOC-WS Increment 10.1 (AN/USQ-163 Falconer) is a system-of-systems that contains numerous third party-developed software applications and commercial off-the-shelf (COTS) products. Each third party system integrated into the AOC-WS provides its own programmatic documentation.
- The AOC-WS consists of:
  - COTS hardware
  - Third party software applications, including the GCCS-J and TBMCS-FL, which make up a majority of the AOC-WS capabilities
  - Additional third party systems that accept, process, correlate, and fuse command and control data from multiple sources and share it through multiple communications systems
- AOC-WS Increment 10.1 operates on several different local area networks (LANs), including Secret Internet Protocol Router Network, Joint Worldwide Intelligence Communications System, and a coalition LAN, when required. The LANs connect the core operating system and primary applications to joint and coalition partners supporting the applicable area of operation. Web-based applications can also be accessed through the Defense Information Systems Network.

- The future AOC-WS Increment 10.2 will be the first increment for modernization and will lead Air Force transition to a net-centric capability.

Mission
- The Commander, Air Force Forces, or the Joint/Combined Air Component Commander (J/CFACC) use the AOC-WS to exercise control of joint (or combined) air forces including planning, directing, and assessing air, space, and cyberspace operations to meet operational objectives and guidance.

Major Contractors
- AOC-WS 10.1 Production Center
  - Jacobs Technology Inc., Engineering and Technology Acquisition Support Services – Hampton, Virginia
- AOC-WS 10.2 Modernization
  - Northrop Grumman Corporation – Hampton, Virginia

Activity
- The Air Force has developed an RE test cycle for major AOC-WS Increment 10.1 upgrades along with OOC testing to sustain interoperability and provide minor upgrades to third-party systems as required.
- The Air Force conducted developmental testing of AOC-WS 10.1 RE10 baseline upgrade in FY10. The RE10 baseline was intended to introduce GCCS-J-Integrated Imagery and Intelligence (I3) as the intelligence and targeting capability provider for AOC-WS and upgrade TBMCS-FL (with Maintenance Release 1-MR1) to migrate to current Modernized Integrated DataBase (MIDB) 2.1. Without the TBMCS-FL upgrade, the AOC-WS is restricted to using a less capable MIDB 2.0. Due to system performance failures, the program removed all RE10 high-risk software changes from the baseline upgrade, to include GCCS-J and MR1, and cancelled the dedicated operational testing.
- The Air Force successfully conducted an integrated test of RE10 very-low-risk software updates in August 2011 at the 613th AOC at Hickam AFB, Hawaii, and successfully fielded the updates.
- The Air Force conducted developmental testing of AOC-WS Increment 10.1 OOC 11-1 in 2QFY11. OOC 11-1 did not proceed to operational test and was not fielded due to the potential delay to the planned RE11 testing in FY12.
- The Air Force is conducting early risk reduction testing of AOC-WS 10.1 RE11 in 4QFY11 – 1QFY12 and will conduct RE11 developmental testing in 2QFY12. The RE11 will be a major baseline change, and dedicated operational testing is planned to begin in 2QFY12.
- Under the oversight of the DOT&E Information Assurance (IA) and Interoperability (lOP) Program, the Army Test and Evaluation Command conducted an IA and lOP assessment of the USEUCOM exercise Austere Challenge 2010 April 30 – May 8, 2010. The interoperability portion of the assessment focused on coalition targeting and the associated command and control systems used by the Combined Task Force-North, 3rd Air Force, the French Combined Forces Air Component Command, and the theater Joint Forces Air Component Command (603rd AOC). These command centers made use of the MIDB associated with the GCCS-J.
- An update to the program's Test and Evaluation Master Plan, an overarching operational test plan for all AOC-WS 10.1 testing, and a dedicated RE11 operational test plan are being prepared and submitted to DOT&E in support of RE11 testing.

Assessment
- The results of three successive developmental tests of the RE10 baseline system demonstrated that GCCS-J was not stable within the AOC-WS environment and could not support AOC-WS threshold stress levels. There were numerous high-risk problems requiring corrective action before the RE10 baseline could enter operational testing.
- RE10 testing highlighted that the AOC-WS program could not incorporate GCCS-J upgrades in a timely manner when those upgrades were built on the same servers as other AOC-WS applications. As a result, the Air Force plans to use a more flexible, current version of GCCS-J in the RE11 system baseline upgrade. This GCCS-J version will be built on separate servers using the standard GCCS-J program build instructions and design tailored specifically for RE11. RE10 testing also highlighted the differences and incompatibility between GCCS-J requirements and AOC-WS unique operational requirements for GCCS-J capabilities.
- The OOC 11-1 system upgrade was intended to update the version of the GCCS-J Common Operational Picture from version 4.0.2 to version 4.2.0.7U4, and to provide information assurance updates to the AOC-WS baseline. Due to the priority assigned to the broader GCCS-J upgrade in RE11, and a number of mission-critical problems not resolved by the end of the developmental testing period, further work on this upgrade was halted to prevent schedule impact to the RE11 baseline upgrade. Developmental testing of OOC 11-1 also highlighted the need for AOC-WS requirements to be more proactively vetted within the GCCS-J community and, if necessary, additional AOC-WS funding to ensure the required GCCS-J capabilities are implemented.
- The Air Force and DISA collaborated on the development of GCCS-J versions 4.2.0.8 and 4.2.0.9 intending to address overall system performance problems for AOC-WS. Three early risk reduction tests of the AOC-WS RE11 major

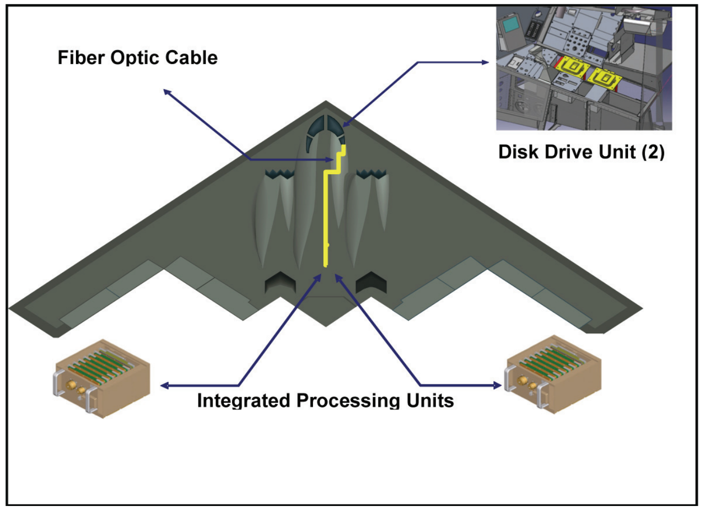
upgrade focused on achieving a stable baseline, particularly with GCCS-J version 4.2.0.9 and TBMCS-FL Maintenance Release 2. As a result of AOC-WS tester involvement in GCCS-J 4.2.0.8 and GCCS-J 4.2.0.9 testing, the Air Force identified critical GCCS-J problems early for corrective action. As a result, most of these problems, together with a list of 15 top priority improvements coordinated by the AOC-WS user community, have been resolved by the GCCS-J program office prior to GCCS-J 4.2.0.9 entering operational testing in late November 2011. Additional fixes to the GCCS-J 4.2.0.9 baseline will be provided before RE11 enters operational testing, currently scheduled for March 2012.
- The 46th Test Squadron Site Activation Test and Fielding team has a mature process for effectively assisting operational AOC-WS personnel in upgrading the system software following integrated test.
- The Air Force is in the process of implementing a Joint Reliability and Maintainability Evaluation Team (JRMET) process for AOC-WS. This process is required to assist in the collection, processing, and analysis of reliability, availability, and maintainability data during both developmental and operational testing.
- Assessments conducted during the USEUCOM exercises Austere Challenge 2010 and 2011 identified a systemic lack of software baseline coordination associated with the GCCS-J and several other programs of record within the AOC-WS, resulting in operationally significant losses of data exchange in critical AOC systems. In multiple instances, data essential to air mission planning in the AOC-WS were either not available or had to be manually transferred between command and control systems. Along with observations during the Austere Challenge exercises, a number of reports and exercise observations associated with the multiple systems populating and supporting the global AOCs have been reviewed. The findings from the exercises are consistent with other tests and assessments, which have demonstrated similar results for other systems fielded as part of the AOC-WS software.
- RE11 baseline upgrades are designed to address all of the major AOC-WS findings identified from the Austere Challenge exercises.

Recommendations
- Status of Previous Recommendations. The Air Force has adequately addressed all previous recommendations.
- FY11 Recommendations. The Air Force should:
  1. Coordinate with third party programs to ensure that critical AOC-WS third-party systems (such as GCCS-J) have testable requirements that meet AOC-WS requirements. Requirements should be properly vetted within the appropriate user and program communities for schedule and funding priority.
  2. Ensure the AOC-WS users and test community continue to actively participate in GCCS-J developmental and operational testing and work together to develop a capability to adequately test GCCS-J to AOC-WS threshold stress levels.
  3. Ensure the AOC-WS test community and GCCS-J developers and test community exchange operationally relevant test data to help find and fix problems early in the GCCS-J software development cycle.
  4. Establish an interface control working group to oversee third-party requirements identification, development, scheduling, testing, and fielding of AOC-WS.
  5. Finalize a JRMET process and provide monthly status information to the AOC-WS Configuration Review Board.
- Additional recommendations from DOT&E's IA/IOP assessment memorandum to the Director of Operations, Joint Staff (J3) specific to AOC-WS include:
  1. The Joint Staff's Interoperability Certification Panel (ICP) review the existing Interoperability Certification Legacy Waivers granted to AOC-WS 10.1 in 2008 and review the ICP Interoperability Watch List.
  2. The Joint Staff, together with the Air Force, reviews and re-validates the current and planned interfaces and interoperability requirements between GCCS-J and other mission-critical systems to establish a clear set of requirements traceable to the operational capabilities within the AOC-WS. These efforts should be synchronized with the Joint Staff's Plan-Build process and combatant commander Integrated Priority Lists.
  3. The Joint Staff and the GCCS-J Program Office should review program priorities and schedules, and conduct a gap analysis to determine critical differences between AOC-WS and other GCCS-J implementations to identify a strategy and prioritization of effort for addressing the AOC-WS shortfalls highlighted in this memorandum.
  4. The Joint Staff or designated sub-unified element should establish or identify a systems integration group for command and control systems that will be responsible for providing comprehensive oversight/management of joint command and control systems and mission-critical interfaces, with particular emphasis on joint data fusion and operations centers, such as the AOC. Systems that should be addressed include, but are not limited to, GCCS-J, MIDB, TBMCS-FL, Joint Automated Deep Operating Coordination system, Joint Targeting Toolbox, and AOC-WS.

B-2 Extremely High Frequency (EHF) Satellite Communications (SATCOM) Increment 1

Executive Summary

- B-2 Extremely High Frequency (EHF) Satellite Communications (SATCOM) Increment One developmental flight testing began in September 2010 and continued throughout FY11. IOT&E is scheduled to begin in Spring 2012.
- The Air Force Operational Test and Evaluation Center (AFOTEC) conducted an Operational Assessment (OA) from March 7 through July 29, 2011, to assess the program's progress towards operational effectiveness, suitability, and mission capability in support of the program's Milestone C decision.
- Preliminary results from the OA period indicate the system made progress towards meeting user requirements, though software maturity and functional equivalence to legacy system capabilities require further development in FY12 to support readiness for IOT&E.



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.
- B-2 system avionics include a multi-mode radar, GPS-aided navigation, and a Defensive Management System for radar warning functions.
- The B-2 EHF SATCOM and computer upgrade program is designed to deliver capability across three distinct increments. Increment 1 upgrades the core flight management processing capability of the B-2 and lays the foundation for Increments 2 and 3. Increment 1 replaces the existing aircraft flight management computers with two new Integrated Processing Units (IPUs) and two new Data Drive Units (DDUs) to increase data storage. Increment 1 also re-hosts the aircraft Flight Management Operational Flight Program (FMOFP) from its legacy flight management software programming language, JOVIAL, to C.
- B-2 EHF SATCOM Increment 2 will remove the legacy B-2 MILSTAR AN/ASC-36 Ultra-High Frequency (UHF)/Air Force Satellite Communications (AFSATCOM) System, and add the Family of Advanced Beyond Line-of-Sight Terminals and a low observable antenna to support EHF and Advanced EHF communications connectivity. Increment 3 is planned to be software-centric and provide full software integration of the B-2 EHF SATCOM upgrade, including Global Information Grid (GIG) connectivity.

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 – Falls Church, Virginia

Activity

- The Air Force conducted B-2 EHF SATCOM Increment 1 testing in accordance with the DOT&E-approved Test and Evaluation Master Plan and OA plan.
- Developmental flight testing began in September 2010 and continued throughout FY11.
- AFOTEC conducted an OA from March 7 through July 29, 2011, to assess the program's progress towards operational effectiveness, suitability, and mission capability in support of the program's October 2011 Milestone C decision. The OA consisted of developmental flight testing, software

laboratory testing, and maintenance demonstration activities. The OA flight test period encompassed 31 EHF developmental test sorties and 105 flight test hours across three developmental operational flight program software releases.
- The program reached Milestone C in October 2011. IOT&E is currently scheduled to begin in April 2012 and complete in June 2012.

Assessment

- The program demonstrated incremental progress towards achieving operational effectiveness and suitability goals during FY11 developmental testing. EHF ground operations-related software stability has yet to demonstrate maturity and functionality consistent with legacy B-2 system capabilities.
- Preliminary performance results from the OA period suggest conventional weapons accuracy and navigational system accuracy made progress towards meeting performance requirements. However, communications systems were unable to demonstrate satellite communications capability during the assessment period. B-2 operational unit alert response posture further requires that the aircraft be capable of radio communications under internal power prior to engine start; yet, the B-2 was unable to demonstrate this capability during the assessment period. Additionally, software instability forced multiple attempts to load mission software on the ground, and loading instability resulted in extended ground operations timelines and work-around actions inconsistent with legacy system performance.
- Preliminary suitability results from the OA period indicate hardware reliability, mean repair time, and maintenance man hours per flight hour metrics were progressing to meet system requirements. Integrated diagnostics fault isolation and detection accuracy were immature during the OA period and made little progress towards meeting the user requirements.
- The B-2 EHF SATCOM Increment One system demonstrated progress during FY11 test activities; however, system demonstration of software maturity and correction of deficiencies identified during developmental testing remain to be accomplished prior to FY12 IOT&E.

Recommendations

- Status of Previous Recommendations. This is the first annual report for this program.
- FY11 Recommendation.
  1. The Air Force should continue to focus on resolving software maturity and performance shortfalls to ensure system readiness for FY12 IOT&E.

Battle Control System – Fixed (BCS-F)

Executive Summary

- The Air Force is completing 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.
- Results from Increment 3.1, to include Release 3.1.2 (R3.1.2), testing to date found Increment 3.1 supports North American Aerospace Defense Command (NORAD) air defense operations with shortfalls in training and technical system documentation, system security management, and system combat identification operations.
- Increment 3.1 testing also has highlighted significant deficiencies in information assurance. The Air Force has implemented some corrections but a complete assessment of Increment 3.1 performance will not be available until the information assurance and penetration T&E is completed at the end of 2011.

System

- The BCS-F is a tactical air battle management command and control system that provides the two continental U.S. 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. The system operates within the NORAD air defense architecture.
- The Increment 3.1 upgrade includes the following:
  - Transitions the system to a Linux operating system and integrates an improved human-machine interface through the Raytheon-Solipsys Tactical Display Framework.
  - Improves the system data and track processing and management and enables the BCS-F to receive plot and track data from an increased number of radars and display track history plots and sensor data on the single air situation display.
  - Provides internet protocol-based radar and flight plan interfaces and an upgraded capability for tactical datalink operations.
- The BCS-F Increment 3.1 upgrade also provides a new air defense operating system that integrates the National Capital Region 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 two continental U.S. air defense sectors are now providing a tactical air picture to NORAD headquarters and other external agencies via remote tactical air picture/remote workstation, versus the NCS.
- A planned Increment 3, Release 3.2 upgrade will advance BCS-F capabilities through improved tactical datalinks, air tasking order and airspace control orders integration, increased system track capacities, and updated hardware and software.
- BCS-F is employed by the U.S. and Canada.

Mission

- NORAD and U.S. Pacific Command commanders use BCS-F 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 contracted development of Increment 3.1, R3.1.2, to address three critical system deficiencies and 43 functional fixes to non-critical system problems. The Air Force also contracted development of R3.1.2.1 to address two new critical deficiencies discovered during 3.1.2 testing.
- The Air Force conducted operational testing on R3.1.2 at three U.S. sites and the Canadian site in November and December 2010. In addition, they conducted testing on

R3.1.2.1 at all four U.S. sites and the Canadian site in January and February 2011.
- The Air Force contracted development of R3.1.2.2 as a software patch to increase the number of external connections for the remote tactical air picture. The Air Force conducted a limited test of R3.1.2.2 in April 2011 to ensure no degradation to BCS-F operations at the four U.S. sites and the Canadian site.
- The Air Force further contracted development of R3.1.3 to address five critical system deficiencies identified during 3.1 and 3.1.2 operational testing. R3.1.3 also contains over 60 software fixes, the majority of which address information assurance and system administration fixes.
- The Air Force conducted operational testing of R3.1.3 at the system support facility at Tyndall Air Force Base, Florida, in June and July 2011, the Eastern Air Defense Sector, the Alaska Regional Air Operations Center, and the Canadian Air Defense Sector in September 2011. Operational testing at the Western Air Defense Sector is scheduled for September 2011 and operational testing at the Hawaii Regional Air Operations Center is scheduled for October 2011.
- The Joint Interoperability Test Command (JITC) completed a Joint Interoperability Test datalink certification for Increment 3.1 in August 2009. JITC reported in February 2010 that Increment 3.1 conforms to required joint and DoD standards; however, a JITC certification cannot be attained on Increment 3.1 until the Information Support Plan has been certified by the Joint Staff. The program is currently operating under an interim certificate to operate.
- The Increment 3.1 system security penetration testing still remains outstanding. The testing must be completed in order to complete operational testing in accordance with the DOT&E-approved test plan. R3.1.3 testing is scheduled for September through November 2011.
- The Air Force conducted developmental testing on a new upgrade under BCS-F Increment 3, Release 3.2 at the system support facility in July and August 2011. IOT&E is scheduled for April through June 2012 and the Test and Evaluation Master Plan must be finalized and approved prior to the start.
- The Air Force has cancelled plans for a follow-on Increment 4 upgrade.

Assessment

- A final assessment of Increment 3.1 performance will not be available until all testing is completed in FY12 and the data have been analyzed. However, DOT&E initial 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 that Increment 3.1 enhanced situational awareness and their 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 a complete assessment of Increment 3.1 performance will not be available until information assurance and penetration T&E is completed in November 2011.
  - Test data collected to date indicate Increment 3.1 has demonstrated adequate reliability, maintainability, and availability. Increment 3.1 has an average system availability of 99.97 percent, with over 1,900 hours of system operation during operational test. Increment 3.1.2's average availability is 99.86 percent over 1,500 hours of testing.
  - Deficiencies exist in Increment 3.1 training for 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.
  - Results from remote workstation testing highlight major deficiencies with training, documentation, logistics/spares, help desk support, and information assurance that may significantly affect the long-term sustainment of the remote workstations.
  - Results from Increment 3, Release 3.2 developmental testing revealed a critical deficiency in the system's datalink gateway manager capability that would have prevented the system proceeding to IOT&E. The Air Force placed a high priority on corrective action. On-going developmental regression testing is assessing the effectiveness of those actions.
  - The program must conduct a portion of the developmental and operational testing at the operational sites due to limitations of the System Support Facility test-bed, and uniqueness of each air defense site. If the Air Force upgraded the System Support Facility to more accurately represent the air defense sites, it would support more robust BCS-F developmental and operational testing capability and would minimize the overall impact of testing at operational sites.

Recommendations

- Status of Previous Recommendations. The Air Force made progress on one of the two FY10 recommendations. The Air Force still needs to correct and formalize all BCS-F Increment 3 system documentation and training deficiencies. If the Air Force decides to continue future incremental development, they should document current and future users' requirements through a new Joint Capabilities Integration Development System document. The Air Force still needs to address the FY09 recommendation to upgrade the System Support Facility to support more robust BCS-F developmental and operational testing capability in order to minimize the impact of overall testing on the operational sites.

- FY11 Recommendations. The Air Force should:
  1. Submit the BCS-F Increment 3, Release 3.2 Test and Evaluation Master Plan for approval.
  2. Complete all information assurance testing to include penetration testing on BCS-F R3.1.3 at an operational air defense sector and schedule information assurance and penetration testing for R3.2.
  3. Continue to track and correct information assurance deficiencies to completion.
  4. Brief NORAD leadership on results of testing conducted to date to include information assurance testing.
  5. Ensure all system documentation and training identified as deficient be corrected and formalized.
  6. Develop a plan for remote workstation management to include sustainment, training, documentation, and information assurance compliance.

C-5M

Executive Summary

- DOT&E issued a Combined Operational and Live Fire Test Report on the C-5M in October 2010. The C-5M is operationally effective but not operationally suitable.
- The C-5 program office is addressing deficiencies identified during the 2010 operational test, including problems with thrust reversers, the Environmental Control System, and autopilot, through an aggressive correction action plan. Operational testing of corrective actions is scheduled to begin in January 2012.
- The Air Force completed the first Large Aircraft Infrared Countermeasures (LAIRCM) modification of a C-5M in July 2011.

System

- The C-5 is the largest four-engine military transport aircraft in the United States. The C-5 has 36 standard 463L 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 incorporates a mission computer, a glass cockpit with digital avionics (including autopilot and autothrottles), and state-of-the-art communications, navigation, and surveillance components for air traffic management.
  - The Reliability Enhancement and Re-Engining Program provides over 50 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 and equipment 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

- DOT&E issued a Combined Operational and Live Fire Test Report on the C-5M in October 2010. The C-5M is operationally effective but not operationally suitable.
- Developmental testing of the next C-5M software version, Block 3.5, began in August 2010. Operational testing is planned to start in January 2012.
- The C-5 program office is addressing deficiencies identified during the 2010 operational test, including problems with thrust reversers, the Environmental Control System, and autopilot, through an aggressive corrective action plan.
- Operational testing of corrective actions is scheduled to begin in January 2012 in conjunction with operational testing of Block 3.5.
- The Air Force completed the first LAIRCM modification of a C 5M in July 2011. Testing was satisfactorily conducted in 2007.

Assessment

- The C-5M is operationally effective. The new General Electric F138-GE-100 engines improve the range/payload performance of the aircraft to deliver cargo worldwide. The increased thrust and modern design of the new engines allow the aircraft to meet the four Key Performance Parameters relating to engine performance: time to climb, one engine climb out gradient, noise compliance, and emission compliance.
- The C-5M had several significant deficiencies, identified before the 2010 OT&E, that persisted throughout testing and affected the ability to successfully accomplish missions without workarounds and additional aircrew workload. Three major deficiency corrections have been undergoing developmental testing and are scheduled for OT&E:
  - 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.
  - Autothrottles – overactive in cruise operations, especially during turbulent conditions; numerous pitch and speed changes occurred, in addition to the failure of the autothrottles to maintain commanded airspeed during critical phases of flight.
  - Environmental Control System – degraded performance because of the autothrottle instabilities. During flight through turbulent air, overactive autothrottles affected the bleed air supply, resulting in little control over the Environmental Control System. This caused cabin pressure fluctuations and cabin temperatures dipped below 50 degrees Fahrenheit.
- The C-5M is not operationally suitable. The aircraft'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 by a lack of dedicated training systems.
- Deficiencies in several aspects of C-5M support functions, identified before the 2010 OT&E began, had a significant effect on the suitability, specifically the maintainability, of the aircraft. Planned fixes for the following deficiencies are nearing readiness for test and future implementation:
  - BIT – a very high false alarm rate combined with a low fault isolation rate increased the time needed to troubleshoot and complete maintenance actions. BIT detections of critical faults did not meet the requirement of 99 percent during operational testing.
  - Training Systems and Devices – aircrew and maintainer training devices specific to the C-5M are not yet available. Simulators at the contractor's 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 saw maintenance procedures and performed corrective actions for the first time during IOT&E. This occurred because training had not yet been accomplished.
  - Information Assurance – the C-5M is susceptible to information assurance problems. The additional risk from information operations on the EDS is low. Air Mobility Command is addressing the information assurance deficiencies in the interface of the EDS. Improvements are anticipated in the next block upgrade.

Recommendations

- Status of Previous Recommendations. The Air Force is addressing previous recommendations.
- FY11 Recommendation.
  1. The Air Force should correct the remaining BIT, training, EDS, technical orders, and engine support equipment deficiencies.

C-17

Executive Summary

- Using the Formation Flight System (FFS), the C-17 is operationally effective in large airdrop formation missions during visual and instrument meteorological conditions, day and night.
- The Air Force conducted Phase I of the Force Development Evaluation (FDE) on the improved FFS in fall 2010; the Air Force conducted Phase II in March 2011.
- The training aids and materials for the FFS need improvement.

System

- The C-17 is a four-engine turbofan cargo aircraft with a crew of three (two pilots and one loadmaster).
- The C-17 has 18 pallet positions to carry cargo and can carry payloads up to 170,900 pounds.
- The FFS combines automated station keeping equipment functions within the C-17 formation, and digital intra-formation messaging with Traffic Collision and Avoidance System functions that provide separation from aircraft outside the formation.
- The C-17 can fly formations in visual and instrument meteorological conditions, day and night, at low-level and cruise altitudes in conjunction with airdrops of personnel, heavy equipment, and supplies for up to brigade-size units using an improved FFS.

Mission

Units equipped with the C-17:

- Provide worldwide theater and strategic airlift and airdrop
- Augment aero-medical evacuations and Special Operations
- Deliver loads (including passengers; bulk, oversize, and outsize cargo; and special equipment) to austere airfields

Major Contractor

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

Activity

- Since IOT&E, the C-17 has not been able to perform the strategic brigade airdrop mission.
- The improved FFS is replacing an earlier FFS implementation, as well as the Station Keeping Equipment 2000 subsystem, which was inadequate in the 1995 C-17 IOT&E and in subsequent modifications.
- Phase I of the FDE of the improved FFS occurred in September 2010. New FFS software allowed completion of two multi-element formation missions using six C-17s in an integrated developmental/operational test.
- Phase II (dedicated operational testing) FDE commenced in the spring of 2011. The Air Force used seven modified C-17 aircraft with the latest mission computer software and the updated FFS components for the tests.
- The Air Force conducted testing in accordance with the DOT&E-approved test plan.

Assessment

- With the improved FFS, the C-17 crew can now accomplish the strategic brigade airdrop mission that previously could not be safely accomplished in instrument meteorological conditions.
- Large C-17 airdrop formations can be flown effectively using the FFS in visual and instrument meteorological conditions, day and night. The FFS satisfactorily demonstrated the following functions: (1) station keeping with the Automatic Flight Control System engaged; (2) station keeping with the aircraft flown manually; (3) station keeping during formation lead changes; (4) transfer of aircrew FFS data communications; and (5) adequate range of operations in the Silent Mode.
- The test results regarding safety, human factors, aircrew documentation, and aircrew training in support of operational suitability were satisfactory with the exception of aircrew training.
- Crew training aids and materials require modification to adequately explain FFS functions, procedures, and performance. Similarly, the FFS computer-based training module was not suitable for the aircrew to fully understand FFS operations and limitations. Missions as complex and demanding as formation airdrop require thorough and complete pre-mission training experiences, data, and documentation.

- There were no FFS reliability failures during the operational test period.
- The improved FFS corrects the last major deficiency identified in the DOT&E C-17 Globemaster II Airlift Aircraft report, dated November 1995. This concludes DOT&E oversight of the C-17 program.

Recommendations

- Status of Previous Recommendations. The Air Force addressed all previous recommendations.
- FY11 Recommendation.
  1. The Air Force should update aircrew training aids and materials.

C-27J

Executive Summary

- DOT&E completed a Combined Operational and Live Fire Test and Evaluation Report for the C-27J in May 2011. The Program Office completed both the LFT&E and Multi-Service Operational Test and Evaluation (MOT&E) in FY10, but has not yet made a full-rate production decision.
- The C-27J is operationally effective in conducting its primary mission of delivering time sensitive/mission critical cargo and personnel to forward units in remote locations using unimproved airfields.
- The C-27J is not operationally suitable. During operational testing, the aircraft did not achieve its required reliability or availability, although it did achieve required maintainability. However, reliability has shown improvement since the MOT&E.
- The C-27J is survivable, with limitations, when coupled with the use of appropriate tactics, techniques, and procedures against the Man-Portable Air Defense System and ballistic projectiles it could encounter when operated in Afghanistan or Iraq.
- Two C-27J aircraft deployed with Air National Guard and Army National Guard crews to Afghanistan in August 2011.

System

- The C-27J is a two-engine, six-blade turboprop tactical transport aircraft.
- The aircraft can 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 C-27J is capable of self-deployment to theater.
- The C-27J can carry three standard pallets, six bundles for airdrop, 40 passengers, 26 combat-equipped paratroopers, or 18 litters for medical evacuation.
- The C-27J 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 C-27J will 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 C-27J to support its intra-theater airlift operations.
- Secondary missions for the C-27J include performing routine sustainment operations, medical evacuation, support of Homeland Defense, airdrop of personnel and equipment, and humanitarian assistance missions.

Major Contractor

L-3 Communications Integrated Systems, L.P. – Greenville, Texas

Activity

- DOT&E completed a Combined Operational and Live Fire Test and Evaluation Report for the C-27J in May 2011. The Program Office completed both the LFT&E and MOT&E in FY10, but the C-27J has not yet made a full-rate production decision. The Program Office conducted a successful but limited demonstration of modifications to the cargo handling system in March 2011. The program also identified or implemented corrections to suitability problems identified during the MOT&E, including improvements to the Heads-Up Display and corrections to the causes of system aborts. Any new corrections also require further operational evaluation.
- The Air Force is planning the transition from Interim Contractor Support to organic maintenance for C-27J, which will require a re-evaluation of operational suitability. The Air Force Operational Test and Evaluation Center and the Program Office held an initial test design meeting to begin planning for the 2013 FOT&E.
- Ten aircraft have been delivered (of a total planned buy of 38) and 20 crews have been trained.
- Two aircraft deployed to Afghanistan in August 2011 with both Air National Guard and Army National Guard crews.

Assessment

- The C-27J is operationally effective in its primary mission of delivering time sensitive/mission critical cargo and personnel to forward units in remote locations on unimproved airfields, as well as aerial sustainment, aeromedical evacuation, and self-deployment.
- The C-27J is not operationally suitable. Shortfalls in availability and in several subsystems adversely affect safety, situational awareness, or workload.
  - Post-MOT&E data show that the system meets its reliability requirement.
  - During testing, the high cannibalization rate to maintain operational aircraft suggests inadequate spare part supplies.
- The Air Force has implemented corrections to suitability problems with the Heads-Up Display and the cargo handling system. Additional operational testing is needed to verify correction of deficiencies.
- The modifications improved the cargo handling system by reducing the pallet jamming observed in the MOT&E, but further monitoring in operational conditions is warranted.
- A planned update to the aircraft software, which includes improvements to the flight management system and integration of take-off and landing data calculation, has been postponed indefinitely.
- The C-27J is survivable, with limitations, when operated using appropriate tactics, techniques, and procedures against the Man-Portable Air Defense System and ballistic projectiles that it could encounter during operations in Afghanistan or Iraq.

Recommendations

- Status of Previous Recommendations. The program has implemented changes to address the FY10 recommendations, but continued evaluation of suitability corrections in operational conditions is required.
- FY11 Recommendations.
  1. The Air Force should collect and track reliability and maintainability data from deployed aircraft.
  2. The program should update the Test and Evaluation Master Plan to include FOT&E, and update the reliability growth plan.

C-130J

Executive Summary

- The C-130J is in production with periodic Block Upgrades to correct deficiencies and to provide capability enhancements.
- The C-130J is not effective in performing formation airdrop missions in instrument meteorological conditions where the use of Station Keeping Equipment (SKE) is required. The SKE software enhancement corrected previously observed anomalies for formations comprised only of C-130J aircraft ("J-only mode"), but SKE reliability problems during FOT&E prevented the achievement of the required formation flight success rate.
- The Air Force is correcting some deficiencies and adding new capabilities in the Block Upgrade 7.0. Delivery of the 7.0 upgrade has been delayed approximately one year, with a Force Development Evaluation (FDE) scheduled for early FY13.

System

- The C-130J is a medium-sized four-engine turboprop tactical transport aircraft.
- Compared to previous models, the cockpit crew requirement is reduced from four to two on the J model; loadmaster requirements vary (one or two), depending on mission need.
- Compared to legacy models, the C-130J has approximately 70 percent new development. Enhancements unique to the C-130J include a glass cockpit and digital avionics, advanced integrated diagnostics, a new propulsion system, improved defensive systems, and an enhanced cargo handling system.
- The C-130J has two different lengths denoted as a long and a short body. The long body carries eight standard pallets; the short carries six.

Mission

- Combatant commanders use the C-130J within a theater of operations for combat delivery missions which include:
  - 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 Aeronautics Corporation – Bethesda, Maryland

Activity

- The Air Force is correcting deficiencies found in both developmental and operational testing and adding new capabilities in the Block Upgrade 7.0. Block Upgrade 7.0 has experienced approximately one year of schedule delays; the FDE is now expected to occur in 1QFY13.
- DOT&E approved the C-130J Test and Evaluation Master Plan (TEMP) in November 2010, which encompasses the Block Upgrade 7.0 and SKE software enhancement testing.
- The Air Force conducted FOT&E of the SKE software enhancement in February and March 2011 in accordance with the DOT&E-approved test plan. DOT&E is releasing a report on the SKE FOT&E in FY12.
- The Air Force completed developmental test and evaluation (DT&E) of the Data Transfer and Diagnostics System (DTADS) in April 2011. DTADS will replace the current computerized maintenance system (the integrated diagnostics system interface and Portable Maintenance Aid) that had suitability shortfalls during IOT&E. FOT&E began in October 2011.
- The Air Force completed DT&E of the Large Aircraft Infrared Countermeasures (LAIRCM) system in April 2011 and conducted an FDE in July 2011. Reliability data collection for LAIRCM is ongoing.
- Due to diminishing manufacturing sources, the current STAR VII mission computer hardware is being replaced in FY12 by STAR IX hardware with a new operating system.

Assessment

- The SKE software enhancement corrected previously observed anomalies for formations comprised only of C-130J aircraft

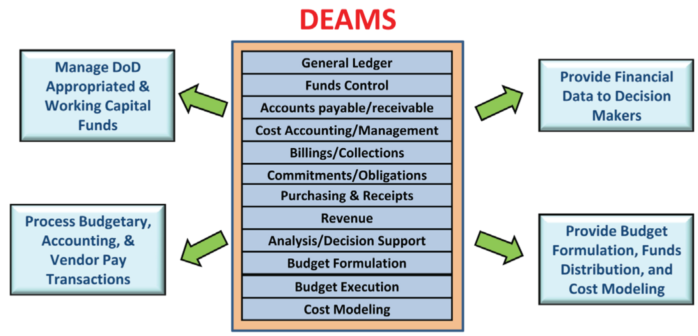
("J-only mode"). However, reliability problems with the SKE systems under test prevented the achievement of the required formation flight success rate. Consequently, the C-130J is still not certified for formation flight in instrument meteorological conditions and is therefore only partially mission capable for the airdrop mission.
- The new STAR IX mission computer hardware requires installation of a new version of the operational flight program to run on the new operating system. This could create configuration management problems in both hardware and software. This requires future operational test and evaluation.

Recommendations
- Status of Previous Recommendations. There are no previous recommendations.
- FY11 Recommendation.
  1. The Air Force should correct deficiencies related to formation flight and verify fixes during FOT&E.

Defense Enterprise Accounting and Management System (DEAMS)

Executive Summary

- The Air Force deployed an early release of the Defense Enterprise Accounting and Management System (DEAMS), Spiral 2, in May 2010 that added additional capabilities to an ongoing technology demonstration. More than 1,000 users are currently online.
- The Air Force Operational Test and Evaluation Center (AFOTEC) began, but did not complete, an Early Operational Assessment (EOA) of DEAMS Spiral 2 from August through December 2010 at Scott AFB, Illinois, and at the Defense Finance and Accounting Service in Limestone, Maine. The primary objective of the EOA was to support a Milestone B review by assessing system maturity to reduce the risk for demonstrating operational effectiveness and suitability in IOT&E.
- AFOTEC curtailed the EOA when it became apparent that major system deficiencies were present and that the Milestone B review was to be significantly delayed.
- Although DEAMS Spiral 2 had been operational at the test locations since May 2010, major system deficiencies were present throughout the EOA and have continued to accrue.



- Once DEAMS has been shown to be operationally effective and suitable for the transportation commands, it will expand service to the Air Force's major commands.

System

- DEAMS is a Major Automated Information System that uses commercial off-the-shelf Enterprise Resource Planning software to provide accounting and management services.
- The program office is following an evolutionary acquisition strategy that adds additional capabilities incrementally.
- DEAMS operates on the Global Combat Support System – Air Force (GCSS-AF) Integration Framework. It interfaces with approximately 40 other systems that provide travel, payroll, disbursing, transportation, logistics, acquisition, and accounting support.

Mission

- United States Transportation Command (USTRANSCOM) and Air Force financial managers will use DEAMS to compile and share accurate, up-to-the-minute financial management data and information across USTRANSCOM and the Air Force.
- USTRANSCOM, Air Force, and DoD leadership will use DEAMS to access vital, standardized, real-time financial data and information to make strategic business decisions.
- USTRANSCOM and the Air Force will use DEAMS to satisfy congressional and DoD requirements for auditing funds, standardizing financial ledgers, timely reporting, and reduction of costly rework.

Major Contractor

Accenture Federal Services – Fairborn, Ohio

Activity

- The Air Force deployed an early release of DEAMS Spiral 2 in May 2010 that added additional capabilities to an ongoing technology demonstration. More than 1,000 users are currently online.
- AFOTEC began, but did not complete, an EOA of DEAMS Spiral 2 from August through December 2010 at Scott AFB, Illinois, and at the Defense Finance and Accounting Service in Limestone, Maine, in accordance with a DOT&E-approved EOA plan. The primary objective of the EOA was to support a Milestone B review by assessing system maturity to reduce the risk for demonstrating operational effectiveness and suitability in IOT&E.
- AFOTEC curtailed the EOA when it became apparent that major system deficiencies were present and that the Milestone B review was to be significantly delayed.

Assessment

- DEAMS Spiral 2 currently supports the financial management mission by posting transactions in a timely manner, preventing users from exceeding budget targets, and correctly computing the capitalization and depreciation of assets.
- The data from the incomplete EOA were insufficient to determine readiness for IOT&E, currently scheduled for

1QFY14, and a full evaluation of operational effectiveness, suitability, and mission capability.

- Substantial manual intervention by personnel from the Functional Management Office is required on a daily basis to keep the system working. Without the manual intervention, the system would not work correctly.
- Important interfaces were inoperable. During the EOA, non-functioning interfaces with the Component Billing and Automated Funds Management systems required manual procedures from onsite personnel. An interoperability assessment completed by the Joint Interoperability Test Command in July 2011 listed only 58 of the 82 interface requirements as meeting all requirements.
- Required reports were not being produced or were inaccurate or incomplete. During the EOA, the users could not produce a complete and accurate Open Document List, which led to an incomplete Tri-Annual Review process.
- Training and user guides need improvement in consistency, accuracy, and overall functionality. The lack of adequate training and good-quality user guides inhibited users to effectively execute their mission tasks.
- Required financial management functionality is not present or not working properly. This was apparent in the numbers of major system deficiencies that were present during the EOA. Since the Air Force released Spiral 2 in May 2010, 2,313 deficiencies have been reported and 1,680 have been closed, leaving a gap of 633 open deficiencies. Although the program has made progress on closing the deficiencies, new ones continue to accrue.

Recommendations

- Status of Previous Recommendations. This is the first annual report for this program.
- FY11 Recommendations.
  1. The DEAMS program manager should ensure that all critical interfaces and functionality are implemented and continue testing until all high-severity deficiencies have been identified and corrected.
  2. Once the deficiencies have been corrected and verified, AFOTEC should conduct another operational assessment to determine whether there has been significant progress to reduce the risk for demonstrating operational effectiveness and suitability in IOT&E.

DoD National Airspace System (NAS)

Executive Summary

- The Air Force completed DOT&E-recommended operational testing for three significant DoD National Airspace System (NAS) upgrades implemented since initial fielding. These upgrades improved system processing capacity and integration with foreign air traffic operations.
- The DoD NAS program continues to improve information assurance controls and procedures. A joint DoD and Federal Aviation Administration (FAA) working group is developing a common DoD and FAA information assurance control set to address information assurance concerns outlined in the 2009 DOT&E DoD NAS FOT&E Report and the 2009 Air Force Operational Test and Evaluation Center DoD NAS FOT&E Report. The program projects that a final Authority to Operate (ATO) certification will be achieved in FY12.

System

- The DoD NAS is a joint program with the FAA to upgrade Air Traffic Control (ATC) automation equipment and supporting radar and communications systems at designated FAA and military installations, both inside and outside the continental United States.
- The DoD NAS is comprised of the DoD Advanced Automation System, Digital Airport Surveillance Radar, and Voice Communication Switching System. These systems provide modernized capabilities and improve interoperability between DoD, FAA, and host-nation ATC facilities at foreign DoD operating locations.

Mission

- Military air traffic controllers will use the DoD NAS to direct ATC operations in DoD-controlled airspace. Specific mission tasks include radar identification and tracking, air-to-ground voice communication, aircraft separation, and air traffic sequencing.
- DoD and FAA ATC facilities use the DoD NAS to accomplish a seamless transition of aircraft between military and FAA controlled airspace.

Major Contractors

- Raytheon Network Centric Systems – Marlboro, Massachusetts
- Litton-Denro Inc. – Gaithersburg, Maryland

Activity

- In 2010 and 2011, the Air Force Flight Standards Agency (AFFSA) completed a series of DOT&E-directed operational tests to assess the performance of three DoD NAS pre-planned product improvements. These system improvements include the Automated Protocol Exchanger (APEX) to facilitate DoD NAS integration with foreign air traffic control systems, the Advanced Signal Data Processor (ASDP) intended to expand data processing capacity, and a Mono-Pulse Secondary Surveillance Radar (MSSR) Mode S transponder upgrade. AFFSA conducted APEX operational testing at Yokota Air Base, Japan, in November 2010. ASDP and MSSR operational testing was conducted at Royal Air Force Lakenheath Air Base, United Kingdom, in July 2011.
- The DoD NAS joint program office, Service representatives, and the FAA, formed a joint working group to assess information assurance shortfalls identified in the 2009 AFOTEC FOT&E report. This working group identified differences in DoD and FAA information assurance controls and standards, and sought to identify mutually acceptable strategies for reducing operational security risks in areas such as computer account authentication, user identification, and account management procedures.

Assessment

- AFFSA operational testing demonstrated that the ASDP, APEX, and MSSR preplanned product improvements were successfully integrated into the fielded DoD NAS system. Operational sites equipped with these upgrades continue to provide timely and accurate radar and air traffic information to support air traffic control operations. The ASDP upgrade provides the same operational capabilities as the legacy system, but with the expanded processing capacity necessary to accommodate future air traffic system upgrades. The enhanced capabilities provided by APEX reduce controller workload when transferring control of aircraft to and from host-nation air traffic control facilities. The upgraded MSSR provides Mode S transponder capabilities necessary to support operations within high-density European airspace. These improved system capabilities enhance the effectiveness of the baseline DoD NAS system assessed as operationally effective during the 2009 AFOTEC FOT&E.
- The MSSR upgrade also addressed previously identified diminishing manufacturing source challenges to enhance long-term system sustainment. However, AFFSA test results indicate that logistics support systems for ASDP and MSSR upgrades are immature. Rapid access to spare parts is an ongoing concern for field operating locations.
- The DoD NAS program continues to improve information assurance controls and procedures. Based on the work of the joint information assurance working group, a common DoD and FAA information assurance control set is being developed for implementation. In the interim, the DoD NAS system continues to operate under an Interim ATO network certification. The program projects that a final ATO network certification will be achieved in FY12. In addition, the program has not yet completed actions necessary to achieve full joint interoperability certification.

Recommendations

- Status of Previous Recommendations. The Air Force addressed the FY09 recommendations for follow-on operational testing of planned DoD NAS system upgrades and a review of DoD and FAA information assurance controls and standards.
- FY11 Recommendations. None.

F-15E Radar Modernization Program (RMP)

Executive Summary

- F-15E Radar Modernization Program (RMP) developmental flight testing began in January 2011. The RMP demonstrated incremental progress towards operational effectiveness, suitability, and mission capability during developmental test activities throughout FY11. IOT&E is scheduled to begin in June 2012.
- The Air Force Operational Test and Evaluation Center (AFOTEC) conducted an Operational Assessment (OA) from January 5 through April 29, 2011, to assess RMP progress towards operational effectiveness, suitability, and mission capability in support of the program's Milestone C decision.
- During the OA period, RMP demonstrated functional equivalence to the legacy F-15E radar in some of the system's air-to-air modes and made progress in meeting air-to-air detection and track capabilities under limited and highly scripted test conditions. However, short range air-to-air capabilities and air-to-ground capabilities were insufficiently mature to demonstrate functional equivalence during FY11 developmental flight test.
- Two significant shortfalls were uncovered during FY11 developmental testing: unanticipated electromagnetic interference (EMI) between the radar and aircraft Ultra High Frequency (UHF) radio, and aircraft Environmental Control System (ECS) component failures and in-flight cautions associated with RMP system integration on the aircraft. Resolution of these shortfalls is ongoing and should be completed prior to IOT&E.

System

- The F-15E is a twin engine, tandem seat, fixed wing, all weather, multi-role fighter aircraft. The F-15E has a fully missionized cockpit and a multimode air intercept and air-to-ground radar, giving the aircrew the capability to employ air-to-air and air-to-ground munitions, a 20-millimeter cannon, and countermeasures for evading enemy fire.
- The RMP replaces the F-15E legacy APG-70 mechanically scanned radar with an active electronically scanned array (AESA) system designated as the APG-82(V)1. The RMP is designed to retain functionality of the legacy radar system while providing expanded mission employment capabilities to include:
  - Near-simultaneous interleaving of selected air-to-air and air-to-ground functions.
  - Enhanced air-to-air and air-to-ground classified combat identification capabilities.
  - Longer range air-to-air target detection and enhanced track capabilities.
  - Longer range and higher resolution air-to-ground radar mapping.
  - Improved ground moving target track capability.
- The RMP upgrade is also intended to address legacy F-15E radar system suitability shortfalls including: poor reliability, parts obsolescence, and high sustainment costs. The Air Force intends to retrofit the RMP across the existing F-15E fleet.
- The RMP APG-82(V)1 design leverages capabilities from currently fielded AESA radar systems. The APG 82(V)1 antenna and power supply are currently in use on the F-15C APG-63(V)3 program, and the radar receiver/exciter and Common Integrated Sensor Processor are based on F/A-18E/F APG-79 AESA system.
- Other hardware and software modifications comprising the RMP effort include a more powerful ECS, updates to the aircraft Operational Flight Program and Electronic Warfare software, a new radio frequency tunable filter, and aircraft modifications to include a new wideband radome and wiring changes.

Mission

A unit equipped with the F-15E conducts all weather, day and night missions to include:

- Offensive and Defensive Counterair
- Conventional Air Interdiction and Nuclear Strike
- Close Air Support and Strike Coordination and Reconnaissance
- Suppression of Enemy Air Defenses
- Combat Search and Rescue

Major Contractors

- The Boeing Company – Saint Louis, Missouri
- Raytheon – El Segundo, California

Activity

- The Air Force conducted F-15E RMP testing in accordance with the DOT&E-approved Test and Evaluation Master Plan and OA plan.
- The RMP began developmental flight testing on January 18, 2011. From January through July 2011, the program completed 48 of 110 planned developmental test sorties and accrued 178.6 flight test hours.
- AFOTEC conducted an OA from January 5 through April 29, 2011, to assess RMP progress towards operational effectiveness, suitability, and mission capability in support of the program's Milestone C decision. The OA consisted of developmental flight testing, hardware-in-the-loop laboratory testing, and Joint Preflight Integration of Munitions and Electronics Systems testing to evaluate RMP-configured F-15E avionics performance in a controlled electromagnetic environment. The OA flight test encompassed 39 RMP sorties and 93.2 flight test hours across five early developmental radar operational flight program software releases.
- During the OA, aircrew observed severe UHF radio noise when operating in air-to-air modes during flight testing. Subsequent ground testing revealed that the noise was due to EMI between the APG-82(V)1 AESA transmitter/receiver and the radios. To resolve the problem, the program is pursuing the incorporation of software changes to the radar timeline and pulse shape in subsequent developmental testing prior to IOT&E.
- The Air Force Program Executive Office granted Milestone C approval for RMP in September, 2011, authorizing low-rate initial production for the first six radar sets.
- IOT&E is currently scheduled to begin in June 2012 and complete in November 2012.

Assessment

- The RMP demonstrated incremental progress towards achieving systems operational performance and suitability goals during FY11 developmental testing.
- During the OA period, the RMP demonstrated legacy APG-70 radar functionality in long-range air-to-air and some air-to-ground modes as well as progress towards satisfying other RMP requirements as follows:
  - Qualitative aircrew surveys suggest legacy APG-70 pilot-vehicle interface functionality has been retained. The RMP demonstrated functional equivalence to APG-70 long-range air-to-air modes and air-to-ground modes and capabilities. However, RMP within visual range (WVR) capabilities had not demonstrated similar legacy radar functionality by the end of the assessment period.
  - Limited quantitative performance data indicate basic long-range air-to-air detection and track capabilities against non-maneuvering targets are progressing to meet or exceed RMP specifications. Similarly, air-to-air combat identification (CID) data indicate early performance is meeting specification at ranges beyond legacy APG-70 capabilities. However, WVR target acquisition and track performance was generally worse than the WVR capabilities of the legacy APG-70 radar.
  - RMP air-to-ground capabilities were relatively immature during the assessment period, and revealed air-to-ground map quality and ground moving target track were generally worse than the legacy APG-70 system.
- Several RMP capabilities were not assessed during the OA period and remain to be accomplished in post Milestone C developmental testing. These include: air-to-air and air-to-ground weapons employment, electronic warfare capabilities, and integrated air-to-air and air-to-ground radar employment in an operationally-representative environment.
- During the OA period, observed system reliability, maintainability, and availability, suggest the RMP is progressing towards meeting operational suitability requirements. However, achieving the Air Force software stability requirement by IOT&E may not be feasible. Suitability-related findings from the operational assessment include the following:
  - There were no hardware failures in 130.5 radar operating hours, suggesting a minimum mean time between critical failure (MTBCF) of 81.1 hours (80 percent lower confidence bound) was achieved during the assessment period.
  - The RMP Capabilities Production Document (CPD) specifies that RMP shall not degrade aircraft availability below that of legacy APG-70 radar-equipped F-15Es. Point estimates for aircraft availability (86.7 percent), aircraft maintainability (15.3 mean maintenance hours per flight hour), and radar system maintainability (0.13 mean maintenance hours per flight hour) satisfy that requirement.
  - The majority of RMP maintenance activity during the assessment period was associated with aircraft ECS component failures and in-flight cautions. Sensitivity of the legacy ECS avionics cooling monitor unit (ACMU) to RMP liquid cooling system flow rate fluctuations triggered numerous ECS cautions during in flight testing. Corrective action to modify the ACMU and aircraft software interface is ongoing and must be resolved prior to IOT&E.
  - The RMP mean time between software anomaly (MTBSA) point estimate of 1.15 hours at the end of the assessment period (within an 80 percent confidence interval of 0.89 to 1.51 hours) is consistent with the program's projected software stability at this early stage of development. However, achieving the RMP CPD requirement of 30 hours MTBSA at IOT&E will require very aggressive software stability growth across the remainder of the program's developmental test period. The RMP shares over 90 percent software code commonality with the Navy's F/A-18E/F APG-79 radar. Over the past five years, APG-79 software stability has achieved approximately 18 hours mean operating hours between operational mission failure despite an accumulated 100,000 fleet flight hours. Given RMP's commonality with the APG-79, the pending

incorporation of air-to-ground CID and RMP anti-tamper software capabilities, and the aggressive MTBSA growth path required in the remaining developmental test period, the Air Force is not likely to meet the 30 hour MTBSA requirement.

- Unexpected EMI between the RMP and the F-15E UHF radios occurred during the assessment period. When operating in air-to-air modes, UHF noise severely impeded aircrew operations. Since the end of the assessment period, the Air Force has conducted ground tests indicating radar software changes should reduce or eliminate the EMI without adversely affecting RMP performance. Resolution of this EMI problem is required prior to IOT&E.

Recommendations

- Status of Previous Recommendations. This is the first annual report for this program.
- FY11 Recommendations. The Air Force should:
  1. Continue to address and resolve ECS and UHF EMI shortfalls identified during the OA prior to IOT&E.
  2. Consider either amending the RMP 30-hour MTBSA requirement or structuring the program (in particular, adding time and resources for additional development) such that it is able to achieve the desired performance measure.

F-22A Advanced Tactical Fighter

Executive Summary

- The Air Force Operational Test and Evaluation Center (AFOTEC) began FOT&E of F-22A Increment 3.1 Enhanced Global Strike capabilities in January 2011. Flight testing did not complete in FY11; however, nominal performance during FY11 resulted in an Air Force decision to begin interim fielding of the hardware and software to support fleet-wide aircraft retrofit and non-combat familiarization flight training.
- Air Force Air Combat Command (ACC) concluded the final phase of a three-phase Force Development Evaluation (FDE) for the F-22A Update Three Operational Flight Program (OFP) software suite assessing system software enhancements and electronic protection upgrades to the F-22A system. Analysis of Update Three OFP electronic protection performance results was ongoing at the end of FY11, and preliminary results indicate the OFP provides enhanced mission effectiveness and electronic protection capability for F-22A aircraft.
- Air Force ACC issued its final report on the five-year Low Observables Stability Over Time (LOSOT) test. DOT&E assesses the results of this test demonstrate: the F-22A low observables (LO) system is durable and stable over time; the F-22A LO maintenance concept of operations is executable with adequate support procedures and documentation to facilitate LO maintenance activities; and the F-22A Signature Assessment System (SAS) is an adequate maintenance tool for determining when aircraft LO maintenance actions are required. However, LO maintenance continues to account for a significant proportion of the man hours per flight hour required to maintain the F-22A.
- Suitability data from Increment 3.1 FOT&E flight testing to date suggests improvement over F-22A system reliability, maintainability, and supportability metrics observed in previous formal OT&E periods.
- The Air Force grounded the F-22A fleet due to suspected contamination problems associated with the aircraft environmental control system and associated onboard oxygen generation system from late April through late September 2011. The fleet grounding precluded planned FY11 completion of Increment 3.1 FOT&E flight testing. The Air Force intends to complete this FOT&E in early FY12. Ongoing FY11 OT&E flight activities were suspended through mid-September.

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 datalinked 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 delivers enhanced air to ground mission capability, to include incorporation of Small Diameter Bomb (SDB) 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 began F-22A Increment 3.1 Enhanced Global Strike FOT&E in January 2011. AFOTEC completed associated air-to-air and air-to-ground weapons testing and Advanced Combat Simulator mission testing in FY11. Open-air Increment 3.1 FOT&E flight test missions on the Nevada Test and Training Range (NTTR) did not complete as planned in FY11 due the grounding of the F-22A fleet from April through September 2011. Increment 3.1 FOT&E is expected to complete flight test missions in early FY12. In July 2011, the Air Force authorized an early fielding of the capability prior to conclusion of remaining NTTR mission testing to support aircraft retrofit and non-combat flight training across the F-22A fleet based on preliminary results of FOT&E testing.
- Air Force ACC concluded the final phase of a three-phase FDE for the F-22A Update Three OFP assessing system software enhancements and electronic protection upgrades to the F-22A system. Analysis of Update Three OFP electronic protection performance results was ongoing at the end of FY11.
- Air Force ACC issued its final report on the five-year LOSOT test. This evaluation assessed the validity of the F 22A low observable SAS, durability and stability of the F-22A LO system over time, and the LO maintainability concept of operations.

Assessment

- Preliminary results of Increment 3.1 FOT&E testing in FY11 suggest that the enhanced air-to-ground capabilities will permit the F-22A to perform its intended offensive counter-air suppression of enemy air defenses mission in Global Strike scenarios.
  - FOT&E 3.1 weapons testing results demonstrated the F-22A remains capable of effectively employing legacy JDAM, AIM-9M, and AIM-120C weapons as well as the newly incorporated SDB.
  - Aircrews are capable of using the F-22A radar and onboard sensors to locate and designate surface targets with sufficient accuracy to effectively employ air-to ground weapons to suppress enemy air defenses.
  - Suitability data from 225 sorties and 445 flight test hours suggest improvement over previous F-22A reliability, maintainability, and supportability metrics observed in previous formal OT&E periods.
  - Preliminary trends suggest Increment 3.1 mission capable rates are comparable to those observed in previous OT&E periods. Similarly, testing trends suggest a significant increase in Mean Time Between Critical Failure (MTBCF) compared to previous OT&E periods. Increment 3.1 observed MTBCF in FY11 FOT&E testing to date was 4.01 hours (80 percent lower confidence bound) compared to the reported MTBCF in FY07 FOT&E of 1.73 hours, suggesting Increment 3.1 configured F-22As should be better able to satisfy Air Force operational mission availability and sortie generation rate requirements than previous configurations. Final determination of progress in satisfying the F-22A "at maturity" operational suitability thresholds will be made in conjunction with the conclusion of Increment 3.1 FOT&E in early FY12.
- At the completion of the five-year LOSOT FDE, DOT&E assesses the following:
  - The F-22A LO system is durable and stable over time.
  - The F-22A LO maintenance concept of operations is executable, and support procedures and documentation are adequate to support LO maintenance activities.
  - The F-22A SAS is an adequate tool for determining when aircraft LO maintenance actions are required.
  - LO maintenance accounts for a significant proportion of the man hours per flight hour required to maintain the F-22A affecting aircraft operational availability, mission capable rates, and sortie generation rates. The original LO maintenance manpower estimate was 1.67 spaces per aircraft. The Air Force has increased LO personnel authorizations to 3.1 spaces per aircraft at F-22A operational units to meet the increased manpower demands associated with maintaining the LO system.
  - The Air Force has begun implementation of measures aimed at assisting in the long term maintenance of the F-22A LO system. In FY10, the Air Force instituted 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. Since then the Air Force has acted to procure and field an LO Repair Verification Radar tool to aid in evaluating and verifying LO repairs and assist in performing periodic maintenance audits of the LO system. Additionally, the Air Force has made funds available for periodic aircraft LO reduction efforts wherein contract field teams restore the F-22 LO system to production signature levels. These measures, in conjunction with increased LO manpower should enable the Air Force to continue to maintain the F-22 LO system within tolerances necessary to meet operational mission requirements.

Recommendations

- Status of Previous Recommendations. The Air Force continues to address all previous recommendations.
- FY11 Recommendations. The Air Force should:
  1. Continue to fund and implement measures begun to assist in the long-term maintenance of the F-22A LO system to include: the Signature Management Program; the Repair Verification Radar tool; and periodic field team aircraft LO reduction for operational unit F-22As.
  2. Complete the ongoing FOT&E to fully characterize F-22A Increment 3.1 effectiveness, suitability, and mission capability.

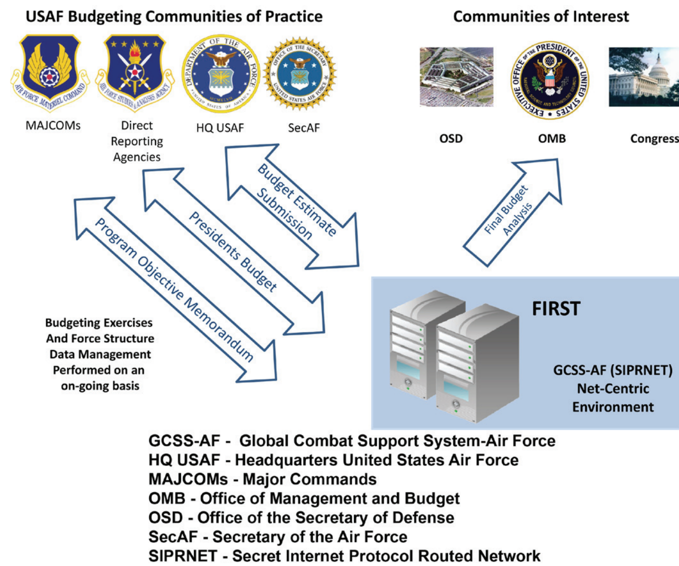
Financial Information Resource System (FIRST)

Executive Summary

- The 346th Test Squadron and Air Force Financial Systems Operations conducted the OT&E of the Financial Information Resource System (FIRST) in the Pentagon from March 28 – 31, 2011.
- The Air Force 92nd Information Operations Squadron (92 IOS) conducted a system vulnerability assessment at Gunter-Annex, Maxwell AFB, Alabama, from February 28 – March 4, 2011.
- DOT&E assessed the system to be operationally effective and operationally suitable, but with limitations in the areas of interoperability and information assurance.
- FIRST was unable to correctly process inventory data provided by the Reliability and Maintainability Information System (REMIS).
- The 92 IOS found five critical and 36 less critical vulnerabilities during their assessment of FIRST and the Global Combat Support System – Air Force (GCSS-AF), which is the infrastructure on which FIRST operates.
- The FIRST program office reported that the five critical vulnerabilities were fixed shortly after the OT&E was completed. The 92 IOS completed the verification of these corrections in early October 2011.

System

- FIRST is a Major Automated Information System that manages the Air Force's force structure data through an Air Force portal via the Secret Internet Protocol Router Network.
- FIRST is operating on the GCSS-AF infrastructure.
- FIRST supports force programming; formulation of budget requirements; and the deliberation, justification, and documentation of budget options.
- FIRST interfaces with the Air Force Equipment Management System and the Reliability and Maintainability Information System.



- FIRST supports approximately 40 authorized end users on the Air Staff, A8, all located in the Pentagon, and is operated and maintained by the Defense Information Systems Agency at their computing facility in Montgomery, Alabama.
- The program has completed development and is entering the sustainment phase.

Mission

- Air Force leadership uses FIRST to prioritize and program the Air Force's force structure requirements.
- Air Force planners use FIRST to maintain an inventory of the Air Force's force structure, including organizations, weapon systems, and flying hours.

Major Contractor

Accenture Federal Services – Reston, Virginia

Activity

- The 346th Test Squadron and Air Force Financial Systems Operations conducted the OT&E of FIRST in the Pentagon from March 28 – 31, 2011, in accordance with the DOT&E-approved OT&E plan.
- The Air Force 92nd Information Operations Squadron (92 IOS) conducted a system vulnerability assessment at Gunter-Annex, Maxwell AFB, Alabama, from February 28 – March 4, 2011.

Assessment

- DOT&E assessed the system to be operationally effective and operationally suitable, but with limitations in the areas of interoperability and information assurance.
- FIRST facilitated decision support within the Air Force corporate structure and also supported the prioritization of Air Force requirements, with one limitation regarding its interface with REMIS. FIRST was able to process flying hours data

but was unable to process inventory data, thus hampering planning actions.
- FIRST could be satisfactorily deployed, maintained, and sustained.
- User surveys indicated that FIRST was providing satisfactory training and program support.
- The 92 IOS found five critical and 36 less critical vulnerabilities during their information assurance assessment of FIRST and the GCSS-AF, which is the infrastructure on which FIRST operates.
- The FIRST program office reported that the five critical vulnerabilities were fixed shortly after the OT&E was completed. The 92 IOS completed the verification of these corrections in early October 2011.

Recommendations
- Status of Previous Recommendations. This is the first annual report for this program.
- FY11 Recommendations. The FIRST program office should:
  1. Resolve the limitation regarding the processing of REMIS inventory data.
  2. Work with the GCSS-AF program office to eliminate or mitigate the 36 less critical information assurance vulnerabilities reported by the 92 IOS to the satisfaction of their respective Designated Approving Authorities.

Global Hawk High-Altitude Long-Endurance Unmanned Aerial System (RQ-4)

Executive Summary

- In January 2011, USD(AT&L) re-structured the RQ-4 Global Hawk program into four sub-programs and directed that formal operational requirements, acquisition strategies, and test strategies be developed for each. In April 2011, the Air Force declared a critical Nunn-McCurdy cost breach for the overall Global Hawk program. Following an OSD program review, USD(AT&L) completed Nunn-McCurdy congressional re-certification requirements in June 2011. The Air Force is now executing separate RQ-4 Global Hawk Block10/20, Block 30, and Block 40 sub-programs, and planning a future Global Hawk Ground Segment Re-Architecture (GSRA) sub-program.

Block 10/20

- The Air Force removed all RQ-4A Global Hawk Block 10 systems from operational service in 2011.
- In response to a U.S. Central Command (USCENTCOM) Joint Urgent Operational Need (JUON) request, the Air Force integrated the Battlefield Airborne Communications Node (BACN) payload onto two of the six production RQ-4B Global Hawk Block 20 air vehicles to provide an around-the-clock BACN theater communications relay capability. Based on operational test results and data from the first six months of USCENTCOM operations, DOT&E concluded that the BACN payload effectively supports theater communication relay operations. However, the two BACN RQ-4B Global Hawk Block 20 air vehicles (designated EQ-4B) cannot provide the requested around-the-clock theater communications relay coverage due to ground control station design limitations and existing Global Hawk air vehicle reliability and availability shortfalls. As a result, the Air Force received congressional direction to modify additional Global Hawk Block 20 air vehicles with the BACN payload to support the requested around-the-clock USCENTCOM operations.

Block 30

- The Air Force conducted RQ-4B Global Hawk Block 30 IOT&E from October 2010 through January 2011. DOT&E concluded the system was not operationally effective for conducting near-continuous, persistent intelligence, surveillance, and reconnaissance (ISR) operations. The Enhanced Imagery Sensor Suite (EISS) provided electro-optical, infrared, and synthetic aperture radar (SAR) imagery that met or exceeded most operational requirements. The Airborne Signals Intelligence Payload (ASIP) provided a limited operational utility, but did not consistently deliver actionable signal intelligence products to operational users, due to technical performance deficiencies and immature training, tactics, techniques, and procedures. The system was not operationally suitable due to low air vehicle reliability, incomplete maintenance technical data, inadequate maintenance training, and ineffective integrated diagnostic systems. When operating at near-continuous operational tempos, the system provided less than half the required 55 percent Effective-Time-On-Station (ETOS) coverage over a 30-day period. The system did not meet joint interoperability certification and information assurance requirements.
- Following IOT&E, the Air Force revised critical spare part requirements and implemented a comprehensive reliability improvement program to reduce critical system component failures and address anticipated component obsolescence deficiencies. These efforts are gradually improving system reliability and availability. Each USCENTCOM, U.S Pacific Command (USPACOM), and U.S European Command (USEUCOM) Global Hawk Combat Air Patrol (CAP), consisting of three aircraft, can generate sufficient sorties to support a steady-state operational tempo of approximately three missions per week. These missions vary in duration depending on theater requirements and operational priorities. Updated modeling and simulation results, which incorporate recent field operating data and revised spare part requirements, project that Global Hawk Block 30 CAP ETOS during near-continuous operational tempos should improve from 27 percent during IOT&E to approximately 45 percent as initial spare parts become available. This indicates that the program is meeting reliability growth goals and progressing toward the minimum 55 percent ETOS operational requirement for

single vehicle control operations. The Air Force requested FY12 funding for initial spare parts procurement with deliveries continuing through FY15.
- In June 2011, the Air Force proposed and implemented a revised RQ-4B Global Hawk Block 30 follow-on test schedule to support incremental delivery of Block 30 improvements, leading to a comprehensive RQ-4B Global Hawk Block 30 FOT&E in late FY12. Operational testing for the first incremental system capability upgrade began in July 2011. However, in August 2011, the Air Force halted operational testing due to a serious air vehicle command and control software deficiency. Test schedule delays have also occurred due to flight test resource constraints, and emerging additional test requirements associated with engine, fuel system, and diminishing manufacturing source upgrades. As a result, the Block 30 FOT&E originally planned for late FY12 is unlikely to occur until at least mid-FY13.

Block 40
- In December 2010, the Air Force completed the final phase of Multi-Platform Radar Technology Insertion Program (MP-RTIP) sensor risk reduction testing on the Scaled Composites Model 281 Proteus test bed aircraft. SAR ground mapping and Ground Moving Target Indicator (GMTI) operating modes met nearly all system performance specifications with improved sensor stability during concurrent SAR/GMTI. Based on these results, the Air Force plans to integrate the MP-RTIP SAR, GMTI, and concurrent SAR/GMTI operating modes on the RQ-4B Global Hawk Block 40 system.
- The Air Force successfully completed RQ-4B Global Hawk Block 40 air vehicle flight-envelope expansion testing in June 2011. MP-RTIP sensor integration flight tests on the Global Hawk Block 40 air vehicle began in July 2011.

System
- The RQ-4 Global Hawk is a remotely-piloted, high-altitude, long-endurance airborne intelligence, surveillance, and reconnaissance system that includes the Global Hawk unmanned air vehicle, various intelligence and communications relay mission payloads, and supporting command and control ground stations.
- The RQ-4A Global Hawk Block 10 system is a limited production version of the original Global Hawk Advanced Concept Technology Demonstration system.
- The RQ-4B Global Hawk Block 20 system is equipped with either the EISS imagery intelligence payload or the BACN theater communications relay payload. The EISS sensor includes infrared, optical, and synthetic aperture radar sensors for collecting still imagery intelligence on ground targets. The BACN payload provides communications connectivity between geographically separated operational units.
- The RQ-4B Global Hawk Block 30 system is equipped with a multi-intelligence payload that includes both the EISS imagery intelligence payload and the ASIP electronic signal collection sensor.
- The RQ-4B Global Hawk Block 40 system is equipped with the MP-RTIP synthetic aperture radar payload designed to simultaneously collect imagery intelligence on stationary ground targets and track ground moving targets.

Mission
- The theater Air Operations Center tasks Air Force RQ-4 Global Hawk reconnaissance units to provide high-altitude, long-endurance intelligence collection capabilities or theater communications relay capabilities to supported commanders.
- Operators collect imagery and signals data in order to support ground units and to identify intelligence essential elements of information for theater commanders. Units equipped with RQ-4B Global Hawk use line-of-sight and beyond line-of-sight satellite datalinks to control the Global Hawk system and transmit collected intelligence data.
- Distributed intelligence processing, exploitation, and dissemination systems receive intelligence data directly from the air vehicle or from the Global Hawk ground station via intelligence data transmission systems.
- Ground-based intelligence analysts exploit collected imagery and signals information to provide intelligence products in support of theater operations.
- Global Hawk can also provide imagery intelligence directly to forward-based personnel through direct line-of-sight datalink systems.

Major Contractor
Northrop Grumman Aerospace Systems, Strike and Surveillance Systems Division – San Diego, California

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Activity
All Blocks
- In January 2011, USD(AT&L) re-structured the RQ-4 Global Hawk program into four sub-programs and directed that formal operational requirements, acquisition strategies, and test strategies be developed for each. The Air Force is now executing separate RQ-4 Global Hawk Block10/20, Block 30, and Block 40 sub-programs and planning a future Global Hawk Ground Segment Re-Architecture (GSRA) sub-program.
- In April 2011, the Air Force declared a critical Nunn-McCurdy cost breach for the overall Global Hawk program. Following an OSD program review, USD(AT&L) completed Nunn-McCurdy congressional re-certification requirements in June 2011. The June 2011 USD(AT&L)

Acquisition Decision Memorandum established future program acquisition and development milestones for each Global Hawk sub-program based on proposed Air Force acquisition and test program schedules.
- All RQ-4 Global Hawk operational testing was accomplished in accordance with DOT&E-approved test plans.

Block 10/20
- The Air Force removed all RQ-4A Global Hawk Block 10 systems from operational service in 2011. RQ-4B Global Hawk Block 20 systems continue to support test and training activities at Edwards AFB, California, and Beale AFB, California.
- In response to a USCENTCOM JUON request, the Air Force integrated the BACN payload onto two of the six production RQ-4B Global Hawk Block 20 air vehicles to provide a theater communications relay capability. The Air Force Operational Test and Evaluation Center (AFOTEC) completed a BACN EQ-4B Global Hawk Block 20 Operational Utility Evaluation (OUE) in September 2010. In November 2010, the Air Force fielded these two systems to the USCENTCOM area of operations.

Block 30
- The Air Force conducted RQ-4B Global Hawk Block 30 IOT&E from October 2010 through January 2011. DOT&E published the RQ-4B Global Hawk Block 30 beyond low-rate initial production teport in May 2011. USD(AT&L) deferred the planned June 2011 RQ-4B Global Hawk Block 30 full-rate production decision due to program budget uncertainties.
- In early 2011, the Air Force deployed RQ-4B Global Hawk Block 30 systems to three forward operating locations in the USCENTCOM, USPACOM, and USEUCOM operating areas. The Air Force declared RQ-4B Global Hawk Block 30 initial operational capability in August 2011 for imagery intelligence operations, but deferred signals intelligence initial operational capability until early 2012 pending delivery of production ASIP sensors.
- In late 2010, the Air Force initiated a multi-year RQ-4B Global Hawk Block 30 follow-on development program to correct identified system deficiencies, address known component obsolescence problems, and deliver previously deferred operational capabilities. In June 2011, the Air Force proposed and implemented a revised follow-on test schedule to support incremental delivery of Block 30 improvements, leading to a comprehensive RQ-4B Global Hawk Block 30 FOT&E in late FY12. Operational testing for the first incremental system capability upgrade began in July 2011. However, in August 2011, the Air Force halted operational testing due to a serious air vehicle command and control software deficiency.

Block 40
- In December 2010, the Air Force completed early developmental testing of the RQ-4B Global Hawk Block 40 MP-RTIP sensor on the Scaled Composites Model 281 Proteus test bed aircraft. This testing focused on improving radar technical performance and improving system stability during concurrent use of the SAR ground mapping and GMTI operating modes.
- USD(AT&L) deferred the planned June 2011 RQ-4B Global Hawk Block 40 Milestone C decision due to program budget uncertainties. In addition, the Air Force proposed significant changes in RQ-4B Global Hawk Block 40 operational capability requirements, including removal of Battle Management Command and Control (BMC2) capabilities as a system threshold requirement. Completion of final RQ-4B Global Hawk Block 40 acquisition and test strategies is on hold pending resolution of budget problems and Joint Staff approval of a revised RQ-4B Global Hawk Block 40 Capabilities Production Document (CPD). In the interim, the Air Force proposed and implemented a revised RQ-4B Global Hawk Block 40 development and test schedule leading to a projected IOT&E and initial fielding in late FY13. This test program does not include development of BMC2 capabilities.
- The Air Force completed Global Hawk Block 40 air vehicle flight envelope expansion testing in June 2011. MP-RTIP sensor integration flight test on the Global Hawk Block 40 air vehicle began in July 2011.

Ground Segment Re-Architecture (GSRA)
- The Air Force began development of initial operational requirements in preparation for possible initiation of the RQ-4B Global Hawk GSRA sub-program in late FY12.

Assessment

Block 10/ 20
- In July 2011, DOT&E published an operational assessment of the BACN RQ-4B Global Hawk Block 20 JUON system. Based on operational test results and data from the first 6 months of USCENTCOM operations, DOT&E concluded that the BACN payload effectively supports theater communication relay operations. However, the two fielded BACN EQ-4B Global Hawk Block 20 air vehicles initially provided only 36 percent of the requested around-the-clock on-station coverage due to air vehicle availability shortfalls and ground control station design limitations.
- Since initial fielding, BACN EQ-4B Global Hawk Block 20 air vehicle availability and ETOS performance has improved as the Air Force has implemented initiatives to increase system reliability. For example, the Air Force fielded an improved interim electrical generator and continued efforts to field a new, re-designed generator system. The Air Force is also developing improved repair methods for aircraft structural components and longer-term structural design changes are under review. Improved inertial navigation units will replace existing units by attrition. In the interim, mission-essential equipment rules have been relaxed to allow flight operations to continue using redundant navigation systems when inertial navigation unit failures occur. A redesigned fuel nozzle

was recently qualified for the Global Hawk engine and retrofits are underway. These efforts, combined with initiatives to improve spare parts availability, increased air vehicle availability rates. As a result, two BACN EQ-4B Global Hawk Block 20 systems can now provide approximately 50 percent of the required around-the-clock on-station coverage. Despite system reliability and availability improvements, augmentation by other BACN-equipped aircraft, such as the Bombardier Global Express BD-700 aircraft or additional BACN EQ-4B Global Hawk Block 20 systems, is required to provide the requested USCENTCOM around-the-clock theater communications relay capability. The Air Force received congressional direction to modify additional Global Hawk Block 20 air vehicles with the BACN payload to support USCENTCOM operations.

Block 30

- In May 2011, DOT&E published the RQ-4B Global Hawk Block 30 Beyond Low-Rate Initial Production Report based on test results from the RQ-4B Global Hawk Block 30 IOT&E conducted from October 2010 through January 2011. DOT&E concluded that the system demonstrated the capability to provide about 40 percent of requested ISR coverage when used at low operational tempos (two to three sorties per week using three air vehicles). When operating at near-continuous operational tempos, the system provided less than half the required 55 percent ETOS coverage over a 30-day period. As a result, the system was not operationally effective for conducting near-continuous, persistent ISR operations. During IOT&E, the EISS provided electro-optical, infrared, and SAR imagery that met or exceeded most operational requirements and provided actionable imagery intelligence products to operational users. The ASIP provided a limited operational utility to detect, identify, and locate some threat radars and to detect some communication signals, but did not consistently deliver actionable signal intelligence products to operational users due to technical performance deficiencies and immature training, tactics, techniques, and procedures. During IOT&E, the RQ-4B Global Hawk Block 30 was not operationally suitable due to low air vehicle reliability, incomplete maintenance technical data, inadequate training, and ineffective integrated diagnostic systems. The system did not meet joint interoperability certification and information assurance requirements.
- Following IOT&E, the Air Force revised critical spare parts requirements and implemented a comprehensive reliability improvement program to reduce critical system component failures and address anticipated component obsolescence. The program also implemented plans to improve maintenance training, technical orders, and other system maintainability problems. These efforts are gradually improving system reliability, availability, and maintainability. Each USCENTCOM, USPACOM, and USEUCOM Global Hawk CAP, consisting of three aircraft, can generate sufficient sorties to support a steady-state operational tempo of approximately three missions per week. These missions vary in duration depending on theater requirements and operational priorities. Updated modeling and simulation results, incorporating field operating data collected through August 2011 and revised spare part requirements, project that Global Hawk Block 30 ETOS performance at near-continuous operational tempos should improve from 27 percent during IOT&E, to approximately 45 percent, as initial spare parts are delivered. This indicates that the program is meeting reliability growth goals and progressing toward the minimum 55 percent ETOS operational requirement for single vehicle control operations. The Air Force requested FY12 funding for initial spare parts procurement with deliveries continuing through FY15. AFOTEC will conduct a complete re-evaluation of RQ-4B Global Hawk Block 30 operational suitability during FOT&E.
- In November 2011, the Air Force developed an initial ASIP performance improvement plan to address signal detection, signal geo-location, operator training, tactics, and technical documentation deficiencies observed during IOT&E. AFOTEC will conduct a complete re-evaluation of RQ-4B Global Hawk Block 30 signals intelligence capabilities during FOT&E.
- Since IOT&E, the Air Force has implemented corrective action plans for some interoperability and information assurance deficiencies. AFOTEC and the Joint Interoperability Test Command will re-evaluate compliance with required interoperability and information assurance standards during FOT&E.
- Operational testing for the next incremental Global Hawk Block 30 capability upgrade began in July 2011. In August 2011, the Air Force halted operational testing due to a serious air vehicle command and control software deficiency. The RQ-4B Global Hawk Block 30 developmental test program previously identified this deficiency, but underestimated its impact during operational missions.
- RQ-4B Global Hawk Block 30 test schedule is high risk due to recently identified software deficiencies, flight test resource constraints, and additional test requirements associated with engine, fuel system, and diminishing manufacturing source upgrades. As a result, the Block 30 FOT&E originally planned for late FY12 is unlikely to occur before mid-FY13.

Block 40

- The MP-RTIP sensor showed improved performance during the final phase of MP-RTIP risk reduction and developmental testing on the Scaled Composites Model 281 Proteus test bed aircraft. The SAR ground mapping and GMTI operating modes met nearly all system performance specifications. Sensor stability during concurrent

SAR/GMTI operations also improved. Based on these results, the Air Force plans to integrate the SAR, GMTI, and concurrent SAR/GMTI operating modes on the RQ-4B Global Hawk Block 40 system. The Air Force deferred further development of other potential radar operating modes, such as High Range Resolution, Airborne Moving Target Indicator, and Maritime Moving Target Indicator indefinitely.

- The Air Force completed RQ-4B Global Hawk Block 40 air vehicle envelope expansion flight tests and began MP-RTIP sensor integration testing in July 2011. Based on lessons learned from Global Hawk Block 30 testing, the Air Force appropriately increased planned interoperability testing to ensure successful integration with supporting intelligence tasking and data processing, exploitation, and dissemination systems.
- Although the RQ-4B Global Hawk Block 40 and MP-RTIP development programs made significant technical progress in late 2010 and 2011, the current program test schedule is very high risk due to a combination of test resource constraints and the low priority of the Block 40 test program relative to Block 30 flight test activities. FY11 test funding reductions reduced Global Hawk flight test capacity at Edwards AFB, California, by up to 30 percent. In addition, Global Hawk Block 40 testing is subordinate to all other ongoing Global Hawk test efforts, such as the Global Hawk Block 30 follow-on test program. Based on Global Hawk test schedule delays experienced since June 2011, RQ-4B Global Hawk Block 40 IOT&E may be delayed up to one year beyond the previously planned FY13 target date.
- The Air Force will deliver the majority of RQ-4B Global Hawk Block 40 systems to Grand Forks AFB, North Dakota, prior to the currently planned IOT&E and operational fielding dates. As a result, the Air Force is considering an option to field these aircraft for early operational employment. However, current program test plans and schedules do not include activities necessary to support early operational fielding.

Recommendations

- Status of Previous Recommendations. The Air Force resolved previous recommendations to develop a Global Hawk reliability improvement plan and improve system interoperability testing. The Air Force also made progress on previous DOT&E recommendations to revise Global Hawk Block 30 and Block 40 operational requirements and identify specific Block 40 end-to-end operational architectures and interoperability requirements.
- FY11 Recommendations. The Air Force should:
  1. Complete development of final RQ-4B Global Hawk Block 30 and Block 40 operational requirements to provide clear expectations and priorities for development and test of operational capabilities.
  2. Complete development of RQ-4B Global Hawk Block 30 and Block 40 test strategies and ensure that adequate test resources are provided to support the wide range of planned Global Hawk T&E activities needed to meet proposed Nunn-McCurdy re-certification baseline schedules, or alternatively, revise schedule baselines to reflect delays that will inevitably result if current T&E resources are not increased.
  3. Provide definitive direction to the Global Hawk program regarding possible RQ-4B Global Hawk Block 40 early operational fielding options as soon as possible to ensure timely development of supporting program test plans and schedules, if required.
  4. Continue implementation of the OSD-approved Global Hawk Reliability and Maintainability Plan to improve the operational suitability of all Global Hawk variants.
  5. Continue implementation of the Air Force ASIP performance improvement plan to address signal detection, signal geo-location, operator training, and technical documentation deficiencies observed during RQ-4B Global Hawk Block 30 IOT&E.
  6. Develop a comprehensive plan to address critical interoperability and information assurance deficiencies observed during RQ-4B Global Hawk Block 30 IOT&E.

Global Positioning System (GPS) Selective Availability Anti-Spoofing Module (SAASM)

Executive Summary

- The Air Force upgraded the GPS Control Segment to the Architecture Evolution Plan (AEP) Version 5.5.4 and the Launch, Early Orbit, Anomaly Detection, and Disposal (LADO) system Version 5.8. They conducted a Force Development Evaluation (FDE) to support an operational acceptance decision in January 2012.
- The Air Force upgraded the GPS Control Segment to AEP Version 5.6 to provide Contingency Recovery and Over-the-Air Rekeying of military GPS receivers with Selective Availability/Anti-Spoof Module (SAASM).
- The Services conducted a Multi-Service Operational Test and Evaluation (MOT&E) to support a February 2012 decision for the Initial Operational Capability of the SAASM functions. Initial findings show SAASM to be operationally effective and suitable, but the Services need to place significant emphasis on ensuring that SAASM training/capabilities are utilized.
- SAASM is an enhanced GPS security architecture designed to provide over-the-air rekeying of GPS receivers in order to encrypt and decrypt the GPS signal. M-code will provide anti-jam capabilities.

System

- NAVSTAR GPS is an Air Force-managed, joint Service precision navigation and timing space program used for DoD and non-DoD operations.
- NAVSTAR GPS consists of three operational segments:
  - Space Segment - 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 5.6.2 is the current version of the control system supporting Blocks II/IIA, IIR/IIR-M, and IIF. AEP 5.7 will allow the command, control, and upload of different messages to sub-constellations of GPS satellites.
    - Next Generation GPS Operational Control Segment (OCX) replaces AEP 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.
- Air Force Space Command has launched four blocks of NAVSTAR GPS satellites and has one block of spacecraft in development:
  - Block I (1982-1992)
  - Block II/IIA (1990-1997)
  - Block IIR/IIR-M (Modernized) (1997 – 1999)
  - 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/Block III: Lockheed Martin Space Systems – Valley Forge, Pennsylvania
- Block IIF: The Boeing Company, Integrated Defense Systems – Seal Beach, California
- OCX: Raytheon Company, Intelligence and Information Systems – Denver, Colorado

Activity

- The Air Force upgraded the Control Segment to support the Block IIF satellites and the 17th Test Squadron conducted an FDE in August and September 2010 for GPS AEP Version 5.5.4 and LADO system Version 5.8.
- The Air Force conducted a SAASM MOT&E in August 2011 with support from the Army Test and Evaluation Command; Commander, Operational Test and Evaluation Force; and the Marine Corps Operational Test and Evaluation Activity. This test will support the Initial Operational Capability decision by Air Force Space Command in February 2012. DOT&E will provide a report in 1QFY12.
- The Air Force conducted testing in accordance with the DOT&E-approved Test and Evaluation Master Plan (TEMP) and operational test plan.
- The next revision of the enterprise level TEMP is in coordination and expected for OSD approval in support of the OCX Milestone B scheduled for November 2011.

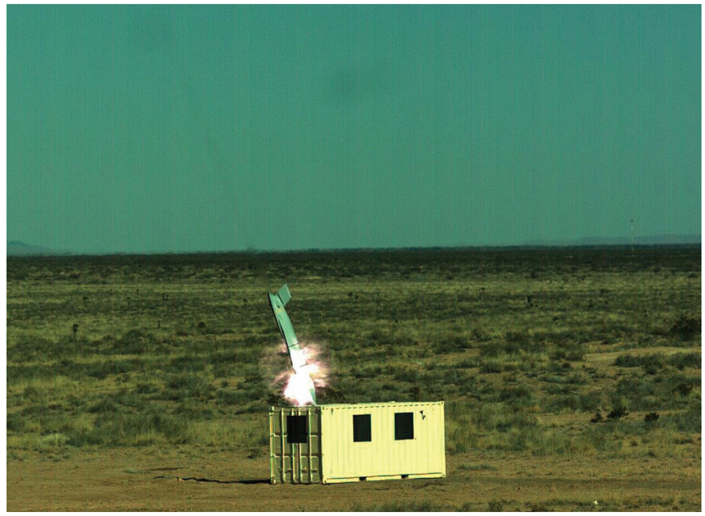
Assessment

- Initial SAASM MOT&E findings show it to be operationally effective and suitable but with some significant observations:
  - Emphasizing/enforcing the use of crypto-keyed GPS receivers will enhance operational utility in a jammed environment
  - Developing concepts of operations and techniques, tactics, and procedures for keying GPS receivers will allow Services to ensure operational effectiveness of each device
  - Information assurance during the SAASM MOT&E was limited to SAASM equipment only and did not incorporate the overall GPS enterprise
- Test planning to support fielding of military GPS user equipment on the proposed schedule will require a deeper understanding of OCX in order to design testing that is adequate to evaluate the operational effectiveness.

Recommendations

- Status of Previous Recommendations. The Air Force has addressed all but two previous recommendations.
  1. Planning should continue to focus on end to-end testing of OCX with GPS receivers (including ground equipment). Testing should ensure 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 operationally realistic environments.
  2. The synchronization of the development of the Space, Control, and User segments should continue to be monitored because delays in any segment will delay operational testing of all segments.
- FY11 Recommendations.
  1. The Air Force should ensure comprehensive and realistic information assurance testing is conducted of all external interfaces that support GPS operations and performance.
  2. The Services should emphasize/enforce the use of crypto-keyed GPS receivers.
  3. The Services should develop concepts of operations and techniques, tactics, and procedures for keying GPS receivers.

Joint Air-to-Surface Standoff Missile (JASSM)



Executive Summary
- The Air Force executed five Joint Air-to-Surface Standoff Missile (JASSM)-Extended Range (JASSM-ER) live fire shots in FY11. All five prosecuted their targets successfully.
- The Air Force, in conjunction with the prime contractor Lockheed Martin, is in the process of re-examining preliminary design and engineering development of the Electronic Safe and Arm Fuze (ESAF).
- There was one Lot 6 Reliability Assessment Program (RAP) shot in FY11, the result of which was a failure.
- 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 takes advantage of advances in fuze technology and is intended to be a more reliable fuze with the same capabilities as the baseline mechanical fuze. The ESAF would be used in JASSM baseline and ER variants.
- 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 adds the capability to attack maritime targets using two-way datalink 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 preplanning 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 Anti-Surface Warfare would add the capability to attack maritime targets and would add 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 is certifying JASSM for carriage and employment on the F-15E Strike Eagle; jettison and separation tests continued into FY11. The Air Force also successfully tested the missile operational flight profile to be incorporated into Lot 8 missiles onboard B-52 aircraft.
- There was one production Lot 6 RAP test flight in FY11 using a retrofitted Lot 6 missile. The December 2010 missile shot was a failure, as the missile departed controlled flight soon after launch from the B-2 bomber launch platform. The Lot 6 RAP test plan calls for an equal mix of re-worked early production Lot 6 missiles and current

configuration Lot 6 missiles, ensuring adequate and equal testing of both variants.

JASSM ESAF

- The ESAF program remains unfunded; however, the Air Force continues to express technical interest in the program. The Air Force, in conjunction with the major contractor, is in the process of re-examining preliminary design and engineering development of ESAF and is pursuing the availability of a second fuzing option, technological advancements in fuzing, and increased JASSM reliability.

JASSM-ER

- The Air Force executed five JASSM-ER live fire shots in FY11. Two of these missile firings (IT-7 and IT-10) were part of the integrated test program conducted under the auspices of the JASSM program office. The remaining three were Air Force Operational Test and Evaluation Center-administered IOT&E firings. All five JASSM-ER missiles accurately pinpointed and subsequently destroyed their targets at both nominal and maximum JASSM-ER ranges.

Assessment

JASSM Baseline

- Despite improvements in workmanship and production processes, there is still a need to evaluate the inherent reliability of production lot missiles to ensure that the reliability growth plan is successful.

JASSM ESAF

- DOT&E is concerned with the Air Force's current decision not to fund the ESAF program, which has the potential to increase the overall reliability of the JASSM variants. The ESAF program would replace the current electro-mechanical fuze, which relies on moving parts prone to reliability failures. In addition, the ESAF has more built-in test capability than the current electro-mechanical FMU-156/B fuze. LFT&E requirements (sled and flight tests) will need to be re-examined for data completeness should the Air Force choose to reinitiate the ESAF program.

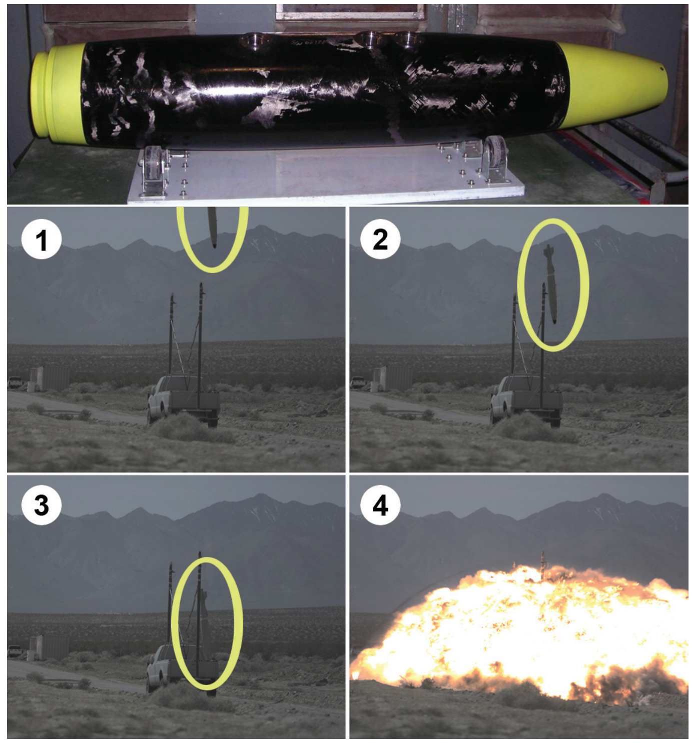
JASSM-ER

- The five JASSM-ER shots indicate that the JASSM-ER may meet requirements. However, full characterization of the weapon requires completion of the entire 21-shot IOT&E test program.

Recommendations

- Status of Previous Recommendations. Due to the continued battery problems in the telemetry kits, the Air Force could not adequately address the FY09 recommendation on reliability characterization. The Air Force has addressed all other previous recommendations.
- FY11 Recommendations.
  1. The Air Force should continue to characterize the reliability of baseline missile production lots (including completion of the Lot 6 RAP), incorporating reliability and program management improvements.
  2. The Air Force, in conjunction with the contractor, should continue the preliminary design and development of the ESAF.

Joint Direct Attack Munition (JDAM)



Executive Summary

- The Navy established the Direct Attack Moving Target Capability (DAMTC) as a program of record in February 2010 and competitively selected Laser Joint Direct Attack Munition (LJDAM) as the non-developmental material solution. The program completed the final part of the Integrated Test (IT) in April 2011 following a January 2011 Operational Assessment Report and subsequent low-rate initial production (LRIP) decision. A brief Developmental Test (DT) program is nearing completion prior to the commencement of Operational Testing (OT) in November 2011.
- The Navy released 11 LJDAM weapons in FY11 to complete the IT and will complete a six-weapon DT flight test program to confirm performance of a redesigned laser sensor lens and optics assembly prior to OT.
- The Precision Lethality Mark 82 (PL Mk 82) is a Quick Reaction Capability program created in response to a Joint Urgent Operational Need (UON) for a low collateral damage weapon. The Air Force completed a series of arena, sled, and live flight tests on the PL Mk 82 to support a fielding decision expected to take place in October 2011. DOT&E published an Early Fielding Report on weapon performance in September 2011. The report categorized the weapon as effective in precision strike and reducing collateral damage compared to a steel-case Mk 82 bomb.

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, BLU-126, and BLU-129/B 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 Operational Flight Program (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 due to the program being fielded as part of an UON. The latest weapon OFP is intended to expand operational capability to maneuvering targets and increase overall effectiveness and suitability across the spectrum of employment modes.
- U.S. Central Command generated a Joint UON requesting a high lethality low collateral damage composite case variant of the Mk 82 with precision capability. The Air Force created the PL Mk 82 using a composite material and modified tungsten explosive fill. The warhead is compatible with JDAM and LJDAM guidance kits and is designated the BLU-129/B.

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. The moving and maneuvering target capability of DAMTC is intended for use in Close Air Support, Strike Coordination and Armed Reconnaissance, and Time Sensitive Target missions.

Major Contractor

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

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Activity

DAMTC

- The Navy established DAMTC as a program of record in February 2010, selecting LJDAM as the non-developmental material solution. As a non-developmental program, the IT and added DT for the lens change are the only test phases prior to commencement of OT. DOT&E put DAMTC on oversight, as it was previously fielded under a UON, with a less-developed OFP and very limited OT testing. Additional testing will verify expanded LJDAM capability and operational employment.
- Naval Commander, Operational Test and Evaluation Force (COTF) completed its Operational Assessment (OA) in January 2011 supporting an LRIP decision made later that month. Data from eight IT weapon releases conducted in FY10 and an additional seven releases from an earlier LJDAM Quick Reaction Assessment were used as part of the OA.
- Air Force operational user information from LJDAM field employment showed significant degradation of the laser sensor lens used on DAMTC when deployed in harsh environments (such as Afghanistan). The Navy initiated a search for a replacement material and Boeing developed a Sapphire lens to replace the existing lens.
- The Navy completed the IT phase with the release of 11 weapons in FY11. Results from these tests will support an Operational Test Readiness Review (OTRR) scheduled for early FY12.
- The Navy will conduct a six-weapon DT phase, using side-by-side comparison testing between the two lens types, immediately prior to the OT Phase to ensure the Sapphire lens has no negative impact on system effectiveness. A successful DT phase will verify IT data and ensuing conclusions are valid and allow Operational Testing to commence.
- DOT&E approved the DAMTC OT Test Plan and Integrated Evaluation Framework; test execution will begin upon successful conclusion of the DT phase and subsequent analysis.

PL Mk 82

- The Air Force completed a rapid fielding recommendation for the PL Mk 82.
- The program office and Air Force Operational Test Center (AFOTEC) collaborated on seven arena tests and two sled tests to characterize warhead performance and to help evaluate effectiveness requirements related to lethality. AFOTEC flew a series of four live weapon open-air flight tests at Eglin AFB, Florida, and the test range at Naval Air Weapons Center China Lake, California, to evaluate the end-to-end performance of the PL Mk 82 warhead in both the JDAM and LJDAM configurations. F-16 and F-15E aircraft employed the weapons from operationally representative attack profiles.

Assessment

DAMTC

- Results from the OA and the FY11 releases from IT (event IT-C1) indicate that the LJDAM has the potential to meet DAMTC requirements.
- DAMTC's results through IT-C1 demonstrate a Circular Error Probable (CEP) inside the threshold requirement of six meters against maneuvering targets.
- Preliminary DT results using the new Sapphire laser sensor lens and optics assembly indicate highly comparable sensor detection range to the previous material, and the Sapphire lens is expected to provide improved reliability in harsh environments during its intended service life.
- Elapsed testing time is currently insufficient to determine the impact of the new material on reliability. However, laboratory environmental tests results demonstrated Sapphire lens performance met system-level requirements.
- Review of the current DAMTC test strategy indicates a properly resourced program for the remainder of the DT and OT phases.

PL Mk 82

- DOT&E published an Early Fielding Report on weapon performance in September 2011; the report categorized the weapon as effective in precision strike and reducing collateral damage compared to a steel-case Mk-82 bomb.
- All four PL Mk 82 flight tests were successful, with guidance to a very accurate impact (less than 10 feet) and high order detonation of the PL Mk 82 warhead.
- Although the PL Mk 82 did not meet the desired design lethality, it approximates the steel-cased Mk 82 bomb lethality while reducing collateral damage relative to the Mk 82 by nearly a factor of two.
- PL Mk 82 met its perforation requirement.

Recommendations

- Status of Previous Recommendations. The Navy is completing the FY10 recommendation by providing adequate time to analyze the results of the last IT weapons prior to initiation of OT. The Navy also delayed OT in order to examine the comparability of the Sapphire lens with the original material in an added DT phase.

- FY11 Recommendation.
  1. The Navy should initiate and conduct OT only after adequate confidence has been achieved during the DT phase that the new lens material and optics assembly will not degrade performance seen in IT-C1 and will improve current reliability.

Joint Mission Planning System – Air Force (JMPS-AF)

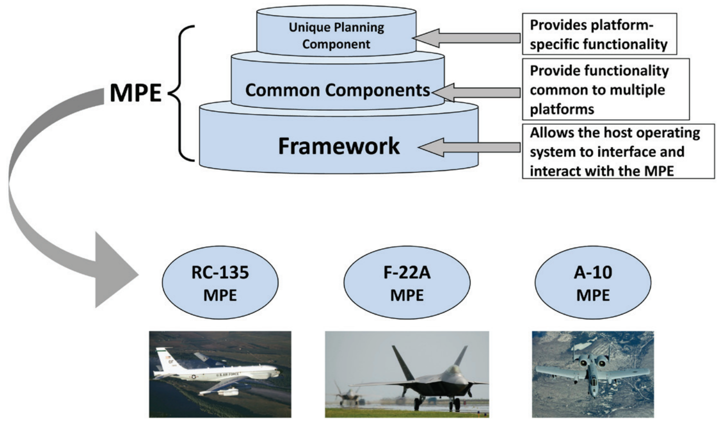
Executive Summary

- The Air Force completed operational testing of the RC-135 Mission Planning Environment (MPE) Spiral 2.1, the F-22 MPE Version 11.1, the A-10 MPE Version 7a, the E-3 MPE Release 1.0, and E-8 MPE Release 1.0. Each of these MPEs features tailored planning capabilities for their respective host platforms and any associated precision-guided weapons.
- The Air Force is leading Service efforts to develop the new common core Joint Mission Planning System Framework version 1.4. Once matured, all Services intend to adopt this new framework as a common core to build Service and host platform-specific MPEs.
- The Air Force is reviewing options for the development and programming required to achieve the Capability Development Document requirements for the nine tanker and special mission aircraft MPEs eliminated from the Increment IV program due to Air Force reprogramming of funds in December 2009.

System

- The Joint Mission Planning System – Air Force (JMPS-AF) is a Windows XP or Vista PC-based common solution for Air Force aircraft mission planning. It is a package of common and platform-unique mission planning applications.
- Using a "building block" approach, developers integrate and assemble a JMPS-AF MPE from a set of software sub-components to meet the needs of a particular aircraft type. An MPE consists of a framework, one or more common components/federated applications, and then a Unique Planning Component (UPC).
  - The foundation of an MPE is the framework, which allows the host operating system (Windows XP or Windows Vista) to interface and interact with the MPE.
  - The second level of an MPE consists of the common components and/or federated applications; these applications provide functionality that is common to multiple aircraft platforms (i.e. weather or GPS munitions).
  - The final level of software is the UPC, which provides platform-specific functionality and integrates the common component functions and the framework interface to produce the overall mission planning software environment for the platform.
  - When bundled, the three levels of software become an MPE that is specific to a single aircraft type. Depending on the aircraft model, a JMPS-AF MPE might operate on stand-alone, locally networked, or domain controlled Windows XP or Vista computers, or a mixture of all three operating environments.

JMPS-Air Force Mission Planning Environments (MPEs)



- The Air Force has split its JMPS-AF 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 the RC-135, and early versions of the F-22A and A-10.
  - Increment IV MPEs are based on more advanced JMPS-AF versions, and include platforms such as the E-3, E-8, and later versions of the F-22A and A-10. The Air Force is currently developing a plan to incorporate the tanker and airlift aircraft classes into the Increment IV MPE system. Although the JMPS-AF framework software is being co-developed among DoD components, JMPS-AF is not a joint program. Each Service tests and fields its own aircraft-specific MPEs.

Mission

Aircrew use JMPS-AF 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 – Oswego, New York
- Northrop Grumman – Carson City, California
- Boeing – St. Louis, Missouri
- DCS Corporation – Arlington, Virginia
- TYBRIN Corporation – Fort Walton Beach, Florida

Activity

- The Air Force conducted all MPE operational testing 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) conducted the Force Development Evaluation (FDE) of the JMPS-AF Increment III RC-135 Spiral 2.1 MPE in May 2011 at Offutt AFB, Nebraska.
- The 28th TES completed the FDE of the JMPS-AF Increment III F-22 MPE version 11.1 maintenance release in July 2011 at Eglin AFB, Florida.
- The Increment III system completed production and deployment and has transitioned into the Operations and Support phase of the Defense Acquisition Management System.

Increment IV

- The 28th TES conducted the FDE of the JMPS-AF Increment IV A-10 MPE version 7A in December 2010 at Eglin AFB, Florida, and in April 2011 at Nellis AFB, Nevada.
- The 28th TES conducted FDE of the JMPS-AF Increment IV E-3 MPE version 1.0 in November and December 2010 at Tinker AFB, Oklahoma.
- AFOTEC Detachment 2 conducted operational testing of the E-8 MPE version 1.0 in July and August of 2011 at Robins AFB, Georgia. The E-8 MPE is the representative test platform for JMPS-AF Increment IV mission planning functionality.
- The JMPS-AF Program Office conducted a Business Case Analysis from June through September 2011 to identify the most appropriate way ahead to complete JMPS-AF MPE development for the nine tanker, airlift, and special mission platforms de-scoped from the original Increment IV requirements list on account of Air Force re-programming in December 2009.

Assessment

- The Take-Off and Landing Data (TOLD) modules in the JMPS-AF MPEs evaluated to date do not generate accurate data and are not certified for flight use. Planners are required to revert to paper manuals or legacy mission planning systems to calculate TOLD data. The inability to calculate TOLD data negatively affects the operational effectiveness of the various MPEs.

Increment III

- RC-135 Spiral 2.1 MPE operational testing showed that the users' mean time to plan was 33 minutes per mission over a total of 70 missions, compared to the requirement of 120 minutes. Installation of the MPE on the host computer equipment was cumbersome due to inadequate installation documentation. Aircraft flight characteristics are not corrected for weather over the entire flight-operating envelope, requiring aircrew to manually input flight level winds in order to permit accurate JMPS-AF calculation of fuel consumption and time of flight. The MPE experienced one critical failure in 38.2 hours of test. This exceeded the Air Force 2.0-hour mean time between critical failure (MTBCF) requirement for JMPS-AF systems.
- F-22 version 11.1 MPE FDE results showed that pilots can plan F-22 missions, generate mission-related products, and transfer mission data to a Data Transfer Cartridge. The average time to plan a representative mission was 1 hour and 4 minutes, which is within the 2.0-hour requirement. Operational availability of the software was 99.4 percent with no critical failures observed.

Increment IV

- Six experienced aircrew members conducted operational testing on the A-10 MPE version 7a. The aircrew were able to plan 64 missions well within the 120-minute requirement, with a mean time to plan of 53 minutes per mission. However, less experienced users are likely to need extensive training to effectively plan missions. The MPE uses A-10A rather than A-10C weight, drag, and fuel usage parameters, which in certain conditions can result in misleading flight characteristics. Importing a flight path that contains one or more points with an "unknown" elevation, results in the point being displayed to the planner as "zero" elevation; this could cause fuel consumption and timing errors when the route calculation function is completed. The MPE experienced no critical failures in 81 hours of testing; the MTBCF threshold is 2.0 hours.
- E-3 MPE Release 1.0 operational testing showed that the users' mean time to plan a mission was one hour and 20 minutes, well within the 4-hour requirement. Capabilities to calculate TOLD data were not included in the MPE, so aircrew calculated TOLD data manually. The MPE did not experience a critical failure in more than 60 hours of operation, satisfying the MTBCF threshold requirement of 4 hours.
- DOT&E is still assessing the E-8 operational test results; however, preliminary results to date indicate several discrepancies that should be corrected prior to fielding. These include incorrect magnetic variation calculations within the navigation functionality and inability to load certain missions that incorporate en-route delays in the flight plan onto the data transfer device.

Recommendations

- Status of Previous Recommendations. The Air Force completed the FY10 recommendation to update and gain approval for the draft JMPS-AF Increment IV Test and Evaluation Master Plan.
- FY11 Recommendations.
  1. The Air Force should develop and implement a dedicated process to implement required fixes to flight performance and monitor TOLD data within all MPEs in order to eliminate delays with certification/de-certification of TOLD data for operational use.
  2. Correct any critical deficiencies prior to fielding the JMPS-AF Increment IV representative MPE software for the E-8 aircraft.

KC-46A

Executive Summary

- The KC-46A contract is firm-fixed-price with incentive for engineering and manufacturing development. The Air Force awarded the contract to the Boeing Company in February 2011.
- The DOT&E review of the post-Milestone B draft Test and Evaluation Master Plan (TEMP) indicates the KC-46A test program it describes is not executable.

System

- The KC-46A aerial refueling aircraft is the first increment (179) of replacement tankers for the Air Force's fleet of KC-135 tankers (more than 500). The KC-46A will use a modified Boeing 767-200 commercial airframe with numerous military and technological upgrades. The KC-46A is intended to provide boom (pictured above) and probe-drogue refueling capabilities on every sortie. The Air Force intends to equip the KC-46A with an air refueling receptacle so that it can also receive fuel from other tankers, including the legacy aircraft.
- The KC-46A will be designed to have significant palletized cargo and aeromedical capacities, defensive systems, chemical/biological/radiological/nuclear survivability, and the ability to host communications gateway payloads.

Mission

- Units equipped with the KC-46A will perform air refueling to accomplish six primary missions: nuclear operations support, global strike, air bridge support, aircraft deployment, theater support, and special operations support. Units will use the KC-46A for airlift, aeromedical evacuation, emergency aerial refueling, air sampling, and support of combat search and rescue.
- Units equipped with the KC-46A will be capable of operating in day/night and adverse weather conditions over vast distances to support U.S. joint, allied, and coalition forces. The units will have the necessary navigation and communication equipment for worldwide operations, including secure line-of-sight and beyond line-of-sight tactical datalink capability.

Major Contractor

The Boeing Company, Commercial Aircraft in conjunction with Defense, Space & Security – Seattle, Washington

Activity

- The KC-46A contract is firm-fixed-price with incentive for engineering and manufacturing development. The Air Force awarded the contract to the Boeing Company in February 2011.
- Developmental, operational, defensive systems, live fire, and integrated survivability test planning are ongoing.

Assessment

The DOT&E review of the post-Milestone B draft TEMP indicates the KC-46 test program is not executable. Specifically, the planned test program includes the following deficiencies:

- The military flight-hours-per-aircraft-per-month that are proposed in the TEMP exceed the historical averages that the Air Force and Navy have experienced during other large aircraft test programs. Disregarding Federal Aviation Administration (FAA) Amended Type Certification, the 42 flight-hours-per-aircraft-per-month for military testing is too aggressive for flight tests that are more specialized, higher risk, and more resource-intensive than FAA certification. Military testing experience with aircraft including the P-8, C-17, C-130J, C-27, and C-5 reflects fewer than 30 flight-hours-per-aircraft-per-month on average.
- Planned effectiveness for military flight testing substantially exceeds the relevant historical experience. The planned 15 percent re-fly rate for military test points is optimistic. That factor may be appropriate for commercial aircraft flight testing; however, it is not realistic for flight testing of military aircraft, including those derived from commercial aircraft. The P-8 (a B-737 derivative) is currently demonstrating a 45 percent re-fly rate for military test points. An average re-fly rate of 45 percent combined with 30 flight-hours-per-aircraft-per-month would extend the projected 17-month schedule for military testing by at least 4 months, a best case estimate because it assumes all 4 test aircraft would be available and equally capable of conducting the additional flight testing needed.

- The proposed schedule has no calendar time allotted for correction of discrepancies and/or deficiencies discovered during developmental testing prior to the planned start of operational testing. Historical experience indicates that some deficiencies will be discovered that need to be corrected prior to conducting operational testing.
- The contract identifies three phases of engineering and manufacturing development devoted to Air Force and Navy receiver aircraft qualifications: (1) five receivers including the KC-46 before Milestone C; (2) an uncertain number during military developmental test (the number, type, and flight hours needed for receivers are currently unknown because of uncertainty regarding extensive data collection requirements for KC-46 simulators); and (3) as many receivers as possible during a maximum of 750 flight hours after IOT&E, to be accomplished in parallel with the correction of deficiencies discovered during developmental and operational testing. Previous receiver certifications have required control law changes for the refueling boom and/or procedural modifications for boom or drogue operations. Time for such changes is not evident in the developmental test program.
- The draft TEMP allocates only four months for operational testing. The proposed 750 operational test flight hours will require approximately 47 flight-hours-per-aircraft-per-month using 4 aircraft, another aggressive plan. However, those 750 flight hours are inadequate to assess KC-46 suitability using operational personnel and flying a full complement of operationally representative missions. To achieve about 75 percent probability of demonstrating the required "break rate" during IOT&E, 1,250 flight hours are needed. At the assumed flight rate, that would require 2.7 additional calendar months. At a more typical 30 flight-hours-per-aircraft-per-month, IOT&E would require an additional 4 months. This extension is additive to the minimum 4-month extension of the military flight test program discussed above.

Recommendations

- Status of Previous Recommendations. This is the first annual report for this program.
- FY11 Recommendation.
  1. The Air Force should provide a TEMP that contains a realistic schedule using historical military flight test parameters.

Large Aircraft Infrared Countermeasures (LAIRCM)

Executive Summary

- The Large Aircraft Infrared Countermeasures (LAIRCM) Phase II system is operationally effective, but is not suitable as tested. DOT&E's evaluation will be provided in a classified Beyond Low-Rate Initial Production report transmitted in 2012. Automatic LAIRCM Phase II system resets occurred during IOT&E that significantly reduced the system's reliability.
- DOT&E approved the LAIRCM Phase II IOT&E test plan in March 2011, and Air Force Operational Test and Evaluation Center (AFOTEC) conducted the IOT&E in 3QFY11. The Air Force conducted LAIRCM testing in accordance with the DOT&E-approved Test and Evaluation Master Plan (TEMP) and test plans.
- The LAIRCM Reliability Integrated Product Team (R-IPT) has made significant progress obtaining and evaluating reliability and maintainability data from all LAIRCM platforms worldwide. The R-IPT produces detailed monthly reliability, maintainability, and failure rate metrics in order to guide funding for product upgrades.

System

- The LAIRCM system is a defensive system for large transport and rotary-wing aircraft that combines a Missile Warning System (MWS) and infrared laser jammer countermeasure system to protect the aircraft from infrared guided threat missiles.
- LAIRCM Phase I was fielded in 2005.
  - Key components include the AAR-54 ultraviolet MWS, countermeasures processor, and Small Laser Transmitter Assembly (SLTA) infrared laser jammer.
  - Platforms with LAIRCM Phase I include C-5, C-17, C-37, C-40, C-130H, MC-130W, and CV-22.
- LAIRCM Phase II is a spiral upgrade designed to provide higher performance warning and better false alarm rejection compared to the Phase I MWS and improved reliability in the jammer subsystem. The Phase II hardware is identical to the system procured for the Marine Corps by the Department of Navy LAIRCM program.
  - The new two-color infrared MWS is called the NexGen MWS.
  - The new jammer is the Guardian Laser Turret Assembly (GLTA).
    - The GLTA has already been installed and integration testing has been completed on the C-17, C-40, AC-130H, and C-5 aircraft.
    - Platforms such as the C-5, C-17, and C-130 aircraft have already upgraded to the GLTA. The Air Force plans to integrate LAIRCM on KC-46 aircraft and the Navy plans to integrate LAIRCM on P-8 aircraft.

Mission

Combatant commanders use LAIRCM to provide automatic protection for large transport or 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 landings, tactical descents, air drops, low-level flight, and aerial refueling.

Major Contractor

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

Activity

- The Air Force completed the developmental testing of LAIRCM Phase II on the C-17 in 1QFY11 at Edwards AFB, California.
- DOT&E approved the LAIRCM Phase II IOT&E test plan in March 2011, and AFOTEC conducted the IOT&E in 3QFY11 using the High-Speed Sled Track and the Joint Mobile Infrared Countermeasure Testing System (JMITS) at Holloman AFB, New Mexico, and the Towed Airborne Plume Simulator (TAPS) at Pensacola Naval Air Station, Florida. In support of the IOT&E, AFOTEC conducted modeling and simulation activities at Eglin AFB, Florida, and at a contractor facility in Dayton, Ohio. AFOTEC conducted a Maintenance Demonstration evaluation at Charleston AFB, South Carolina.

- The LAIRCM R-IPT continues to assimilate detailed data on the reliability and maintainability of the LAIRCM system.
- The Air Force is engineering several hardware and software changes and upgrades designed to improve the LAIRCM Phase I and II systems. These changes include software block-cycle upgrades, the Control Indicator Unit Replacement program, and the LAIRCM System Processor Replacement program.
- The Air Force conducted LAIRCM testing in accordance with the DOT&E-approved TEMP and test plans.
- The LAIRCM Program Office updated the January 2007 DOT&E-approved TEMP to reflect the program's revised Acquisition Strategy.

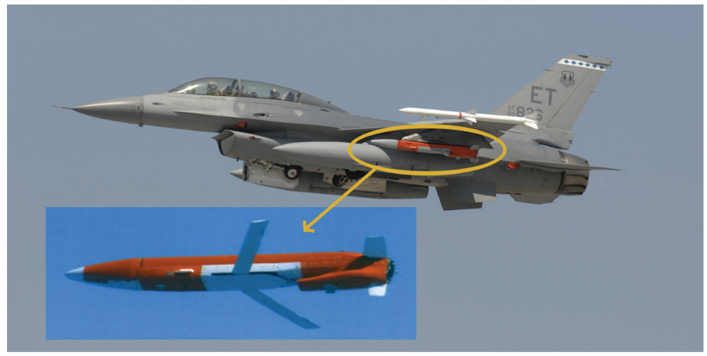
Assessment

- The LAIRCM Phase II system is operationally effective, but not suitable as tested. Automatic LAIRCM Phase II system resets occurred during IOT&E that significantly reduced the system's reliability.
- The LAIRCM R-IPT has made significant progress in assimilating reliability and maintainability data from all LAIRCM platforms worldwide. The R-IPT produces detailed monthly reliability, maintainability, and failure rate metrics in order to guide funding for product upgrades.

Recommendations

- Status of Previous Recommendations. The Air Force has addressed all previous recommendations.
- FY11 Recommendations.
  1. The Air Force should determine the root cause for the automatic LAIRCM Phase II system resets that occurred during IOT&E, and develop and verify a solution. This will significantly improve system reliability.
  2. Additional recommendations are provided in the classified DOT&E 2012 LAIRCM Phase II Beyond Low-Rate Initial Production report.

Miniature Air-Launched Decoy (MALD) and MALD-Jammer (MALD-J)



Executive Summary

- The Air Force's primary open-air electronic warfare range, the Nevada Test and Training Range (NTTR), requires continued Air Force attention to ensure sufficient resources are available to support Miniature Air Launched Decoy – Jammer (MALD-J) test requirements. Limited available range time will likely extend the planned FY12 MALD-J IOT&E up to six months.
- 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 the full capability can be employed during combat.

MALD

- In April 2011, DOT&E completed the MALD IOT&E Report to inform an Air Force acquisition decision for the low-rate initial production contract (LRIP Lot 4), which completes the planned MALD procurement.
- DOT&E assessed the MALD performance as operationally effective for combat, but not operationally suitable, due to poor demonstrated materiel reliability in the intended operational environment.
- In June 2011, the Air Force completed developmental tests to confirm fixes to the failures identified in the 2010 IOT&E. The Air Force subsequently recertified MALD for operational testing after decertifying the weapon following the 2010 failures.
- The Air Force Operational Test and Evaluation Center (AFOTEC) resumed IOT&E in July 2011. The IOT&E included B-52 long-endurance MALD carriage flights designed to replicate the likely operational employment environment and provide confidence that the corrective actions were sufficient.
- In August 2011, AFOTEC concluded IOT&E with the free-flight launch of two MALD vehicles flown during the long-endurance carriage flights in July. However, one of the MALD vehicles failed to initiate the engine start sequence after release from the B-52 and fell unpowered into the ocean. The Air Force subsequently initiated a failure review board (FRB) to investigate the failure and determine any necessary corrective action.
- The August 2011 IOT&E mission failure supports the DOT&E assessment of poor MALD material reliability. The testing failed to demonstrate the resolution of deficiencies when MALD is employed in an operationally-realistic manner. The ongoing Air Force FRB will likely result in additional developmental testing to confirm hardware upgrades are adequate before conducting the MALD-J IOT&E.

MALD-J

- In June 2011, the Air Force completed the MALD-J engineering, manufacturing, and development (EMD) phase. The EMD phase included an AFOTEC Operational Assessment of MALD-J's operational performance and readiness for IOT&E.
- In August 2011, DOT&E completed an operational assessment report to assess MALD-J's progress towards achieving operational effectiveness, suitability, and survivability.
- DOT&E concluded that the MALD-J payload demonstrates adequate jammer performance to support mission accomplishment, but that mission planning performance (though adequate for open-air flight tests) was limited in its ability to support employment of numerous MALD-Js in major combat operations. DOT&E conclusions regarding MALD-J suitability, particularly its reliability, depend in part upon data from the MALD testing, which will be used to evaluate whether vehicle reliability problems have been resolved.
- MALD-J EMD testing revealed no significant reliability deficiencies with the jammer payload. However, a MALD-J vehicle flown during the 2011 MALD IOT&E long carriage flights experienced a BIT failure that was subsequently investigated by the program office. Early results from the investigation show the fault was isolated to improper manufacturing processes on the jammer payload module. As a result, all MALD-J vehicles will be returned to the contractor for jammer payload removal and rework.
- DOT&E approved the MALD-J Milestone C Test and Evaluation Master Plan (TEMP) in September 2011.

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

- In January 2011, the Air Force completed a developmental return to flight test mission that evaluated the hardware, software, and firmware upgrades that resulted from the 2010 IOT&E failures. These failures resulted in the Air Force decertifying the weapon for operational test and suspension of IOT&E.
- In April 2011, DOT&E completed a MALD IOT&E report to inform the Air Force acquisition decision for the MALD LRIP Lot 4 contract.
- In June 2011, the Air Force recertified MALD for operational testing after completing necessary developmental tests and concluding all failure review boards.
- AFOTEC resumed IOT&E in July 2011 with a B-52 long-endurance flight from Barksdale AFB, Louisiana, to Anderson AFB, Guam; a local Guam flight crossing the international dateline and equator; and a return long-endurance flight back to Barksdale AFB, Louisiana. The B-52 carried eight MALDs (along with eight MALD-Js) for a total carriage time exceeding 40 hours for each vehicle. The long-endurance mission and resultant vehicle carriage time was executed to replicate the likely MALD operational employment environment and provide confidence that recent corrective actions for reliability were sufficient.
- In August 2011, AFOTEC concluded IOT&E with the free-flight launch of two MALD vehicles that were carried on the long-endurance B-52 missions. However, one of the MALD vehicles failed to initiate the engine start sequence after release from the B-52 and fell unpowered into the ocean. The Air Force subsequently initiated an FRB to investigate the failure.
- AFOTEC conducted the IOT&E in accordance with the DOT&E-approved TEMP and test plan.

MALD-J

- In June 2011, the Air Force completed the MALD-J EMD phase that included an AFOTEC Operational Assessment.
- The EMD phase culminated in an operationally realistic open-air flight test with two MALD-J vehicles flying in a synchronized orbit while two Sabreliner aircraft configured with captive MALD-J test vehicles flew in coordinated orbits.
- The Nevada Test and Training Range (NTTR) provided processed test data to the integrated test team 10 days after the MALD-J flight test occurred, which supported the program's overall evaluation and schedule.
- In June 2011, the Air Force established an integrated product team to manage the development of the many-on-many mission level simulation (i.e., multiple MALD-J versus multiple threat radars) planned to be conducted during IOT&E.
- The July 2011 long-endurance B-52 MALD IOT&E missions included the carriage of eight MALD-Js. The Air Force plans to launch the vehicles during the IOT&E planned for FY12 to further assess vehicle material reliability.
- DOT&E approved the MALD-J Milestone C TEMP in September 2011.
- 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, requires continued Air Force attention to ensure sufficient resources are available to support MALD-J test requirements. Limited available range time will likely extend the planned FY12 MALD-J IOT&E up to six months. In addition, the normal time of 45 work days to process and disseminate test data does not support timely MALD-J analysis and reporting. The NTTR efforts to support the last EMD flight test with test data 10 days after the test mission should be the standard support for the rest of the MALD-J test program.

- The Air Force MALD/MALD-J 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 the full capability can be employed during combat.

MALD

- The April 2011 DOT&E report concluded MALD performance as operationally effective for combat, but not operationally suitable due to poor demonstrated materiel reliability in the intended operational environment.
- During the 2010 IOT&E, the MALD reliability point estimate that combines free-flight and aircraft carriage time was 77 percent, which fell short of the threshold requirement of 93 percent. This shortfall would have an operational impact by increasing the number of MALDs required to accomplish each mission by 22 percent.
- MALD carriage life during the 2010 IOT&E failed to meet the required threshold of a minimum of 60 hours. All MALDs that accumulated over 14 hours of carriage time, and were subsequently launched by the Air Force, failed during free-flight test. This is significant for long-endurance B-52 missions, which are likely to accumulate 14 or more hours of carriage time before operational employment.
- The August 2011 IOT&E mission failure further validates the DOT&E assessment of poor MALD material reliability. The testing failed to demonstrate the resolution of deficiencies when MALD is employed in an operationally realistic manner. The ongoing Air Force FRB will likely result in additional developmental testing to confirm any hardware upgrades are adequate before conducting MALD-J IOT&E in FY12.

MALD-J

- The August 2011 DOT&E Operational Assessment report concluded the MALD-J payload demonstrates adequate jammer performance to support mission accomplishment, but that mission planning performance (though adequate for open-air flight tests) was limited in its ability to support employment of numerous MALD-Js in major combat operations.
- DOT&E conclusions regarding MALD-J suitability, particularly its reliability, depend in part upon data from MALD testing, which will be used by DOT&E to evaluate whether vehicle reliability problems have been resolved. In the interim, outstanding MALD reliability deficiencies pose some risk to the planned FY12 MALD-J IOT&E due to the vehicle commonality between the two variants.
- MALD-J EMD testing revealed no significant reliability deficiencies with the jammer payload. However, a MALD-J vehicle flown during the 2011 MALD IOT&E long carriage flights experienced a BIT failure that was subsequently investigated by the program office. Early results from the investigation show the fault was isolated to improper manufacturing processes on the jammer payload module. As a result, all MALD-J vehicles will be returned to the contractor for jammer payload removal and rework.
- The planned mission-level simulation (i.e., multiple MALD-J versus multiple threat radars) is required to assess both MALD-J's and the protected aircraft survivability. Delivering this capability in time to support IOT&E is a program risk due to technical challenges; however, the Air Force's creation of an integrated product team with key stakeholders and leadership oversight may provide an opportunity to deliver the capability in time to meet the MALD-J schedule.
- During developmental testing, the Air Force did not assess MALD-J's performance in a joint environment, or with Fifth Generation aircraft flying within the threats' area of responsibility; the Air Force will need to address both areas during IOT&E.

Recommendations

- Status of Previous Recommendations. The Air Force is satisfactorily addressing all of the five FY10 recommendations.
- FY11 Recommendations. The Air Force should:
  1. Continue to provide sufficient resources to the NTTR to enable personnel to process and distribute test data in a timely manner.
  2. Include Fifth Generation aircraft flying within the MALD-J protected coverage area along with other joint aircraft during MALD-J IOT&E.
  3. Evaluate a mission planning exercise using a relevant Combatant Command Air Operations Center planning cell to plan an operationally-representative mission for a B-52 tasked unit during MALD-J IOT&E.
  4. Evaluate MALD-J in a GPS denied/degraded environment while the payload is operating in both the decoy and jammer modes.
  5. Continue efforts to develop a mature modeling and simulation many-on-many capability to support MALD-J IOT&E and the follow-on MALD-J Increment II.

MQ-9 Reaper Unmanned Aircraft System (UAS)

Executive Summary

- The Air Force has successfully integrated the MQ-9 Unmanned Aircraft System (UAS) into ongoing combat operations since the completion of IOT&E and transition to Acquisition Category 1D status in 2009. The program has accelerated production and incorporated ever-increasing combat capability to meet current and evolving combat mission needs. Similarly, the MQ-9 UAS has demonstrated a unique capacity to meet the challenges of urgent combat operational needs through the rapid incorporation of emergent sensor and systems technologies outside of the MQ-9 baseline program of record.
- The MQ-9 continues to be effective in executing combat missions with the fielded Block 1 remotely-piloted aircraft (RPA) using both program of record capabilities and emergent systems technologies dictated by evolving operational needs.
- Responding to urgent operational needs and incorporating associated emerging technologies has affected the program's ability to meet MQ-9 program of record requirements within a predictable development timeline and stable test and fielding schedule in FY11.
- The Air Force deferred the planned FY11 Milestone C decision for the Block 5 RPA due to immature system integration. Accelerated Block 1 RPA production and incorporation of emergent capabilities outside of the acquisition program of record have dominated MQ-9 priorities and have resulted in systemic challenges in prioritizing and maturing software Operational Flight Programs (OFPs) to meet development and fielding timelines for the Increment One program of record.
- The Air Force path to satisfying the MQ-9 UAS Increment One requirements evolved in FY11. Resolution of outstanding requirements and shortfalls identified in previous MQ-9 IOT&E will be addressed through an FOT&E of the final Increment One UAS configuration consisting of the Block 5 RPA, the Block 30 Ground Control Station (GCS), and RPA OFP 904.6. Planned FY13 FOT&E has slipped to FY14 due to ongoing developmental challenges and associated programmatic schedule impacts.
- Ongoing developmental challenges precluded operational testing and subsequent fielding of baseline program enhanced capabilities to operational MQ-9 units in FY11 (OFP 904.0, OFP 904.2, and Joint Direct Attack Munition (JDAM)).
- Findings from an Air Force operational assessment (OA) of the Increment One system (Block 5 RPA, Block 30 GCS) indicated incremental progress towards achieving effectiveness requirements in support of future FOT&E. However, progress towards achieving system suitability requirements was not evident during the OA.
- The MQ-9 program continues to lack an approved Test and Evaluation Master Plan (TEMP) to support ongoing developmental and operational testing. Additionally, the MQ-9 UAS lacks realistic and achievable system Mean Time Between Critical Failure (MTBCF) reliability requirements and a growth path to achieve such requirements.

System

- The MQ-9 Reaper UAS is a remotely-piloted, armed, air vehicle that uses optical, infrared, and radar sensors to locate, identify, target, and attack ground targets.
- The system includes GCS for launch/recovery and mission control of sensors and weapons.
- The MQ-9 RPA is a medium-sized aircraft 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.
- The MQ-9 is commanded through its GCS for launch/recovery and mission control of sensors and weapons. C band line-of-sight datalinks are used for RPA launch and recovery operations, and Ku-band satellite links are used for RPA mission control.
- The MQ-9 RPA 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 One Capability Production Document (CPD) requirements, with Block 1 and Block 5 RPAs and Block 15 and Block 30 GCSs.
- The Air Force is currently fielding the Block 1 RPA.
- The Block 5 RPA is designed to incorporate improved main landing gear, an upgraded electrical system with more power, an additional ARC-210 radio, encrypted datalinks, a redesigned avionics bay and digital electronic engine control system, the BRU-71 bomb rack, high-definition video, and upgraded software to allow the 2-person aircrew to operate all onboard systems. The Block 5 RPA will be formally tested in FOT&E in 2014.

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

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Activity

- MQ-9 Block 1 RPA OFP software and Block 5 RPA hardware developmental testing was ongoing throughout FY11. OFP software suites 904.0, 904.2, and 904.4 are intended to provide incremental enhancements to fielded Block 1 RPAs and to mature capabilities to be incorporated into OFP 904.6. The final MQ-9 Increment One UAS configuration will include the Block 5 RPA, Block 30 GCS, and OFP 904.6. The Air Force plans to retrofit Block 1 RPAs to a Block 5 hardware configuration upon completion of Increment One FOT&E anticipated in FY14.
- The Air Force Air Combat Command (ACC) began a Force Development Evaluation (FDE) to support limited MQ-9 fielding of the GBU-38, 500-pound JDAM in November 2009. Software anomalies discovered during the FDE resulted in JDAM testing being placed in a pause status pending resolution of MQ-9 OFP fuzing and weapons envelope discrepancies in 2010. MQ-9 JDAM FDE testing remained on hold throughout FY11 and is not likely to resume until CY12.
- Planned FY11 ACC FDE testing of MQ-9 Block 1 OFPs 904.0 and 904.2 did not occur. Software maturity challenges and continued developmental delays resulted in the program's decision not to attempt to field OFP 904.0. Similarly, ongoing software challenges have pushed OFP 904.2 FDE to CY12.
- The Air Force Operational Test and Evaluation Center (AFOTEC) completed an OA of MQ-9 Block 5 RPA capabilities in support of a planned June 2011 Block 5 Milestone C acquisition decision. Testing was conducted in accordance with a DOT&E-approved OA plan. Though incremental progress towards achieving some outstanding MQ-9 Increment One requirements was noted, system maturity and integration were not sufficient to support the June Milestone, which has been deferred pending demonstration of system maturity until possibly as late as FY13.
- DOT&E approved the existing MQ-9 TEMP in October 2007 to support IOT&E of the MQ-9 UAS with the Block 1 RPA. Since the MQ-9 UAS was designated an Acquisition Category 1D program in December 2009, no TEMP update has been submitted to OSD for consideration and approval. Ongoing, post-IOT&E MQ-9 developmental and operational testing continues to be conducted outside of the construct of an applicable DOT&E approved TEMP.

Assessment

- Upon completion of the Increment One Block 1 UAS IOT&E in 2009, DOT&E assessed the MQ-9 UAS was effective in the Killer mission role and suitable. IOT&E did not assess the MQ-9 UAS Hunter mission role primarily due to immature systems development and integration of the Lynx synthetic aperture radar (SAR). Without the Lynx SAR, the MQ-9 remains unable to execute all weather Hunter-Killer operations. The SAR is the only MQ-9 system capable of providing the MQ-9 UAS with the capability to find, fix, track, and engage targets through the weather. Additionally, the Air Force deferred 14 MQ-9 CPD threshold capabilities from IOT&E for assessment in future OT&E. Since 2009, the approach to satisfying the outstanding CPD requirements has evolved, and the Air Force intends to fulfill the Increment One CPD requirements with a final UAS configuration consisting of a Block 5 RPA, Block 30 GCS, and OFP 904.6. The Block 5 RPA includes major hardware modifications to the baseline Block 1 aircraft compelling the Air Force to pursue a separate Milestone C decision for this new aircraft configuration within the Increment One UAS program of record. MQ-9 production is currently at full-rate levels with authorization to produce 48 Block 1 RPAs annually until such time as a Block 5 Milestone C decision is made. The Air Force intends to retrofit all Block 1 RPAs to a Block 5 configuration upon completion of Block 5 development and testing. Formal operational testing of the final MQ-9 Increment One UAS (Block 5 RPA, Block 30 GCS, OFP 904.6) is required and will be conducted as an AFOTEC-led FOT&E to fully assess the Increment One effectiveness, suitability, mission capabilities, and satisfaction of CPD key performance parameters.
- Accelerated RPA production and responding to emergent capability insertion requests outside of the acquisition program of record (e.g. Urgent Operational Need Statements) continue to dominate Air Force MQ-9 program priorities. Consequently, the program faces systemic challenges in prioritizing and maturing software OFPs to meet development and fielding timelines for the Increment One program of record. During FY11, projected FOT&E for the final Increment One configuration UAS (Block 5 RPA, Block 30 GCS, OFP 904.6) slipped from FY13 to FY14, and the desired June 2011 Block 5 RPA Milestone C decision was deferred

due to the program's inability to demonstrate sufficient system integration maturity in the FY11 development schedule. Until the program is able to better prioritize and control maturation and development of the Increment One program of record capabilities, future delays in operational testing and fielding of associated capabilities will continue to occur.

- Insufficient progress in resolving MQ-9 UAS program of record developmental challenges in hardware and software development precluded the fielding of planned program of record combat capabilities to operational MQ-9 units (OFP 904.0, OFP 904.2, and JDAM).
- Findings from the AFOTEC OA of the Increment One Block 5 RPA indicated incremental progress towards achieving RPA system effectiveness requirements in support of future FOT&E; however, progress towards achieving system suitability requirements was not evident during the OA. Block 5 RPA maturity did not enable assessment of all Block 5 hardware systems integrated into a single aircraft. Limited systems attributes were assessed as configured in multiple RPAs modified with elements of Block 5 hardware, and GCSs modified with elements of Block 30 GCS hardware and interface capabilities.
  - The MQ-9 demonstrated the ability to utilize the Lynx SAR to locate and designate fixed targets with sufficient accuracy to successfully employ JDAM weapons in developmental testing. However, Lynx SAR capabilities were not mature enough to support using the system's ground moving target indicator capabilities to track moving surface targets.
  - The Block 5 heavy weight landing gear system, high capacity starter/generator, and, the BRU-71 bomb rack demonstrated progress towards meeting system requirements. However, dual ARC-210 radios, encrypted datalinks, the redesigned avionics bay, and digital electronic engine control system had not been incorporated into the test aircraft for assessment.
  - Progress towards satisfying Increment One suitability requirements was not evident during the OA period. The program continues to lack: finalized technical orders to maintain the MQ-9 system; consolidated and comprehensive documentation of maintenance records; and a reliability growth plan and formal process to track and adjudicate suitability shortfalls during system developmental and operational testing.
  - A subsequent OA, to include Block 5 RPA flight test, will be required to inform the FY13 Block 5 RPA Milestone C decision.
- In 2009, DOT&E assessed that the MQ-9 CPD threshold MTBCF requirements of 500 hours (RPA and GCS) evaluated during IOT&E were unachievable and that the Air Force should re-evaluate the requirements. To date, the program continues to lack achievable MTBCF requirements and a reliability growth path to support such requirements.
- Developmental testing made incremental progress in resolving deficiencies discovered during the 2009 MQ-9 JDAM FDE testing; however, OFP software deficiencies remain and the system has yet to demonstrate readiness for resumed operational testing.
- As was the case in FY10, information assurance (IA) vulnerabilities and deficiencies are not well characterized because the system has only completed limited IA testing. The system continues to operate under an extended Interim Authority to Operate, pending full system IA testing.
- The Air Force has yet to submit a TEMP for OSD approval to support the ongoing developmental and operational T&E activities associated with the MQ-9 Increment One program of record. The previously approved 2007 TEMP was adequate to support the MQ-9 IOT&E in 2008; however, there is no TEMP supporting current T&E. The lack of an approved TEMP hampers DOT&E's ability to accurately assess the adequacy of ongoing operational T&E efforts and evaluate program progress towards satisfying Increment One Capability Production Document (CPD) requirements.

Recommendations

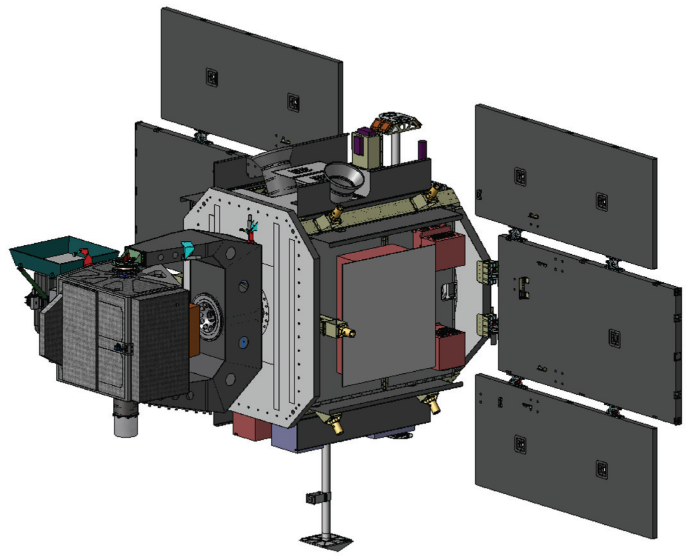
- Status of Previous Recommendations. The Air Force is attempting to address previous DOT&E recommendations, though accelerated production and incorporation of non-program of record emergent capabilities priorities continue to hinder the program's ability to make substantial progress towards satisfying the MQ-9 UAS Increment One program of record requirements.
- FY11 Recommendations. The Air Force should:
  1. Resolve the MQ-9 GBU-38 JDAM integration deficiencies and complete the 2009 JDAM operational testing that has been in a pause status since 2010.
  2. Revisit the MQ-9 CPD MTBCF threshold requirements and establish achievable, testable requirements and a reliability growth path to achieve such requirements.
  3. Conduct a subsequent formal operational assessment of the MQ-9 UAS to support and inform an FY12/13 Block 5 RPA Milestone C decision.
  4. Complete IA testing to support full accreditation of the MQ-9 system.
  5. Complete development of Increment One UAS hardware and software to support FOT&E of the Increment One system to assess operational effectiveness, suitability, and mission capability of the final Increment One UAS configuration (Block 5 RPA, Block 30 GCS, and OFP 904.6).
  6. Conduct an OA, including Block 5 RPA flight test, to inform the FY13 Block 5 RPA Milestone C decision.
  7. Complete and submit a TEMP for OSD approval addressing ongoing MQ-9 Increment One UAS developmental and operational T&E.

Space-Based Space Surveillance (SBSS) Block 10

Executive Summary
- The Space-Based Space Surveillance (SBSS) Block 10 system is now a contributing sensor to the U.S. Strategic Command Space Catalog.
- The Air Force launched the SBSS satellite at the end of FY10. During FY11, they completed both on-orbit developmental testing and IOT&E, leading up to formal Air Force Space Command operational acceptance in 1QFY12.
- DOT&E recommends follow-on evaluation associated with sensor processing, software baseline changes, and the SBSS operations crew configuration.
- DOT&E also recommended an analysis of ongoing space surveillance network acquisition programs to ensure their interdependencies deliver a coherent space situational awareness picture.

System
- The Air Force developed SBSS Block 10 to replace and enhance the capability previously provided by the Midcourse Space Experiment Space-Based Visible Sensor, which reached end-of-life in 2008.
- SBSS consists of a single satellite in low-earth orbit carrying a payload with a visible-spectrum sensor.
- The 1st Space Operations Squadron operates the system from the SBSS satellite operations center located at Schriever Air Force Base, Colorado.

Mission
- Commanders of the Joint Space Operations Center at Vandenberg Air Force Base, California, will use SBSS to provide timely analysis of high interest satellite maneuvers, predictions of potential collisions for tracked objects, location of lost objects, and identification of unknown objects.



- U.S. Strategic Command personnel will use SBSS to provide space surveillance, reconnaissance, intelligence, environmental monitoring, and data fusion and exploitation to satisfy space situational awareness needs of Service members.
- National Air and Space Intelligence Center will use SBSS to detect changes in the status of high interest objects, which could indicate a potential maneuver or instability resulting from a failure to maintain proper control of a satellite.

Major Contractor
Boeing Space and Intelligence Systems – El Segundo, California

Activity
- The Air Force successfully launched the SBSS Block 10 satellite from Vandenberg Air Force Base using a Minotaur IV on September 25, 2010.
- After initial on-orbit operations, the program office and the 1st Space Operations Squadron conducted a system characterization period to refine data processing algorithms and to confirm that the system was meeting expected specifications.
- SBSS began supplying data to the Space Catalog midway through system characterization (February 2011).
- The Air Force Operational Test and Evaluation Center conducted a dedicated IOT&E for SBSS from March 23 to April 22, 2011.
- DOT&E provided a classified assessment to Congress, Secretary of Defense, Secretary of the Air Force, and the Commander of Air Force Space Command.

Assessment
- SBSS provides significantly greater accuracy and capacity in reporting relative to current ground-based surveillance systems.
- The Air Force Operational Test and Evaluation Center's IOT&E was adequate and conducted in accordance with the DOT&E-approved Test and Evaluation Master Plan and operational test plan.

- The Air Force tested SBSS with the current operational configuration, which is a blended Air Force and contractor crew. When the operational unit makes a transition to an all-Air Force crew, the Air Force should conduct a follow-on evaluation.
- During the later stages of integrated testing, a data formatting problem was discovered which prevented full utilization of SBSS mission data by one user. This problem should have been identified earlier in developmental testing by sharing sample data products with the end users.

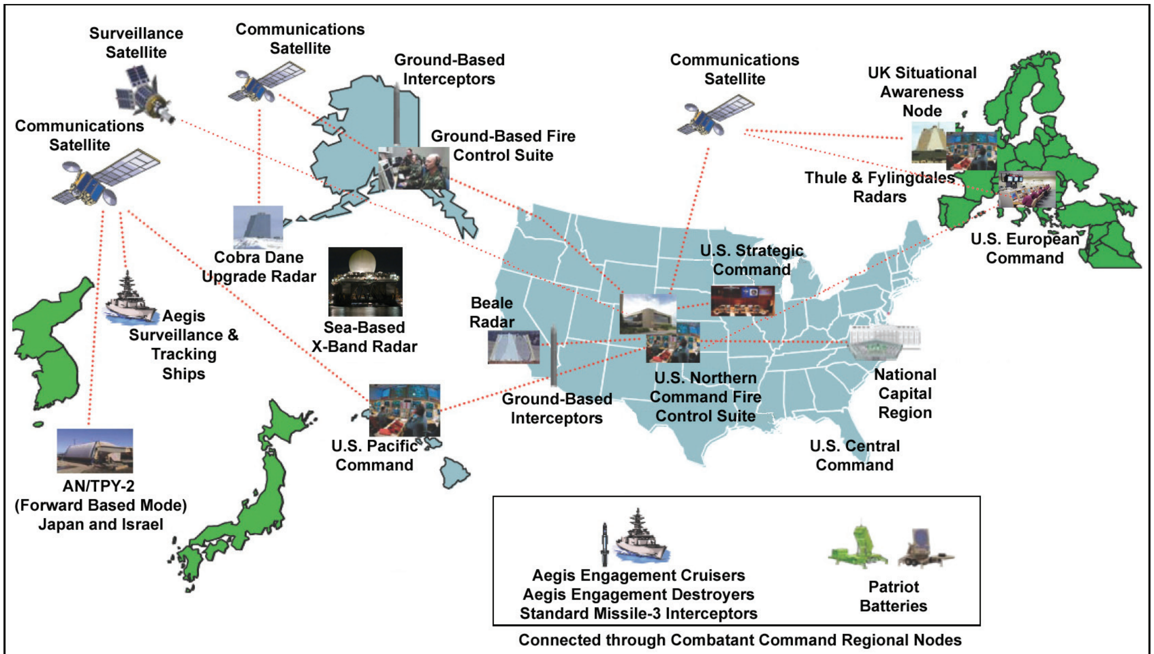
Recommendations

- Status of Previous Recommendations. This is the first annual report for this program.
- FY11 Recommendations. The Air Force should:
  1. Operationally evaluate the expected transition from a blended Air Force and contractor crew to an all-Air Force crew.
  2. Re-evaluate current space surveillance network management with respect to uncorrelated sensor data to ensure all collection platforms, including SBSS, contribute to optimize space situational awareness
  3. Analyze other ongoing acquisition programs, including SBSS Follow-on, Space Fence and Joint Space Operations Center Mission System to ensure the overall space surveillance system can use the data new sensors will collect.

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) continued execution of its Integrated Master Test Plan (IMTP) to collect the data needed to accredit the models and simulations used for assessing the performance and effectiveness of the Ballistic Missile Defense System (BMDS).
- Using the Standard Missile-3 (SM-3) Block IA interceptor, Aegis Ballistic Missile Defense (Aegis BMD) intercepted an intermediate-range ballistic missile using up-range data from an AN/TPY-2 (Forward-Based Mode [FBM]) radar and, in a Japanese Aegis BMD flight test, it intercepted a medium-range separating ballistic missile. Aegis BMD failed to intercept the target in the first flight test of the SM-3 Block IB interceptor during FY11.
- The Ground-based Midcourse Defense (GMD) element conducted an unsuccessful intercept flight test during FY11.
- The Terminal High-Altitude Area Defense (THAAD) program conducted a successful IOT&E flight test on October 3, 2011.
- The Patriot program conducted a successful intercept flight test using a Missile Segment Enhancement (MSE) interceptor during FY11 and conducted three successful developmental flight test missions in early FY12.
- Command, Control, Battle Management, and Communications (C2BMC) demonstrated the ability to control a single AN/TPY-2 (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 during flight test events. The ability to control two AN/TPY-2 (FBM) radars has been demonstrated through hardware-in-the loop ground testing, but not with operational radars using operational communications architectures and hardware.

System

- The current BMDS architecture integrates ballistic missile defense capabilities against all ranges of threats.
- BMDS is a distributed system currently comprised of four elements (three shooter elements and one command and control element) and five sensor systems (four radar systems and one space-based system).

  Elements
  - Aegis BMD (shooter)
  - C2BMC (command and control)
  - GMD (shooter)
  - Patriot (shooter)

  Sensors
  - Aegis BMD AN/SPY-1 Radar
  - Cobra Dane Radar
  - Upgraded Early Warning Radars (UEWRs)
  - AN/TPY-2 (FBM) Radar
  - Space-Based Infrared System/Defense Support Program (SBIRS/DSP)
  - Sea-Based X-Band (SBX) Radar (primarily a test asset that can be operationally deployed as needed)
- THAAD is a projected near-term addition to the BMDS.

- Advanced technology BMDS capabilities include the following:
  - Airborne Laser Test Bed
  - Precision Tracking Space System, a follow-on to the Space Tracking and Surveillance System (STSS)
  - Airborne Infrared 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, and the BMDS to defend U.S. territory, deployed forces, friends, and allies against ballistic missile threats of all ranges and 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 element of the BMDS.
- The Army employs Patriot to provide theater defense for deployed forces against short- and medium-range threats.

Major Contractors

- The Boeing Company, Integrated Defense Systems, Missile Defense Systems – Huntsville, Alabama
- Lockheed Martin
  - Missile and Fire Control – Dallas, Texas
  - Maritime Systems & Sensors – Moorestown, New Jersey
  - Information Systems and Global Services – Gaithersburg, Maryland
- Raytheon Missile Systems – Tucson, Arizona

Activity

- The MDA, in collaboration with the Operational Test Community, made two updates to the IMTP using critical factors analysis (also referred to as Critical Engagement Conditions) and considered other important data needs (also referred to as Empirical Measurement Events) to drive test design, planning, and execution.
- The MDA conducted Technical Assessment-04 (TA-04) to assess the readiness and integration of BMDS element-level digital simulations for participation in Performance Assessment-04, which is planned for 4QFY13.
- During July 2011, a short-range air-launched target was launched in Flight Test Other-17 (FTX-17). This was the return-to-flight test of air-launched targets after they were grounded following a failure in Flight Test THAAD-11 (FTT-11).
- In March 2011, a short-range ballistic missile target was launched, and for the first time, STSS demonstrator satellites acquired and tracked the target from boost through midcourse, with data transmitted to ground stations and sent to an underway Aegis BMD 3.6.1 ship in near-real-time (FTX-16 E1).
- During Flight Test Standard Missile-15 (FTM-15), ground stations sent STSS target track data to the C2BMC Experimental Labs for a simulated remote engagement by the Aegis BMD ship.

Aegis BMD

- In FY11, the Aegis BMD program continued the test and evaluation of the Aegis BMD 3.6.1 software load with the SM-3 Block IA interceptors. Aegis BMD 4.0.1 system testing was conducted both at-sea and in land-based laboratory facilities.
- The Aegis BMD program conducted three intercept tests. The first was Japan Flight Test Standard Missile-4 (JFTM-4) in October 2010 with Aegis BMD 3.6.1. The second was FTM-15 in April 2011 with Aegis BMD 3.6.1. The third was FTM-16 Event 2 in September 2011 with Aegis BMD 4.0.1. Using the fielded SM-3 Block IA interceptor, FTM-15 demonstrated, for the first time, the Aegis BMD capability to engage an intermediate-range separating ballistic missile during the midcourse phase of flight. This capability supports Phase 1of the Phased Adaptive Approach for defense of Europe. The SM-3 Block IB interceptor failed to hit its target during FTM-16 Event 2.
- Aegis BMD also participated in several BMDS system-level flight and ground tests including:
  - Fast Eagle hardware-in-the-loop exercise in October 2010
  - Assured Response 04X in October 2010
  - Flight Test Ground-based Interceptor-06a (FTG-06a) in December 2010
  - Ground Test Distributed-04b (GTD-04b) in February and March 2011
  - Ground Test Integrated-04d (GTI-04d) in July 2011
  - Technical Assessment-04 (TA-04)
  - GTD-04d Part I

GMD

- GMD executed the FTG-06a event in December 2010. FTG-06a was a re-test of the unsuccessful FTG-06 intercept attempt in January 2010. The AN/TPY-2 and SBX radars provided acquisition, track, and discrimination data to the GMD system. This test resulted in a failed target intercept. FTG-06a was the second flight test and intercept attempt by an interceptor equipped with the new Capability Enhancement II (CE II) Exo-atmospheric Kill Vehicle (EKV).

- The MDA executed the system-level event, GTD-04b, in February and March 2011 using fielded and to-be-fielded element software and BMDS element representations, which included GMD.

THAAD

- The THAAD program conducted one intercept flight test, Flight Test THAAD-12 (FTT-12) (IOT&E) on October 4, 2011, that ended in intercepts of two threat-representative targets.
- THAAD participated in GTD-04b and TA-04.

Patriot

- The Army began the Post-Deployment Build-7 (PDB-7) developmental test and evaluation on July 27, 2011, at White Sands Missile Range (WSMR), New Mexico. Ground testing runs for record ended on October 7. Developmental endurance and flight testing is scheduled to complete in January 2012. Data analysis is ongoing.
- A third MSE missile flight test, Flight Test Patriot-04 (FTP-04) (7-3), was conducted at WSMR in March 2011. Patriot fired two MSE interceptors at a ballistic missile target. The first MSE intercepted the target and the second intercepted debris from the first intercept.
- During the first PDB-7 flight test (FTP-05 or P7-4) at WSMR in November 2011, Patriot fired two Patriot Advanced Capability-3 (PAC-3) missiles at a short-range ballistic missile target. The first PAC-3 intercepted the target. Data analysis is ongoing.
- During the second PDB-7 flight test (P7-3) at WSMR in November 2011, Patriot fired two Guidance Enhanced Missile (GEM) interceptors at a short-range ballistic missile target. The first GEM intercepted the target. Data analysis is ongoing.
- During the third PDB-7 flight test (P7-2) at WSMR in November 2011, Patriot fired a GEM-T and GEM-C interceptor at each of two short-range ballistic missile targets. The GEM-T and GEM-C missile variants are intended to counter tactical ballistic missiles and cruise missiles, respectively. The GEM-Ts intercepted both targets. Data analysis is ongoing.

C2BMC

- C2BMC S6.2 participated in Fast Eagle and Assured Response-04D.
- C2BMC S6.4 participated in Assured Response-04X, FTG-06a, Caravan 2 United States Flight Test-4, GTD-04b, Assured Response-04D, FTM-15, GTI-04d, GTD-04d Part 1, GTX-04a, TA-04, FTM-16 E1, FTM-16 E2, FTT-12, and FTX-16 E1.

Assessment

- The 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, and nearly all element-level testing. They perform operational roles at individual element levels through major combatant command levels using operational tactics, techniques, and procedures.
- The elements that comprise the present and future BMDS are at different levels of testing and maturity.

Aegis BMD

- During FTM-15, Aegis BMD demonstrated launch-on-remote capability with "remote engagements authorized" against an intermediate-range ballistic missile target using an AN/TPY-2 (FBM) radar track. This capability supports Phase 1 of the Phased Adaptive Approach for defense of Europe, which is planned for deployment at the end of CY11.
- 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 during both JFTM-4 and FTM-15.
- In its first flight test, the SM-3 Block IB interceptor failed to intercept a separating target during FTM-16 Event 2 due to an in-flight missile failure. A Failure Review Board is analyzing the test data to determine the root cause of this failure.

GMD

- To date, GMD has demonstrated a limited capability against a simple threat. The FTG-06a 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 acquisition of specific critical engagement condition data. However, the root cause of the FTG-06a failure has been identified and fixes will be verified during a flight test to be conducted next year. Ground testing continued to demonstrate increasing GMD interoperability with the BMDS sensors and elements.
- GMD capability assessments are complicated by:
  - Extant differences between fielded and flight-tested interceptor configurations
  - Two flight test failures during the past 24 months
  - Interceptor design changes precipitated by parts obsolescence and previous flight test failures

THAAD

- THAAD demonstrated the ability to perform a multiple simultaneous engagement and the execution of a full battle sequence from planning through live operations during the FTT-12 IOT&E.

Patriot

- Patriot continues to provide mature and moderately well-understood capabilities against many of its short- and medium-range ballistic missile threats. This assessment is based 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 non-tactical ballistic missile threats is limited because Patriot endgame estimates were not made for these threats.

- The full report on Patriot can be found in the Army section of this Annual Report.

C2BMC

- C2BMC continued 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. C2BMC has demonstrated the capability to control a single AN/TPY-2 radar during flight testing.

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, and the FY09 recommendation regarding IMTP execution, are still valid.
- FY11 Recommendation.
  1. The MDA should repeat flight tests to verify root causes and Failure Review Board results for the Aegis BMD and GMD flight test failures to confirm permanent fixes to the problems the boards discovered.

Aegis Ballistic Missile Defense (BMD)

Executive Summary

- Aegis Ballistic Missile Defense (BMD) intercepted two separating ballistic missile targets in FY11, including an intermediate-range target engaged by a ship exercising launch-on-remote functionality.
- FY11 flight testing completed the planned FOT&E flight testing for the Aegis BMD 3.6.1 system with Standard Missile-3 (SM-3) Block IA interceptors.
- Aegis BMD continued developmental testing of the next generation Aegis BMD 4.0.1 system in FY11. The new system failed to intercept a separating ballistic missile with an SM-3 Block IB interceptor in its first developmental flight mission.
- Aegis BMD continued to improve interoperability with other BMDS elements and sensors during flight and ground testing in FY11.
- Hardware-in-the-loop (HWIL) ground testing demonstrated potential Aegis BMD capability to contribute to theater-level defense missions spanning a range of ballistic missile defense scenarios.

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 Launch System, which stores and fires SM-3 Block IA and Block IB interceptors (on select ships), and modified SM-2 Block IV interceptors (on select ships).
  - SM-3 Block IA and Block IB interceptors, which use a maneuverable kinetic warhead to accomplish midcourse engagements.
  - Modified SM-2 Block IV interceptors, which provide terminal engagement capability against short-range ballistic missiles.
- 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 datalinks.

Mission

The Navy can accomplish three missile defense-related missions using Aegis BMD:

- Defend deployed forces and allies from short- to intermediate-range theater ballistic missile threats
- Provide forward-deployed radar capabilities to enhance defense against ballistic missile threats of all ranges by sending cues or target track data to other elements of the BMDS
- 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

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 conclusion of the 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. In parallel, the program continued developmental testing of the Aegis BMD 4.0.1 system with SM-3 Block IB interceptors.
- The Aegis BMD program conducted two successful and one unsuccessful intercept missions in FY11:

In October 2010 during Japan Flight Test Standard Missile-4 (JFTM-4), a Japanese Aegis BMD destroyer intercepted a short-range separating target with an SM-3 Block IA interceptor. JFTM-4 also included two tracking events with separating ballistic missile targets, one of which included a cued simulated engagement by an Aegis BMD 3.6.1 destroyer. An Aegis BMD cruiser with an engineering load of 4.0.1 software also participated during the JFTM-4 events and conducted simulated engagements.

During Flight Test Standard Missile-15 (FTM-15) in April 2011, an Aegis BMD 3.6.1 destroyer, set up with remote engagements authorized, intercepted an intermediate-range separating target with an SM-3 Block IA interceptor using up-range track data from an AN/TPY-2 radar in forward-based mode (FBM). The FTM-15 engagement was the first intercept of an intermediate-range ballistic missile with an SM-3 Block IA interceptor, and the first intercept mission with a ship set up with remote engagements authorized. FTM-15 supports the assessment of Phase 1 of the Phased Adaptive Approach (PAA) for defense of Europe.

During FTM-16 Event 2 in September 2011, an Aegis BMD cruiser with 4.0.1 software failed to intercept a simple separating ballistic missile target with an SM-3 Block IB interceptor. FTM-16 Event 2 was the first intercept attempt for the new Aegis BMD 4.0.1 system with SM-3 Block IB interceptors.

- In FY11, 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 the Fast Eagle HWIL exercise in October 2010, during which ballistic missile defense capabilities were explored using laboratory assets for Aegis BMD, AN/TPY-2 (FBM), C2BMC, Space-Based Infrared System (SBIRS), and Patriot, with U.S. military operators manning the systems.
  - Laboratory and digital representations of Aegis BMD participated in Assured Response-04X in October 2010, a BMD exercise designed to develop and refine Concepts of Operations and tactics, techniques, and procedures, and to demonstrate BMDS capabilities.
  - Aegis BMD participated in Flight Test Ground-based Interceptor (FTG)-06a in December 2010, during which a cruiser with an engineering load of 4.0.1 software assessed the capability to conduct LRS&T on an intermediate-range multi-stage ballistic missile target and transmit track data to the BMDS using Link 16. The test also assessed launch-on-remote support capability by conducting a simulated SM-3 launch from a surrogate destroyer with 3.6.1.2 software based on live AN/TPY-2 (FBM) track data.
  - FTM-15 System Pre-Mission Test-1 (December 2010) and -2 (February 2011) utilized laboratory representations of Aegis BMD (3.6.1), AN/TPY-2, and C2BMC to characterize performance for the test scenario in FTM-15 as risk reduction studies prior to the flight mission.
  - Ground Test Distributed (GTD)-04b in February and March 2011 explored engagement capability against short-, medium-, intermediate-, and long-range ballistic missile threats using three Aegis BMD laboratory facilities and representations of other BMDS assets.
  - Laboratory and digital representations of Aegis BMD participated in Assured Response-04D in March 2011, which was a distributed exercise incorporating regionally focused active defense scenarios for architectures similar to those to be fielded as part of Phase 1 of the PAA for defense of Europe.
  - During FTM-16 Event 1 in March 2011, an Aegis BMD 4.0.1 cruiser conducted a simulated engagement against a complex separating short-range ballistic missile with an SM-3 Block IB simulated dynamic interceptor. Separate events following Event 1 tested BMD 4.0.1 anti-air warfare capability.
  - Flight Test Other (FTX)-16 Event 1 in March 2011 assessed the capability of Aegis BMD 3.6.1 to conduct a simulated engagement of a short-range ballistic missile using track data from the Space Tracking and Surveillance System.
  - Ground Test Integrated (GTI)-04d Part 1 in July 2011 and Part 2 in October 2011 tested the engagement capabilities of existing missile defense systems against short- and medium-range ballistic missiles, and tested system-level sensor resource management and tasking in an HWIL environment in support of a PAA Phase 1 assessment. Participants included SBIRS, Aegis BMD (laboratory sites with 3.6.1 software), AN/TPY-2 (FBM), and C2BMC.
  - Technical Assessment-04 in July 2011 explored PAA Phase 1 capability of the BMDS in the context of defending European allies and deployed forces from medium-range ballistic missile threats by simultaneously executing multiple theater engagements with Aegis BMD (3.6.1), AN/TPY-2 (FBM), and C2BMC in a digital modeling and simulation environment.
  - Ground Test Distributed-04d Part 1, conducted August to September 2011, consisted of a distributed ground test focusing on the communication architecture that will be deployed in PAA Phase 1. Participants included Aegis BMD (3.6.1), AN/TPY-2 (FBM), and C2BMC in a distributed environment using operational communication systems and operationally representative crews.
  - FTM-15 completed the planned FOT&E flight testing for the Aegis BMD 3.6.1 system with SM-3 Block IA interceptors. However, additional testing of the 3.6.1 system will occur during ground testing and in the upcoming Flight Test Operational (FTO)-01 mission in 4QFY12. FTO-01 will be an operational test of the BMDS.

Assessment

- In FY11, Aegis BMD demonstrated, for the first time, the capability to engage an intermediate-range separating ballistic missile in the midcourse phase with an SM-3 Block IA interceptor. In that engagement, the firing ship used track data forwarded by C2BMC from an AN/TPY-2 (FBM) radar to develop a firing solution. The engagement, which exercised Aegis BMD 3.6.1 launch-on-remote functionality, demonstrated an important type of engagement capability needed to support Phase 1 of the PAA for defense of Europe. Cued engagements against longer-range targets would be expected in the European theater.
- Anomalous behavior was observed during the flyout of the SM-3 Block IA interceptor in FTM-15, but the anomaly did not preclude an intercept. If the anomaly occurred under different engagement conditions, it could have had an impact on the success of the engagement. However, it should be noted that the anomaly was not observed in any of the 21 previous SM-3 flyouts. The cause of the anomaly is under investigation by the program.
- Aegis BMD continues to improve its interoperability with other BMDS elements and sensors, as demonstrated in recent ground testing. Improvements in interoperability are still needed, however, to ensure that Aegis BMD can send and receive cues and track data of sufficient quality to support PAA Phase 1, which will be deployed at the end of CY11.
- FTM-16 Event 2 failed to demonstrate the capability to intercept a ballistic missile with the new SM-3 Block IB interceptor fired from an Aegis BMD 4.0.1 ship. Although the interceptor failed to intercept the target, many of the new capabilities of the Aegis BMD 4.0.1 system were exercised during the mission, and functioned as designed. FTM-16 Event 2 was the first developmental firing mission with the Aegis BMD 4.0.1 system. A Failure Review Board is determining the root cause.

Recommendations

- Status of Previous Recommendations. The program addressed the single recommendation from FY10, when it conducted a launch-on-remote engagement against an intermediate-range target in FTM-15.
- FY11 Recommendation.
  1. The MDA should repeat flight tests to verify root causes and Failure Review Board results for the anomalous behaviors of the SM-3 Block 1A and Block 1B interceptors to confirm permanent fixes to the problems the boards discovered.

Command, Control, Battle Management, and Communications (C2BMC) System

Executive Summary

- Command, Control, Battle Management, and Communications (C2BMC) (Spiral 6.4) participated in two ground tests, four flight tests, and two exercises in FY11. C2BMC demonstrated the ability to control a single AN/TPY-2 (Forward-Based Mode [FBM]) radar, receive and forward tracks, and provide situational awareness by receiving and displaying element status data from a variety of Ballistic Missile Defense System (BMDS) sensors and weapons. C2BMC has demonstrated the ability to control two AN/TPY-2 (FBM) radars in a hardware-in-the-loop (HWIL) architecture only.
- The Missile Defense Agency (MDA) conducted Flight Test Standard Missile-15 (FTM-15) in April 2011. During the test, C2BMC forwarded AN/TPY-2 (FBM) tracks to Aegis Ballistic Missile Defense (BMD). The Aegis BMD ship conducted a launch-on-remote engagement of an intermediate-range target missile using the forwarded tracks.
- The MDA continues to track and correct C2BMC software anomalies, improve data presentation, and enhance situational awareness.

System

- C2BMC is a combatant command's interface to the fully integrated BMDS.
- More than 70 C2BMC workstations are fielded at U.S. Strategic, Northern, European, Pacific, and Central Commands, numerous Army Air and Missile Defense Commands, Air and Space Operations Centers, and other supporting warfighter organizations. 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 deliberate planning at the combatant command and component level, permitting a federation of planners across the BMDS. Elements use their own command, control, battle management systems and mission planning tools for stand-alone engagements.
- Currently, C2BMC Spiral 6.4 provides command and control for a single AN/TPY-2 (FBM) radar, with one radar currently located at Shariki, Japan, and one in Israel.
- C2BMC provides track forwarding of AN/TPY-2 (FBM) and AN/SPY-1 tracks to Ground-based Midcourse Defense (GMD). Additionally, it provides track forwarding of AN/TPY-2 (FBM) tracks to Aegis BMD for cueing and engagement.
- 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, and the implementation of the common X-band interface as the next step toward integrated sensor management.

Mission

U.S. Strategic, Northern, European, Central, and Pacific Commands currently use the following C2BMC tools and capabilities to support ballistic missile defense engagements:

- Deliberate and dynamic planning
- Situational awareness
- Track management
- AN/TPY-2 (FBM) sensor management and control
- Engagement monitoring
- Data exchange between C2BMC and BMD elements
- Network management

Major Contractor

Lockheed Martin Information Systems and Global Services – Gaithersburg, Maryland

Activity

Spiral 6.2 (S6.2)

- The operational version of C2BMC software at the U.S. European Command (USEUCOM) and the U.S. Central Command (USCENTCOM) is 6.2.
- C2BMC S6.2 participated in Fast Eagle, an HWIL test conducted in October 2010. The purpose of the test was to demonstrate the integration of AN/TPY-2 (FBM), C2BMC, Space-Based Infrared System (SBIRS), Aegis BMD, and Patriot for the USCENTCOM defense.
- In March 2011, C2BMC participated in a distributed U.S. Strategic Command (USSTRATCOM) exercise, Assured Response 04D (AR 04D), which focused on the Phased Adaptive Approach (PAA) Phase 1 scenarios. C2BMC provided situational awareness to the USEUCOM and USCENTCOM crews.

Spiral 6.4 (S6.4)

- In June 2011, S6.4 became the operational version of C2BMC software at the U.S. Northern Command (USNORTHCOM), the U.S. Pacific Command (USPACOM), and USSTRATCOM. Two Global Engagement Manager (GEM) suites were installed at USPACOM and USNORTHCOM as part of the initial S6.4 deployment.
- C2BMC participated in the global USSTRATCOM exercise Assured Response 04X (AR 04X). AR 04X used both strategic- and theater-level scenarios in the HWIL configuration to exercise the entire BMDS. C2BMC provided situational awareness for both defense of the continental U.S. and PAA Phase 1 scenarios. The USEUCOM sensor managers from the 357th Air and Missile Defense Detachment used GEM to control two AN/TPY-2 (FBM) radars through HWIL architecture.
- Flight Test Ground-based Interceptor-06a (FTG-06a) was an attempted GMD intercept of an intermediate-range target in December 2010. During the test, C2BMC received AN/TPY-2 (FBM) tracks, forwarded the tracks to GMD, and provided situational awareness in multiple locations. C2BMC received and displayed AN/TPY-2 (FBM), Sea-Based X-band (SBX), SBIRS, and GMD summary data, and collected data to support the FTM-15 risk reduction analysis.
- In February 2011, C2BMC participated in Caravan 2 United States Flight Test-4, which demonstrated interoperability between the Arrow Weapon System (AWS) and BMDS elements. C2BMC exchanged messages with Patriot and AWS and provided situational awareness.
- Ground Test Distributed-04b (GTD-04b), which took place in February and March 2011, was a BMDS distributed test focused on the defense of the continental U.S. from North Korean threats. During GTD-04b, the MDA collected data in support of the tri-node fielding decision for the S6.4 software. The USPACOM sensor managers from the 94th Army Air and Missile Defense Command used GEM to command and control a single AN/TPY-2 (FBM). C2BMC provided situational awareness and track forwarding functionality and demonstrated the integration of the new AN/TPY-2 software with S6.4.
- C2BMC S6.4 participated in AR 04D with S6.2 in March 2011. Both software versions provided situational awareness to the USEUCOM and USCENTCOM crews. The USEUCOM sensor managers from the 357th Air and Missile Defense Detachment again demonstrated concurrent control of two AN/TPY-2 (FBM) radars in an HWIL architecture.
- In April 2011, the MDA conducted FTM-15, which was the first launch-on-remote engagement of an intermediate-range target with Aegis BMD. The USPACOM sensor managers from the 94th Army Air and Missile Defense Command controlled the AN/TPY-2 (FBM) radar. C2BMC received AN/TPY-2 (FBM) tracks; processed, down-selected, and forwarded the tracks to the firing Aegis BMD ship; and provided situational awareness to the USPACOM crew. The ship launched an interceptor based on the track information received from C2BMC and successfully intercepted the target.
- Ground Test Integrated-04d took place in July 2011. It was a theater-level HWIL event intended to support the PAA Phase 1 assessment. The members of the 357th Air and Missile Defense Detachment controlled two AN/TPY-2 (FBM) radars using two GEM terminals. C2BMC provided situational awareness for the defense of Europe and Israel.
- The MDA conducted BMDS Technical Assessment-04 (TA-04), a fully-digital simulation, in 4QFY11 to assess the status of BMDS element-level digital simulations and BMDS-level integration of those simulations. TA-04 provides risk reduction for Performance Assessment-04, which is planned for 4QFY13. Multiple simulated threat scenarios stimulated digital representations of the BMDS and its elements within the defined PA-04 architecture. A digital C2BMC S6.4 representation primarily simulated PAA Phase 1 functions.
- The MDA conducted FTM-16 Event 2 in August 2011. In an HWIL environment, C2BMC forwarded target tracks from a deployed AN/TPY-2 (Terminal Mode) radar and Space Tracking and Surveillance System to the Aegis BMD simulator at the Navy's Space and Naval Warfare Systems Command.
- C2BMC participated in FTM-15, FTM-16 E1, FTX-16 E1, FTT12, FTM16 E2, and FTX-17 with prototype software to evaluate future capabilities the MDA plans for future deployment.

Assessment

- Apart from already existing C2BMC roles in providing situational awareness and some planning capability, S6.4 introduced the GEM suite at USPACOM and USNORTHCOM with a backup at Missile Defense Integration and Operations Center. 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.

- C2BMC has limited battle management capabilities allowing combatant command sensor managers to direct an AN/TPY-2 (FBM) radar to execute focused search plans or respond to a precision cue. S6.4 demonstrated command and control of a single AN/TPY-2 (FBM) radar in ground and flight tests. S6.4 demonstrated command and control of two AN/TPY-2 (FBM) radars in an HWIL test environment. The MDA plans to demonstrate this capability in a distributed test with deployed assets in December 2011.
- The February 2011 Caravan 2 United States Flight Test-4 revealed international interoperability and situational awareness problems that the MDA is addressing.
- Despite the participation of the USEUCOM sensor managers in several ground test events in FY11, the MDA has not yet tested the S6.4 suite at USEUCOM, which is part of the PAA Phase 1 capability. The MDA has scheduled this testing for November to December 2011.
- The MDA tested C2BMC S6.4 interactions with theater and strategic elements during GTI-04b and GTD-04b events in FY11. C2BMC S6.4 demonstrated interoperability with BMDS elements, but requires more extensive tests in order to support development of tactics, techniques, and procedures (TTPs). The MDA identified S6.4 software problems and improvements and continues to address them.
- During FTM-15, C2BMC S6.4 demonstrated the ability to forward AN/TPY-2 (FBM) tracks and support Aegis BMD launch-on-remote engagements of intermediate-range ballistic missiles. The MDA will continue to test the S6.4 interoperability with Aegis BMD in FY12 as part of the PAA Phase 1 assessment.
- The MDA is currently analyzing the data from TA-04. The MDA identified several integration and execution issues in TA-04 that the MDA will need to address prior to PA-04.

Recommendations

- Status of Previous Recommendations. The MDA addressed 8 of the previous 10 recommendations. The MDA continues to make progress on the FY06 recommendation to include assessments of information assurance during BMDS-centric C2BMC testing. The MDA has not yet addressed the FY10 recommendation to conduct theater flight testing with S6.4 software with multiple threats and multiple weapon elements.
- FY11 Recommendation.
    1. The MDA should demonstrate the C2BMC S6.4 capability to control at least two operationally-deployed AN/TPY-2 (FBM) radars using operational communications architectures, personnel, and TTPs.

Ground-Based Midcourse Defense (GMD)

Executive Summary

- Kill vehicle problems continue to impede progress in the Ground-based Midcourse Defense (GMD) flight test program. The Missile Defense Agency (MDA) conducted Flight Test Ground-based Interceptor-06a (FTG-06a) in December 2010. In this test, the exoatmospheric kill vehicle deployed but failed to intercept the target. The back-to-back intercept failures in FY10 and FY11 delayed achievement of flight test program goals by at least two years.
- The majority of fielded interceptors have Capability Enhancement I (CE-I) kill vehicles, which have been successfully flight tested. The MDA continues to discover problems with the GMD CE-II kill vehicle-equipped interceptors that require hardware and software changes. Ground test results suggest that the GMD system provides a limited capability for the defense of the U.S. Homeland against emerging intermediate-range and intercontinental ballistic missile threats. The MDA conducted Ground Test Distributed-04b (GTD-04b) in February and March 2011. GMD participation in that test provided insight into GMD functionality, interoperability, and performance within the BMDS.
- Lack of sufficient data for comprehensive model and simulation verification, validation, and accreditation continues to preclude end-to-end GMD performance assessment. The MDA continues to acquire GMD data and to evolve its data acquisition plan, but acquisition of sufficient data will require several more years of testing.

System

GMD is a Ballistic Missile Defense System (BMDS) element that counters intermediate-range and intercontinental ballistic missile threats to the U.S. Homeland. The BMDS includes:

- Cobra Dane Upgrade Radar at Eareckson Air Station (Shemya Island), Alaska
- Upgraded Early Warning Radars (UEWR) at Beale AFB, California; Fylingdales, United Kingdom; and Thule, Greenland
- Ground-based Interceptor (GBI) missiles at Fort Greely, Alaska, and Vandenberg AFB, California
- GMD ground system including GMD Fire Control (GFC) nodes at Schriever AFB, Colorado, and Fort Greely, Alaska; Command Launch Equipment (CLE) at Vandenberg AFB, California, and Fort Greely, Alaska; and In-Flight Interceptor Communication System Data Terminals at Vandenberg AFB, California, Fort Greely, Alaska, and Shemya Island, Alaska
- GMD secure data and voice communication system including long-haul communications using the Defense Satellite Communication System (DSCS), commercial satellite communications, and fiber optic cable (both terrestrial and submarine)

- External interfaces that connect to Aegis Ballistic Missile Defense (BMD); North American Aerospace Defense – U.S. Northern Command (NORAD-NORTHCOM) Command Center (N2C2) and Command, Control, Battle Management, and Communications (C2BMC) at Peterson AFB, Colorado; Space-Based Infrared System/Defense Support Program (SBIRS/DSP) at Buckley AFB, Colorado; and AN/TPY-2 (Forward-Based Mode [FBM]) radar at Shariki Air Base, Japan
- Sea-Based X-Band (SBX) radar, which is at sea with no permanent homeport (currently under continuing MDA development, but can be operationally deployed as needed)

Mission

Military operators for the U.S. Army Space and Missile Defense Command/Army Forces Strategic Command (the Army service component to U.S. Strategic Command) will use the GMD system to defend the U.S. Homeland against intermediate-range and intercontinental ballistic missile attacks using its weapon, the GBI, to defeat threat missiles during the midcourse segment of flight.

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-06a, a planned intercept flight test, in December 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 CE-II kill vehicle. FTG-06a was a re-test of the unsuccessful FTG-06 intercept attempt in January 2010.
  - The MDA launched an intermediate-range target ballistic missile with a simulated re-entry vehicle and associated objects from the Ronald Reagan Test Site at Kwajalein Atoll in the Republic of the Marshall Islands.
  - The SBIRS/DSP system participated in this flight test.
  - An AN/TPY-2 (FBM) radar at Wake Island and the SBX radar at a test location in the Pacific Ocean provided target acquisition and track data to the GMD system. In addition, the SBX provided discrimination data to the GMD system.
  - C2BMC at Wake Island forwarded AN/TPY-2 radar tracks to GMD and provided situational awareness to combatant commanders.
  - Military personnel from the Army 100th Missile Defense Brigade at Schriever AFB, Colorado, directed the launch of a GMD interceptor from a silo at Vandenberg AFB, California.
  - The GMD interceptor flew to its designated point and deployed an exoatmospheric kill vehicle.
  - The exoatmospheric kill vehicle acquired the target complex and discriminated the most lethal object, but the kill vehicle failed to intercept the target re-entry vehicle.
- Due to the failed FTG-06a intercept, the MDA changed the GMD flight test program.
  - The MDA initiated a Failure Review Board, and that board subsequently identified the root cause of the failure to intercept. The MDA is testing corrective actions on kill vehicle components to correct undesirable performance.
  - The MDA added an interceptor-only flight test, GMD Controlled Test Vehicle-01 (GM CTV-01), in 3QFY12 that would verify interceptor fixes developed in response to the Failure Review Board findings.
  - The MDA added a new intercept flight test attempt, FTG-06b, in 4QFY12 to demonstrate intercept and to achieve the unmet objectives of FTG-06 and FTG-06a.
  - To accommodate the new interceptor flight tests, the MDA rescheduled FTG-13 from 4QFY13 to 4QFY16 (and made it an operational test), FTG-15 from 4QFY16 to 4QFY17, FTG-12 from 4QFY17 to 4QFY21, FTG-08 from 4QFY14 to 3QFY14, and removed the GMD salvo test from FTO-02. The GMD salvo test is now FTG-11, and its planned date remains 4QFY15. FTG-14 moved from 4QFY21 to 4QFY22.
- The MDA conducted BMDS Ground Test Distributed-04b (GTD-04b), a ground test of fielded and to-be-fielded elements, components, and communications, in February and March 2011 to demonstrate functionality, interoperability, and performance of a to-be-fielded version of the BMDS and its elements.
  - Threat scenarios stimulated operational BMDS elements and test version elements located at multiple sites throughout the United States.
  - The GMD system participated and employed GMD communications and an updated version of GFC software in the GFC operational nodes at Schriever AFB, Colorado, and Fort Greely, Alaska.
  - During a portion of GTD-04b, operational military personnel at the Army 100th Missile Defense Brigade at Schriever AFB, Colorado, and the 49th Battalion at Fort Greely, Alaska, executed operational tactics, techniques, and procedures for the simulated GMD defense of the U.S. Homeland against intermediate-range and intercontinental ballistic missile attacks.

Assessment

- Kill vehicle problems continue to impede progress in the GMD flight test program. In FTG-06a, the second flight test of a CE II kill vehicle, the FTG-06 kill vehicle failure mode was not observed, but other undesirable kill vehicle performance occurred and resulted in a failed intercept attempt. The back-to-back intercept flight test failures in FY10 and FY11 delay achievement of intercept flight test program goals by at least two years. The undesirable kill vehicle performance that caused the failed intercept will be reviewed in the classified annex of DOT&E's "2011 Assessment of the Ballistic Missile Defense System (BMDS)" report to Congress.
- FTG-06a achieved a number of test objectives with some limitations. The MDA, for the first time, launched a GMD interceptor on track data provided by the AN/TPY-2 (FBM) radar. In addition, the MDA verified the effectiveness of software changes that were made to the SBX radar in response to its undesirable performance in FTG-06 and demonstrated a capability of the SBX radar to support engagement of an intermediate-range ballistic missile target. The MDA, however, employed the SBX radar in FTG-06 in a manner that departed from full operational realism in order to achieve specific developmental test objectives and to reduce risk to the achievement of primary test objectives. Military personnel from the Army 100th Missile Defense Brigade directed launch of the GMD interceptor, but they employed tailored tactics, techniques, and procedures that departed from full operational realism and that were driven by test constraints. The MDA also acquired additional data on interceptor launch and fly out performances. Although an intercept was not achieved, target complex signature and feature data were collected to verify EKV discrimination algorithms. A classified assessment of the SBIRS/DSP system performance will be reviewed in the classified annex of DOT&E's "2011 Assessment of the Ballistic Missile Defense System (BMDS)" report to Congress.

- GTD-04b demonstrated the integrated capability of new versions of the BMDS and its elements. The GMD system participated in this ground test with a new version of GFC software. The GMD system exercised communications internally among the GMD components and externally to the BMDS and the BMDS sensors at operational locations. GTD-04b provided insight into GMD functionality, interoperability, and performance within the BMDS. Test results suggest that the GMD system provides a limited capability for the defense of the U.S. Homeland against emerging intermediate-range and intercontinental ballistic missile threats. GMD 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.
- Acquisition of suitability data continued. Further refinements of the BMDS Joint Reliability and Maintainability Evaluation Team database are necessary to support evaluation of reliability, availability, and maintainability. Incomplete data requirements for the GMD interceptor and command and launch equipment limit database utility. In addition, the database lacks software maturity metrics for all components. The ongoing discovery and fix of interceptor problems complicate assessment of the operational effectiveness and suitability of the GMD interceptor.
- The MDA lacks threat and target payload models for GMD lethality assessment and lacks full-scale, high-fidelity test data to validate GMD lethality performance. Such models and data will be needed.
- MDA survivability testing is not adequate to support a survivability assessment of the GMD system and its components. The MDA has taken several steps to improve the survivability of the GMD operational architecture. These steps include the geographic dispersal of the GFC nodes as well as hardening of a new power plant supporting power generation and distribution to mission-critical facilities and equipment. However, the level of survivability of other specific GMD components to electromagnetic pulse and high-power microwave attacks is uncertain. The MDA has set up a High-Altitude Exoatmospheric Nuclear Survivability Executive Steering Committee to assess and direct efforts. The MDA has also developed a High-Altitude Exoatmospheric Nuclear Survivability standard that is intended to describe better the high-altitude electromagnetic pulse environment.

Recommendations

- Status of Previous Recommendations. The MDA has satisfactorily addressed 9 of the previous 10 GMD recommendations. In FY07, DOT&E recommended the MDA re-examine the GMD-specific lethality simulation needs in light of test data that have emerged from MDA target lethality testing since its last accreditation. Although the MDA has made progress, this recommendation remains open.
- FY11 Recommendation.
  1. The MDA should repeat the flight test to verify root causes and Failure Review Board results for the issues found during FTG-06a to confirm permanent fixes to the problems the board discovered.

Terminal High-Altitude Area Defense (THAAD)

Executive Summary
- The Terminal High-Altitude Area Defense (THAAD) system intercepted two short-range targets nearly simultaneously on October 4, 2011.
- The program completed this multiple simultaneous intercept as part of an IOT&E, which included a full battle sequence, from planning through live operations, under operationally realistic conditions. The assessment of this event will support upcoming production and fielding decisions.
- THAAD continued to make progress completing the first phase of the government ground test program, which is a critical component of the Army materiel readiness release process.
- The materiel release decision for transitioning the first two THAAD fire units from the MDA to the Army has been further delayed until FY12. 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.
- The MDA targets program returned Coleman air-launched targets to flight in July 2011, which will allow the THAAD program to test against an important set of threat characteristics in FY13.

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 Ballistic Missile Defense (BMD), satellites, and other external theater sensors and command and control systems.
- THAAD will complement the lower-tier Patriot system and the upper-tier Aegis BMD system.

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-12 (FTT-12) occurred on October 4, 2011. The test was a successful multiple simultaneous engagement with nearly simultaneous intercepts of two short-range targets. This test was also an IOT&E supporting the upcoming THAAD materiel release and Beyond Low-Rate Initial Production decisions. The THAAD battery performed battle planning, overseas deployment, emplacement, and operations under operationally realistic conditions (within the constraints of test range safety). As part of the IOT&E, the battery demonstrated system capability against a raid, defeating threats generated by the Simulation Over Live Driver (SOLD).
- The THAAD government ground test qualification program completed hot and cold spectrum missile safety testing and rail impact testing for the launcher. Regression rail impact and dust testing for the battery support center were also performed, after several components were redesigned because of previous test failures. Most THAAD ground qualification testing

is now complete, but planning continues as redesigns and capability and obsolescence upgrades take place.

- THAAD participated in one Aegis BMD flight test event in September 2011, FTM-16 Event 2, with the full battery deployed for FTT-12. The THAAD radar observed the target, and TFCC exchanged data with Command, Control, Battle Management, and Communications (C2BMC) and Aegis BMD. The program also performed mission scenarios using SOLD during the pre-test communication checks.
- Throughout 2011, THAAD completed supplementary testing and analyses to support the THAAD lethality assessment.
- Laboratory hardware-in-the-loop and digital representations of THAAD, with operators-in-the-loop, participated in the Assured Response-04X and -04D exercised in October 2010 and February to March 2011, respectively. These exercises are used to develop and refine Concepts of Operations and tactics, techniques, and procedures.
- Ground Test Integrated-04d in July 2011 included laboratory hardware-in-the-loop representations of THAAD. Interoperability and engagement capabilities against short- and medium-range ballistic missiles were tested using BMDS configurations that are deployed or nearing deployment.
- THAAD also participated in Technical Assessment-04 in July 2011. This event used a digital modeling and simulation environment to assess various theater defense capabilities using near-term BMDS configurations.
- The MDA conducted a Reliability Confidence Test in 4QFY11 at McGregor Range, New Mexico, to demonstrate reliability growth in support of an Army conditional materiel release.

Assessment

- THAAD made progress in FY11, demonstrating in FTT-12 the ability to perform a multiple simultaneous engagement. The Operational Test Agency also collected essential technical data on intercepts far off the radar boresight and on performance against unique threat characteristics.
- THAAD also demonstrated a full battle sequence, from planning through live operations, under operationally realistic conditions (within the constraints of test range safety) in FTT-12. The assessment of this event will support upcoming production and fielding decisions.
- 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.
- The Army's Materiel Release Review Board for THAAD has again been delayed, from FY11 to FY12. Army safety review boards recently identified testing that should be complete before the system can be certified, and the testing is not scheduled to complete until 1QFY12. 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.
- The Reliability Confidence Test in 4QFY11 at McGregor Range, New Mexico, included 233 hours of continuous operation demonstrating reliability growth over that demonstrated in the Limited User Test conducted in FY10.
- The MDA targets program returned Coleman air-launched targets to flight in July 2011, which will allow the THAAD program to test against an important set of threat characteristics in FY13. Target development and testing for the longer-range THAAD flight tests, which start in FY12, is still ongoing.

Recommendations

- Status of Previous Recommendations. Although the MDA has made 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.
- FY11 Recommendation.
  1. The MDA should demonstrate THAAD capability to intercept and destroy a medium-range ballistic missile target during one of the next two planned flight tests.

Sensors

Executive Summary

- The AN/TPY-2 Forward-Based Mode (FBM) radar participated in Flight Test Ground-based Interceptor-06a (FTG-06a) in December 2010 and Flight Test Standard Missile-15 (FTM-15) in April 2011. In FTG-06a, the Missile Defense Agency (MDA) demonstrated AN/TPY-2 (FBM) radar capability to provide track data that supported the engagement planning and launch of a Ground-based Midcourse Defense (GMD) interceptor against an intermediate-range ballistic missile target and, for the first time, the MDA launched a GMD interceptor based on AN/TPY-2 (FBM) radar track data. In FTM-15, the MDA demonstrated AN/TPY-2 (FBM) radar capability to provide up-range track data that supported engagement of an intermediate-range ballistic missile target by a missile from an Aegis Ballistic Missile Defense (BMD) destroyer.
- The Sea-Based X-band (SBX) radar participated in FTG-06a. In this test, the MDA verified the effectiveness of software changes that it made to the SBX radar in response to the radar's undesirable performance in FTG-06. SBX demonstrated a capability to provide track data that supported GMD engagement planning against an intermediate-range ballistic missile target. The MDA, however, employed the SBX radar in a manner that departed from full operational realism.
- The MDA has gained significant operational experience with each of the Ballistic Missile Defense System (BMDS) sensors since the completion of sensor upgrade and development programs. The MDA and the BMDS Operational Test Agency Team, however, have not fully accredited models and simulations of the BMDS sensors for performance assessment.

System

The BMDS sensors are systems that provide real-time ballistic missile threat data to the BMDS. The data are used to counter ballistic missile attacks. These sensor systems are operated by the Army, Navy, Air Force, and BMDS, and include a satellite-based, infrared sensor system and seven phased array radar systems. The sensor systems are:

- Space-Based Infrared System/Defense Support Program (SBIRS/DSP), a satellite constellation of infrared sensors operated by the Air Force with an external interface to the BMDS located at Buckley AFB, Colorado

SBIRS/DSP

- Fixed site, fixed orientation, phased array radars
  - Cobra Dane Upgrade (CDU) Radar, an L-band radar (one radar face that provides 120-degree azimuth field of view) operated by the Air Force and located at Eareckson Air Station (Shemya Island), Alaska

Cobra Dane

  - Upgraded Early Warning Radars (UEWRs), ultra high frequency radars operated by the Air Force and located at Beale AFB, California (two radar faces that provide 240-degree azimuth field of view); Fylingdales, United Kingdom (three radar faces that provide 360-degree azimuth field of view); and Thule, Greenland (two radar faces that provide 240-degree azimuth field of view

UEWR

  - AN/TPY-2 (FBM) Radars, X-band radars (one radar face that provides 120-degree azimuth field of view) operated by the Army and located at Shariki Air Base, Japan and a site in Israel

AN/TPY-2

- Mobile platform, variable orientation, phased array radars
  - Aegis Ballistic Missile Defense (Aegis BMD) AN/SPY-1 Radars, S-band radars (four radar faces that provide 360-degree azimuth field of view) operated by the Navy and located aboard Aegis BMD-capable cruisers and destroyers

Aegis BMD

- Sea-Based X-Band (SBX) Radar, an X-band radar operated by BMDS and located aboard a twin hulled, semi-submersible, self-propelled, ocean-going platform (primarily a test asset that can be operationally deployed as needed)


SBX

Mission

Military operators for the 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 that target the United States, U.S. allies, and U.S friends
- Provide data for situational awareness and battle management to the BMDS Command, Control, Battle Management, and Communications (C2BMC) element
- Provide data that support engagement of ballistic missile threats by the Aegis BMD and GMD systems

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 Radar

- The Aegis BMD radar, in its long-range surveillance and track capacity, participated in FTG-06a in December 2010 as an associated operation and acquired track data on the intermediate-range ballistic missile target. It also participated in multiple live tracking exercises during FY11 in the long-range surveillance and track capacity.
- Digital, or hardware-in-the-loop, representations of the Aegis BMD radar participated in the BMDS-level Ground Test Distributed 04b (GTD-04b) in February and March 2011 and Technical Assessment 04 (TA-04) in 4QFY11.

AN/TPY-2 (FBM) Radar

- The AN/TPY-2 (FBM) radar participated in FTG-06a from a location on Wake Island and, in that test, provided real-time track data to the GMD system.
- The AN/TPY-2 (FBM) radar also participated in FTM-15 in April 2011; in that test, the AN/TPY-2 (FBM) radar provided up-range track data to C2BMC for processing, down-select, and forwarding of tracks to an Aegis BMD 3.6.1 destroyer that was set up with remote engagements authorized.
- Digital representations of the AN/TPY-2 radar participated in the BMDS-level GTD-04b and TA-04.

Cobra Dane Radar

- In FY11, the Cobra Dane radar observed targets of opportunity. The Cobra Dane radar also tracked orbital debris and active satellites as a contributory sensor to the U.S. Space Command Space Surveillance Network.
- Digital representations of the Cobra Dane radar participated in the BMDS-level GTD-04b.

SBIRS/DSP System

- During FY11, the SBIRS/DSP system observed domestic and foreign launch events, provided launch event data to the operational BMDS, and participated in FTG-06a and FTM-15.
- Digital representations of the SBIRS/DSP system participated in the BMDS-level GTD-04b, TA-04, and multiple other BMDS-level ground tests.

SBX Radar

- The SBX radar participated in FTG-06a from a location in the Pacific Ocean, and in that test, provided real-time track data to the GMD system.
- Digital representations of the SBX radar participated in the BMDS-level GTD-04b.
- The SBX mobile platform (with SBX radar onboard) transited to Vigor Shipyard Seattle (formerly Todd Pacific Shipyards) in Seattle, Washington, in May 2011 and underwent scheduled maintenance and upgrades in May through August.

UEWR

- The UEWR at Beale AFB viewed the GMD interceptor flyout in FTG-06a, but due to its location, it played no role in target engagement.
- Digital representations of the UEWRs at Beale, Fylingdales, and Thule participated in the BMDS-level GTD-04b.
- The MDA issued a pre-solicitation notice in June 2011 of intent to upgrade Air Force Early Warning Radars at Clear

Air Force Station, Alaska, and Cape Cod, Massachusetts, to become part of the MDA's sensor network.

Assessment

- The MDA has gained significant operational experience with each of the BMDS sensors since the completion of sensor upgrade and development programs.
- The MDA and the BMDS Operational Test Agency Team, however, have not fully accredited models and simulations of the BMDS sensors for performance assessment. Representations of the AN/TPY-2 (FBM) radar, the SBX radar, and the UEWR have been accredited for limited uses. Representations of the Aegis BMD radar, the Cobra Dane radar, and the SBIRS/DSP system have not been accredited.

Aegis BMD Radar

- The MDA continues to evaluate the capability of the Aegis BMD radar in its long-range surveillance and track mode to support GMD engagement of intermediate-range and intercontinental ballistic missile threats.
- The Aegis BMD radar has participated in FTGs as an associated operation and as an operational sensor asset that has supported intercepts as part of an ensemble of sensors that included the AN/TPY-2 (FBM) radar, the SBX radar, and the UEWR at Beale AFB.
- The MDA has not conducted a BMDS intercept flight test that uses the Aegis BMD radar data in real-time as the primary data source for GMD engagement planning.

AN/TPY-2 (FBM) Radar

- In FTG-06a, the MDA demonstrated AN/TPY-2 (FBM) radar capability to provide track data that supported the engagement planning and launch of a GMD interceptor against an intermediate-range ballistic missile target and, for the first time, the MDA launched a GMD interceptor based on AN/TPY-2 (FBM) radar track data.
- In FTM-15, the MDA demonstrated Aegis BMD capability to use up-range track data from an AN/TPY-2 (FBM) radar to support engagement of an intermediate-range separating target. In that test, an Aegis BMD 3.6.1 destroyer, set up with remote engagements authorized, intercepted an intermediate-range separating target with a Standard Missile-3 (SM-3) Block IA missile using up-range AN/TPY-2 (FBM) radar track data.

Cobra Dane Radar

- Due to its location and field-of-view, the Cobra Dane radar has not participated in BMDS intercept flight tests.
- Data from targets of opportunity and ground tests support performance estimates for the current configuration of the Cobra Dane radar. These estimates rely on models and simulations that are not yet validated and accredited for use in performance assessment. The MDA plans to conduct a target flight test through the Cobra Dane radar field-of-view in 3QFY15 to support model and simulation accreditation.

SBIRS/DSP System

- SBIRS/DSP system performance will be reviewed in the classified annex of DOT&E's "2011 Assessment of the Ballistic Missile Defense System (BMDS)" report to Congress.

SBX Radar

- In FTG-06a, the MDA verified the effectiveness of software changes that were made to the SBX radar in response to its undesirable performances in FTG-06 and demonstrated a capability of the SBX radar to provide track data that supported the engagement planning against an intermediate-range ballistic missile target.
- The MDA, however, employed the SBX radar as an acquisition radar (rather than in its normal role as just a tracking radar) in order to achieve specific developmental test objectives and to reduce risk to the achievement of primary test objectives.

UEWR

- Due to their locations and fields-of-view, the UEWRs have not participated in BMDS intercept flight tests in an operationally realistic manner.
- Data from targets of opportunity and ground tests support performance estimates for the current configuration of the UEWRs. These estimates rely on models and simulations that have not been fully accredited for use in performance assessment.

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.
- FY11 Recommendation.
  1. The MDA should conduct a BMDS intercept flight test that uses the Aegis BMD radar data in real-time as the primary data source for GMD engagement planning.

Technology Programs

Executive Summary

- The Missile Defense Agency (MDA) is pursuing a number of technology programs, including the Airborne Laser Test Bed (ALTB), the Precision Tracking Space System (PTSS), and the Airborne Infrared (ABIR) system.
- During FY10, the MDA transferred the Airborne Laser (ABL) to a national test platform (ALTB) for maturing advanced directed energy technologies for missile defense under the oversight of the Director, Defense Research and Engineering. During the past year, the ALTB conducted two flight tests involving boosting, liquid-fueled Foreign Material Acquisition (FMA) targets. These tests were unsuccessful due to unrelated hardware and software problems. The DoD continues to assess the future of the ALTB.
- The PTSS program is pursuing a pre-launch technology development program, incorporating state-of-practice 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. STSS participated in five flight tests and collected track data in all five tests.
- 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. ABIR participated in five flight tests and collected data in four tests.

Systems

ALTB

The ALTB is a national test bed operated by the MDA. It consists of:

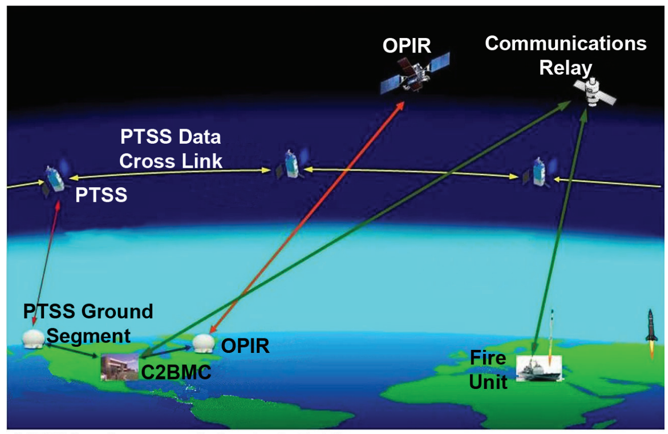
- A modified Boeing 747 400F commercial aircraft.
- A megawatt-class chemical oxygen-iodine laser.
- A laser turret on the aircraft nose and two illuminator lasers on a bench in the fuselage.
- Optical benches with highly sensitive cameras, sensors, and mirrors.
- Hardware and software for battle management, command, control, communications, computers, and intelligence.
- Ground support equipment for storing, mixing, transporting, and loading laser chemicals.

ALTB

PTSS

The PTSS is a program soon to enter technology development 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, 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, intermediate-range, and intercontinental 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: Johns Hopkins University Applied Physics Laboratory – Laurel, Maryland
- 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.

ALTB

- In February 2010, the system successfully conducted the first set of in-flight lethality demonstrations against both liquid- and solid-fueled missiles.
- In September and October 2010, the MDA conducted two subsequent tests against boosting, solid-fueled FMA targets, but problems during both tests prevented high-energy lasing from occurring.
  - During the September 2010 flight test, one of the beam-directing mirrors in the optical bench exceeded pointing limits while the high-energy laser was lazing the target. The built-in auto safety features immediately shut down the laser after about 1.1 seconds of laze. It appears there was an error in the beam-directing software.
  - During the October 2010 flight test, the high-energy laser incorrectly reported it was not ready to fire and aborted the engagement. The MDA traced the cause to a single micro-switch on an iodine valve that incorrectly reported a closed-valve condition. The MDA replaced the valves and implemented new software procedures to ensure a single fault of this type cannot cause a system abort in the future.

PTSS

- The STSS demonstration program and the NFIRE program are supporting the development and fielding of PTSS by acting as surrogate sensors.
- STSS participated in Japanese Flight Test Standard Missile-4 (JFTM-4) Event 1 in October 2010 and collected stereo tracking data on a simple separating short-range ballistic missile (SRBM) target. JFTM-4 Event 1 was the first stereo data collection on a ballistic missile.
- The MDA conducted Flight Test Other-16 (FTX-16) Event 1 in March 2011 to assess the capability of Aegis BMD to conduct a launch-on-remote engagement of a ballistic missile using the STSS track data. STSS tracked a simple unitary SRBM from boost through re-entry, but due to a problem in the External Sensors Laboratory (ESL), track data did not go to the Aegis BMD ship for a simulated Aegis BMD launch-on-remote engagement.
- Flight Test Standard Missile-16 (FTM-16) Event 1 in March 2011 was a simulated Aegis BMD engagement of a complex separating SRBM target. Satellite Vehicle 1 detected and tracked the target in the post-boost stage of flight.
- In July 2011, STSS participated in the return-to-flight demonstration of air-launched SRBM targets, Flight Test Other-17 (FTX-17). During the test, both STSS Satellite Vehicles detected and tracked the target in both boost and post-boost stages of flight to form a stereo track.
- During THAAD FTT-12 (IOT&E) in October 2011, STSS successfully tracked both targets and sent track data to the ESL. By test design, the ESL did not forward the data to THAAD.

- In addition to flight testing, the MDA plans to use analysis and hardware-in-the-loop testing to develop PTSS. During the past year, MDA demonstrated the following:
  - Accurate, simultaneous tracking (stereo track) of the same target by two STSS satellites.
  - Launch-on-remote performance against live targets in FTM-15 using Aegis BMD hardware-in-the-loop.
  - Engage-on-remote performance multiple times using simulated data in hardware-in-the-loop testing.
  - STSS receiving systems cues during FTM-15, ABIR/STSS track data fusion in post-test experiments, and STSS providing precision cues during FTM-16 E2 in a simulation-over-live scenario.

ABIR

- ABIR sensors collected data during JFTM-4 Event 3.
- During FTX-16 Event 1 in March 2011, ABIR successfully acquired the target based on a boost-phase cue from STSS tracks.
- In March 2011, ABIR participated in FTM-16 Event 1. During the test, ABIR acquired and tracked the target based on a cue. ABIR also demonstrated multi-object tracking.
- ABIR participated in FTX-17 in July 2011. During the test, ABIR received a cue from the C2BMC prototype software generated from data from the overhead sensors, but did not track the target.
- During the THAAD FTT-12 (IOT&E) in October 2011, ABIR successfully tracked both targets.
- Over the next few years, the MDA intends to evaluate the following ABIR capabilities during flight testing with the existing hardware:
  - The ability of ABIR to generate a two-dimensional track with sufficient accuracy and timeliness to support BMDS engagement.
  - The ability of ABIR to extract feature data with a two-color infrared sensor to support discrimination.
  - The raid size capacity of ABIR.
  - The ability of ABIR to generate a 3-dimensional track from a single platform.
  - The ability of advanced sensors to extract additional features from a threat.

Recommendations

- Status of Previous Recommendations. There were no previous recommendations.
- FY11 Recommendations. None.

Live Fire Test and Evaluation

Live Fire Test and Evaluation

Live Fire Test and Evaluation Program

DOT&E executed oversight of survivability and lethality test and evaluation for 118 acquisition programs in FY11. Of those 118 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.

DOT&E published LFT&E reports on the following program during the past year:

- Medium Tactical Vehicle Replacement (MTVR) Family of Vehicles (FoV)
- Mine Resistant Ambush Protected (MRAP) – All Terrain Vehicle (M-ATV) Underbody Improvement Kit (UIK)

DOT&E published special reports regarding LFT&E on the following programs during the past year:

- M855A1 Lead-Free, 5.56 mm Cartridge
- Protocols on Military Combat Helmet Standards for Ballistic Testing
- High Mobility Multi-purpose Wheeled Vehicle (HMMWV) Expanded Capacity Vehicle (ECV) Family of Vehicles (FoV)
- Special Operations Forces (SOF) Mine Resistant Ambush Protected – All Terrain Vehicle (M-ATV)
- MRAP Force Protection Industries Cougar A1 and A2 Independent Suspension System (ISS) Vehicles
- Stryker Double-V Hull (DVH) Infantry Carrier Vehicle (ICV)

DOT&E published combined OT&E/LFT&E reports on the following acquisition programs entering full-rate production:

- C-27J Joint Cargo Aircraft
- Excalibur Increment 1A-2
- C-5 Reliability Enhancement and Re-Engining Program

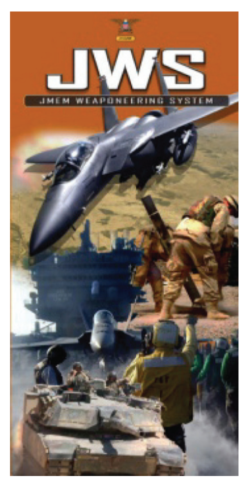
DOT&E also published a combined Early Fielding Report on the Precision Lethality Mark 82 (MK 82) Bomb and a combined FOT&E Report on the MH-60R Multi-Mission Helicopter and MH-60S Multi-Mission Combat Support Helicopter.

In addition to satisfying acquisition 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). The program also 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 and improves survivability analysis tools (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 ensure development of consistent, credible effectiveness estimates for conventional munitions across the DoD. DOT&E oversees the JTCG/ME and provides funding. The JTCG / ME produces and distributes this data in Joint Munitions Effectiveness Manuals (JMEMs). The primary application supported is weaponeering, the detailed technical planning of a weapon strike that occurs at multiple levels in the operational chain of command before actual combat. JMEMs provide computerized operational tools and data for rapid evaluation of alternative weapons and their delivery against specific targets. In many cases, collateral damage estimates generated by these tools are part of the decision criteria for strikes approved at the highest levels of the U.S. Government.

In FY11, the JTCG/ME published two updated JMEMs. The first was the JMEM Weaponeering System (JWS) v2.1 for use with air-to-surface and surface-to-surface weapons. In addition to weapons effectiveness data, JWS includes target vulnerability information for approximately 1,500 targets, including descriptive information, data, and graphics; computer programs and methods needed to accomplish weaponeering; step-by-step training guides, and help files. A major upgrade in JWS v2.1 is the Fast Integrated Structural Tool, requested by U.S. Central and Pacific Commands to enable modeling buildings, bunkers, and tunnels rapidly, within a single program for time sensitive strike evaluation. The JTCG/ME continued to provided direct support to the Joint Staff "No-Strike and The Collateral Damage Estimation Methodology" process, publishing updates to the set of collateral effect radii (CER) tables. Both the JWS software and the CER tables were used extensively during U.S. Africa Command's Odyssey Dawn in support of international military operation in Libya. JTCG/ME also accredited a new collateral damage estimation tool for operational use, which displays collateral damage effective radii reference tables for quick evaluation of potential effects in a target area.



The second JMEM published in FY11 was the Joint Anti-Air Combat Effectiveness (J-ACE) v5.0. J-ACE contains a joint anti-air model and this version has incorporated 21 new or updated threat models for enemy air-to-air and surface-to-air missiles. J-ACE can perform logic checks for maximum off-bore sight launch angle limits that are used by pilots developing tactics at both the U.S. Air Force's Fighter Weapon School and the U.S. Navy's Topgun programs. Additionally, J-ACE v5.0 contains updates on the weapon engagement zone (launch control) effectiveness data for seven U.S. systems and various architectural and graphical user interface improvements. Pilots use this JMEM to develop air superiority methods and by the U.S. Strategic Command for global strike mission planning.

In addition, JTCG/ME continued efforts to develop a JMEM in support of information operations. These efforts, performed in coordination with the U.S. Strategic Command, the U.S. Air Force Targeting Center, and various other government agencies, resulted in enhancements to computer network attack and electronic warfare tools. Initiatives related to JMEM development for other non-traditional effects (e.g., non-lethal weapons, high-energy laser, and high power microwave) continued in conjunction with the Joint Non-Lethal Weapons Directorate at Quantico, Virginia, and the High Energy Laser Joint Technology Office (HELJTO), Albuquerque, New Mexico.

JOINT AIRCRAFT SURVIVABILITY PROGRAM (JASP)

DOT&E sponsors and funds the JASP. The Naval Air Systems Command, the Army Aviation and Missile Command, and the Air Force Aeronautical Systems Center charter the program. DOT&E establishes objectives and priorities for JASP and exercises oversight of the program. JASP increases the effectiveness of DoD aircraft by developing techniques and technology to improve the survivability of U.S. military aircraft. Working with joint and Service staffs, other government agencies, and industry, JASP develops new capabilities and works to assure the Services jointly pursue it.

In FY11, JASP continued to work with the Office of the Assistant Secretary of Defense for Research and Engineering on the Helicopter Survivability Task Force (HSTF). This multi-disciplinary team is tasked with rapidly fielding techniques and technology to improve the survivability of helicopters in theater.

JASP expertise in survivability technologies supported funding two specific vulnerability reduction technologies by HSTF: Firetrace™ passive fire protection for the V-22 and multi-hit transparent armor for MH-47G and UH 60 helicopters. Firetrace™ installation on the V-22s deployed in Operation Enduring Freedom was completed in FY11. Plans to install Firetrace™ on all remaining V 22s were approved by the Navy in September 2011. The designs for multi-hit transparent armor are complete and will soon enter low-rate initial production to outfit aircraft in Afghanistan.

JASP supported the Joint Multi-Role (JMR) Technology Capabilities Demonstration (TCD) program as a member of the Platform Integrated Product Team. The JMR TCD purpose is to demonstrate transformational vertical lift capabilities for developing the next generation, vertical lift fleet. JASP was instrumental in establishing the assumptions and requirements for the vulnerability analysis to be used in evaluating the initial three government model prototypes.

JASP funded 56 multi-year survivability projects for $10.2 Million and delivered 40 reports in FY11. The following examples typify JASP efforts in four focus areas: susceptibility reduction, vulnerability reduction, survivability assessment, and combat damage assessment.

Susceptibility Reduction

These projects address urgent aircraft survivability needs emerging from Operations Enduring Freedom and New Dawn, as well as improve aircraft survivability against future threats.

Exploitation of a Missile Feature for Improved Countermeasure Effectiveness. This project addresses the exploitation of a specific vulnerability common to most threat missiles. Studies with a signal injection hardware-in-the-loop model and seeker test van data confirmed the vulnerability. JASP is now working to confirm the initial results with other hardware-in-the-loop models and live fire test results. If confirmed, this technique may radically improve U.S. countermeasure effectiveness.

Advanced Techniques for Radio Frequency Countermeasures. In partnership with the U.S. Army Communications-Electronics Research, Development, and Engineering Center, Intelligence and Information Warfare Directorate, this project is developing and testing countermeasures technology and techniques to increase aircraft survivability and situational

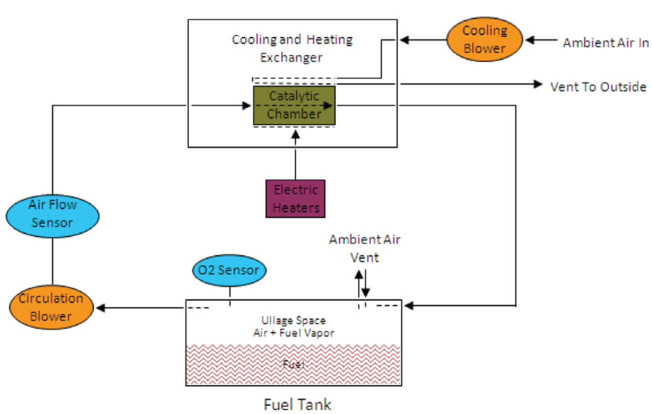
awareness for Army, Navy, and Air Force rotary-wing aircraft. Validated countermeasure techniques are being integrated into the Suite of Integrated Radio Frequency Countermeasures and receiver parameters are being incorporated into the APR-39 family of radar warning receivers by their respective program offices.

ShotSense 3D Aircraft Hostile Fire Indication System.
This project is fielding a high performance, low cost, size, weight, and power, un-cooled infrared threat detection system for the tracking and classification of small arms, rocket-propelled grenades (RPGs), missiles, and other hostile fire. In live fire tests, the system demonstrated the ability to detect and classify threats and cue radar for projectile tracking in natural and urban high clutter environments. The system was developed and is transitioning to counter-rocket, artillery, and mortar applications in the U.S. Army and the United Kingdom Ministry of Defense. A transition to the U.S. Special Operations Command Little Bird helicopter is being investigated.

WeaponWatch® Hostile Fire Determination.
This project is expanding the WeaponWatch® hostile intent determination process to include algorithms for small arms, RPGs, and rockets. The updated algorithms will be implemented in the Ground Fire Acquisition System, by system developers, on AH-64D helicopters at Fort Campbell in the spring of 2012.

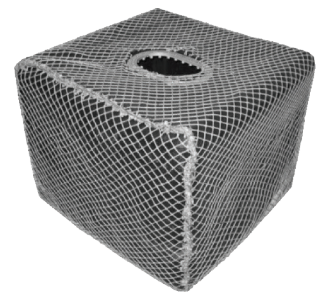
Vulnerability Reduction

Green On-Board Inert Gas Generating System.
This project is developing a catalytic reactor system that converts the highly dangerous oxygen/fuel vapor mix, found in the empty space in a fuel tank, into carbon dioxide and water. The system, designed by a small company, Phyre Technology, is more environmentally friendly than currently fielded fuel tank inerting technologies, while being smaller, lighter, and having a lower projected life cycle cost. Initial laboratory testing demonstrated improved inerting performance under stressing flight profiles. System testing and optimization on a system sized for medium to large fixed-wing aircraft is underway.



Wireless Fire Detector.
This project is investigating a low-cost, lightweight, fast-acting, and reliable fire protection system that is easy to retrofit into fielded aircraft. The potential benefits are a rapid, light-weight system that can be installed without permanent modification to the aircraft, and a quicker, false-alarm-free detection/reporting system that could reduce the amount of extinguishing agent required and reduce pilot workload.

High Performance Fuel Bladder.
This project is developing a high performance fuel bladder using an exoskeleton design and new synthetic sealants resulting in lighter weight fuel containment with improved crash resistance. The exoskeleton absorbs and redistributes the impact loads to prevent failure and the new sealants are more effective in self-sealing when penetrated by a projectile. The AH-64 Apache Program Office supported the decision to build forward and aft fuel cells for testing in actual aircraft. The project is on schedule to complete qualification testing for the Apache fuel bladder by March 2012.



Survivability Assessment

JASP continues to develop aircraft survivability assessment methodologies ranging from the detailed system engineering level through the few-on-few campaign engagement level. These methodologies are used to support analyses of alternatives, LFT&E and OT&E, as well as aircraft system specification requirements and certification.

Improved Digital Radio Frequency Memory (DRFM) Jamming Representation in BRAWLER Aircraft.
This project is modifying the BRAWLER air-to-air engagement simulation model to update the jamming representation, making BRAWLER the first engagement-level simulation to include state of the art, DRFM jamming effects. This supports studies to improve counter-DRFM jamming tactics, techniques, and procedures and will support future studies to examine DRFM technology in towed and expendable decoys, the increase of pilot workload (due to the information DRFM jamming generates), and how to mitigate the effects.

Enhanced Prediction of Ball Round Penetration in Modeling and Simulation.
This project, performed in conjunction with the Joint Technical Coordinating Group for Munitions Effectiveness (JTCG/ME) and the developers of ProjPen, is improving performance of vulnerability analysis tools. ProjPen is the projectile penetration code used in most vulnerability analysis models and simulations. Testing was conducted by the Army to characterize ball round failure and penetration; the data will be incorporated into ProjPen by the Navy. Preliminary analyses show the old practice of using armor piercing rounds, as a surrogate for ball rounds, has led to

over-prediction of vulnerability and over-design of systems from a vulnerability point of view.

Combat Damage Assessment
JASP continued to support the Joint Combat Assessment Team (JCAT) in FY11. JCAT continues its operation in Afghanistan with full-time deployments in Regional Commands – South, Southwest, and East. JCAT supported Iraq and other areas of the world remotely or by rapid deployment from Afghanistan or the Continental U.S. JCAT inspects damaged and destroyed aircraft, acquires maintenance records, and conducts interviews with aircrew and intelligence personnel to develop an accurate and comprehensive assessment of each aircraft combat damage event. They provide weapons, tactics, and logistics consultation to personnel and comprehensive briefings to commanders in charge of daily air operations. These efforts inform battlefield commanders, allowing them to adjust operational tactics, techniques, and procedures based on accurate threat assessments.

The JCAT trains the U.S. aviation community on potential aircraft threats and combat damage. JCAT Navy members hosted the 2011 Threat Weapons and Effects Seminar at Eglin AFB, Florida. Attendees included all four U.S. military Services, Department of State, Department of Homeland Security, Federal Aviation Administration, Department of Energy, Federal Bureau of Investigation, the Bureau of Alcohol, Tobacco, Firearms and Explosives, and U.S. industry partners. Additionally, JCAT provides information to many external customers, including capabilities briefs, intelligence updates, recent "shoot-down" briefs to discuss enemy tactics, techniques, and procedures, and combat damage collection and reporting.

JOINT LIVE FIRE (JLF)

The goal of the Joint Live Fire (JLF) program is to test fielded systems, identify vulnerable areas, understand damage mechanisms, and provide the information for potential design changes, modified tactics, techniques, and procedures, or improved analysis tools. The need for these tests result from systems being exposed to new threats, used in new unanticipated tactics, or being operated in new combat environments, and the subsequent need for an assessment of their performance.

JLF supplements LFT&E of systems by testing new threats that the requirements community did not anticipate during the original development, or old threats employed in new ways. The RPG is an example of a threat employed differently than its intended design. Originally developed as an anti-tank or anti-personnel weapon, hostile forces in Afghanistan often use the RPG as an anti-helicopter weapon.

Aircraft Systems Program
JLF-Air's emphasis on Man-Portable Air-Defense Systems (MANPADS) threat characteristics and empirical vulnerability data continued in FY11. MANPADS have been a threat since the late 1960s but are seldom included in Test and Evaluation Master Plans or considered for LFT&E events. Immature modeling and test capability, test expense, and the perception of MANPADS as an overmatching threat, are the primary reasons given for limited test or analysis of this threat.

Over this same timeframe, the design of U.S. aircraft has evolved, significantly increasing ballistic survivability to the point that current platforms demonstrate some tolerance to MANPADS hits. This damage tolerance, along with the increasing proliferation of threat MANPADS, makes it critical to develop efficient test capabilities and a credible modeling capability to support future LFT&E strategies regarding MANPADS.

The following efforts are resolving key modeling and testing deficiencies highlighted in the JLF 2010 MANPADS Vulnerability Capabilities Roadmap.

MANPADS Threat Model Development – Fragment and Debris. This project is collecting MANPADS fragment data of sufficient quality to improve the accuracy and credibility of MANPADS threat models used to assess and predict aircraft vulnerability. Static missile fragment data were collected in FY11 and dynamic missile fragment data testing is scheduled for early FY12.

Large Engine Vulnerability to MANPADS. This project is determining the vulnerability of a large turbofan engine to a MANPADS threat. In partnership with the Department of Homeland Security and the National Aeronautics and Space Administration, Navy testers, with Air Force support, will shoot two MANPADS into operating CF6 50 engines to explore engine-nacelle fires, uncontained engine debris, and the ability to maintain controlled flight and safely land with damaged engines and airframes. Realistic test conditions include operational power settings, airflow, MANPADS impact velocity, detonation conditions, and shotline selection.

Supersonic Rocket on a Rope. This project is evaluating the capability to "free-fly" a complete missile into a target with precision and repeatability. This project is applying a test technique

already used for U.S. missile systems testing. Essentially, the missile flies towards the target guided by "ropes" that are cut just feet before impact, allowing natural thrust and fuzing, yet controlling the guidance. Initial testing in FY11 demonstrated an impact accuracy of approximately 3 inches.

Rotorcraft Sponson RPG Vulnerability. This project is demonstrating methods of suppressing fires resulting from RPG impacts to sponson fuel tanks - with emphasis on occupant survivability. For several U.S. rotorcraft, fuel tanks are contained in sponsons that are adjacent to the main cabin. Current data indicates that the U.S. aircraft are being shot with RPGs and sponsons should be protected.

Crew Compartment Fire Survivability. This project is measuring the internal cabin environment during a fire to be able to consider the affect on crewmembers, and has the ability to extinguish fire with onboard hand-held equipment. This project developed a test fixture in FY11 to evaluate cabin fires and determine their byproducts (smoke, toxic fumes, heat) and impact on continued operation, escape, and survival.

Combat Incident Emerging Threat Investigation. This project is addressing a recent combat incident in Afghanistan that 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 incident. JCAT requested JLF Air support by providing threat-target characterization data for their incident investigation. Results from two shots completed against a surrogate airframe were provided to JCAT. The initial results from these tests allowed JCAT to understand the engagement conditions and subsequent damage with confidence, increasing the value of information provided to operational commanders.

Ground Systems Programs

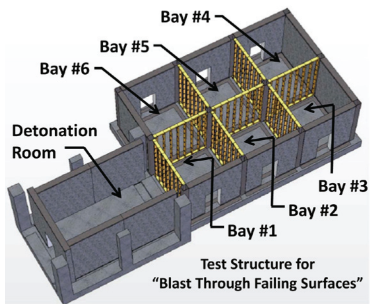
The goal of the Joint Live Fire Ground Systems Program (JLF Ground) is to fully characterize current threat weapons and munitions, providing critical empirical data to JTCG/ME and other interested agencies, such as Joint Improvised Explosive Defeat Organization. The program also addresses combat personnel protection and survivability from threat weapons. The program funds projects to improve the understanding of weapons effects during operations in urban environments.

Exploitation of Generic Hull for Underbody Blast Injury Criterion Development. This project is exploring the differences between the response of a surrogate and an actual human in the under-body blast (UBB) environment and evaluating the scientific basis for use of the Hybrid III automotive crash test dummy in UBB test and evaluation programs. This project will conduct a UBB experiment with a generic blast-resistant vehicle hull. This data will shape current research for creation of a validated UBB-specific human surrogate for use in LFT&E. The insights from this research will also directly aid the development of improved Soldier protection systems for the DoD.

External Blast - Full Vehicle Blast Data and Validation. This project will conduct testing to assess the vulnerability of the various armored, tracked threat vehicles to external air-blast loads. Additional generic plate testing will also be conducted. Engineers will use the data to develop lethal-miss-distance contours (the distance from a detonation that a person or equipment must be to survive) with respect to mobility, firepower, and catastrophic target kills.

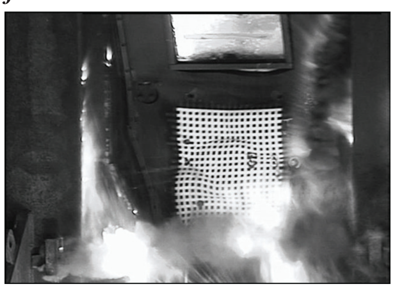
Increase in JP-8 Flash Point Due to Heating Conditions. This project is investigating the relationship between the method for pre-heating and the resultant flash point of JP 8 fuel. Two heating methods, "open" and "closed," referring to whether the fuel is open to the atmosphere or not, were used to determine if the flash point of 50 gallons of JP 8 changed when heated continuously over a 48-hour period. These findings will be used to develop guidelines on suitable pre-test fuel preparation practices in relation to LFT&E.

Blast Through Failing Surfaces.



This project is conducting experiments to characterize air blast propagation through failing walls in a realistic two-dimensional array of urban rooms. Mission planning for military operations in urban terrain (MOUT) requires that weaponeers estimate the explosion-induced damage to urban structures, their contents, and their occupants. A key contributor to this damage is the air blast propagating through the light-duty walls, floors, ceilings, etc., comprising typical urban structures. Data from these experiments are being used by modelers to produce improved predictive methods for MOUT scenarios.

Composite Armor Deflection from IED Events.



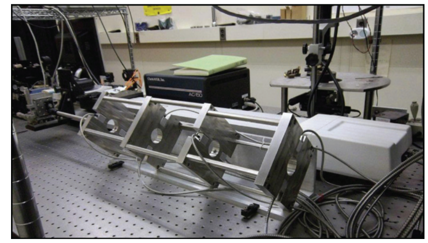
This project is exploring the possibility of dynamic composite armor deflection into vehicle crew compartments during IED events. Composite armors are lightweight solutions for vehicle systems and are designed to protect against an array of threats by absorbing fragment energy through material fracture and deformation. The objectives are to determine if the armor solutions withstood the IED threat and if deflections reached vehicle crew. If so, injury from blunt trauma would need to be assessed. The data will be used to determine Soldier vulnerability to armor deflection in the context of the differing armor recipes and door construction.

Exploratory Testing of Fragment Characterization System.

This project is part of a series of experiments to significantly improve warhead arena test data collection speed and confidence through automation of fragment characterization (3D coordinate location, mass, shape factor, etc.). Previous phases successfully demonstrated capability on a small scale using precision laboratory X-ray systems and had marginal success using high-power large cargo inspection X ray systems. This phase seeks to quantify the baseline capabilities of these systems and determine if modifications can produce a large-scale automated system at a practical cost point.

Instrumentation Accuracy Validation.

This project is demonstrating a ballistic reference chronograph to be used to develop measurement accuracy budgets and uncertainties as well as calibration factors for commonly used velocity instrumentation and techniques. The National Institute of Standards and Technology (NIST) developed the reference chronograph and performed the uncertainty analysis. The Army Research Laboratory (ARL) performed ballistic testing at Aberdeen Proving Ground, Maryland. NIST and ARL also investigated techniques and instrumentation to determine the accuracy of the pitch and yaw measurements. The results will allow the test community to determine if current projectile velocity techniques and instruments are within the uncertainty and error requirements.



Testing to Collect Data in Support of Projectile Penetration (ProjPen) Modeling Capability.

This project is conducting tests to gather data for small caliber armor piercing incendiary projectiles striking titanium plates. Testing is focused on penetration velocities and the gathering of residual masses and velocities of penetrating fragments. This will improve the quality of vulnerability and lethality analyses involving ProjPen. Both the Joint Technical Coordinating Group for Munitions Effectiveness (JTCG/ME) and JASP for the analysis of small caliber projectiles utilize ProjPen.

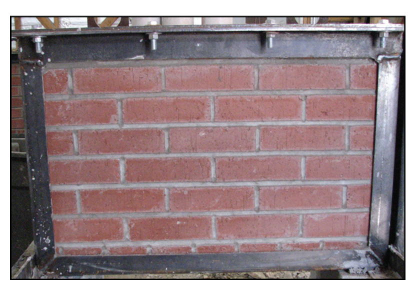
Fiberboard Recovery Media Improvement.

This project is conducting an evaluation to provide higher fidelity weapon effectiveness analysis by utilizing an improved fiberboard for fragment recovery media, typically implemented in warhead arena testing. Two of the greatest problems with using fiberboard are the flammability and variable density of the product. The ARL is investigating the feasibility of producing a product that has a more consistent density, and is less prone to loss due to fire, through discussions with various fiberboard manufacturers.

Testing to Collect Data in Support of Expanded Fast Air Target Encounter Penetration (FATEPEN) Modeling Capability.

This project is conducting tests to gather data to expand the capability of the engineering penetration and damage model FATEPEN as it applies to fragments striking brick targets. This testing is focused on debris collection for brick targets that are typical of general urban construction. The collected data will provide detailed information necessary to better model the interaction. JTCG/ME and others utilize FATEPEN for the effectiveness analysis of fragmenting warheads.

Military Operations in Urban Terrain (MOUT) Medium Caliber Wall Damage Characterization Tests.



This project is testing medium caliber (25 mm and 30 mm) threats used in MOUT environments against concrete and cinder block wall targets. The tests investigate penetration/perforation of kinetic energy and high explosive munitions fired against conventional strength and ultra-high performance concrete walls, and behind-wall effects. Data obtained from the tests will allow improvement in lethality/vulnerability estimates of the munitions and validation of a cumulative damage computational tool that will model round-to-round damage to wall targets.

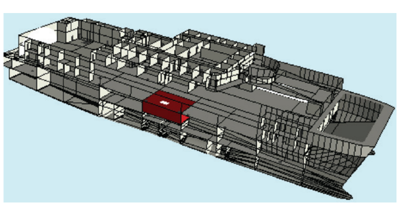
SEA SYSTEMS PROGRAM

The Joint Live Fire Sea Systems Program (JLF-Sea) made significant progress in FY11 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. Navy vessels.

Finnish Fast Attack Craft Testing.

This project continues 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, modeling and simulation support, and analysis. The objective is to understand the behavior of aluminum, vice the more typical steel, hulls, and structures. In FY11, underwater, surface and air explosion testing was conducted, as well as an Office of Naval Research leveraged experiment to study methods that could be used to stop ships. This is a force protection concern, namely how could the Navy prevent a ship from entering a port, or proceeding toward a destination, while causing minimal damage to the ship and no injuries to the crew. These tests will help in understanding weapon effects against aluminum ships, and will complement the LFT&E programs for the Littoral Combat Ship and Joint High Speed Vessel.

Network Fire Model Enhancements.



This project is developing enhancements to the Fire and Smoke Simulator Model (FSSIM). Naval engineers use FSSIM to develop ship designs that limit the spread of fire and smoke. In FY11, the Navy added features to FSSIM addressing limitations for modeling aluminum structures, including surface melting and localized heating and spot melting, and incorporating fuel pool fires. These improvements will support designing more survivable ships.

Lithium Battery Vulnerability.

This project is characterizing the hazard that lithium and lithium-ion batteries can pose to a ship and its crew. NRL conducted tests to identify the type of reaction, burning characteristics, and heat release rate associated with exposing the batteries to dropping, heat, and fire. The results of the tests were then used to develop a Lithium Battery Casualty Mitigation System to minimize the risk to the ship and crew. This project, jointly funded by the Office of Naval Research, has developed a design based on the size and shape of an Mk 48 torpedo for use on submarines. During this fiscal year, a brass board prototype was built for risk reduction testing.

Diesel Submarine Underwater Explosion Testing.

This project continues the 2009 project agreement between the U.S. and German Navies to develop and validate 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 on the sea floor – a typically hard to detect position. Data on both the bottomed submarine response and shallow water loading will be obtained. This project effectively provides data to increase the fidelity of models and the accuracy of survivability assessments for a situation for which little data are currently available.

Glass Damage and Debris Caused by Shaped Charge Impact.

This project is gathering data on the debris produced by the impact of a shaped charge weapon on typical glass window panels used in a ship's Pilot House. The Navy tested RPGs, both statically detonating and actually firing at glass window samples, to characterize the debris field caused by shaped charge impact and penetration. Data from this testing will be used to improve damage predictions for this type of threat encounter.

Submarine Susceptibility to Mines.

This project is addressing the Navy's ability to assess the susceptibility and vulnerability of submarines to threat mines. 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 Modeling and Simulation tools that Services can use used to understand the effects of mine blasts on submarines.

LFT&E SPECIAL INTEREST PROGRAMS

Active Protection Systems (APS)

In response to FY08 legislation, DOT&E completed testing in August 2011 of seven foreign and domestic (two foreign, three domestic, and two combined foreign/domestic) active protection systems with the potential of protecting wheeled tactical vehicles. DOT&E will provide reports to Congress and acquisition leadership in 2QFY12. 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 personnel protection equipment testing. The Services and U.S. Special Operations Command are implementing the DoD testing protocol for hard body armor inserts published last year. The Defense Logistics Agency has incorporated the testing protocol into new contracts for sustainment stocks of hard armor inserts. The Army has incorporated the key concepts of statistical confidence and test design into its requirements for future personal protective systems it desires to develop.

DOT&E, in partnership with the Services and the U.S. Special Operations Command, developed a new combat helmet testing protocol. It ensures the combat helmets provided to Service members meet ballistic protection requirements and provide uniform protection on the battlefield. The implementation of this protocol increases government oversight of personal protective equipment by requiring combat helmets (in addition to hard armor plates) to meet statistical measures of performance when tested in government facilities. DOT&E plans to work with the Services and the U.S. Special Operations Command to prepare a DoD-wide standard for testing of soft armor vests.

Joint Trauma Analysis and Prevention of Injury in Combat

In response to the DOT&E Mine Resistant Ambush Protected (MRAP) LFT&E Report of March 2010, former Secretary Gates tasked DOT&E to coordinate increasing the availability of data coming from the Joint Trauma Analysis and Prevention of Injury in Combat (JTAPIC) Program, as well as the Armed Forces Medical Examiner's Office. Presently, DOT&E has hosted four Senior Reviews with participants from the JTAPIC Program Office and all of the JTAPIC partners, including Army intelligence, medical and materiel analysts, Navy medical researchers, and Marine Corps intelligence analysts. Additionally, the Army Surgeon General initiated the execution of two working-level Lean Six Sigma (LSS) exercises with the goal of increasing the quality and volume of analytical outputs by improving internal operating processes. An improvement in these processes should increase the quality of the data shared between the partners, clarify the role of each partner as well as the JTAPIC Program Office, improve customer awareness of JTAPIC and its capabilities, and establish common procedures that should streamline data sharing and analytical processes between partners residing in various Commands and Services. Thus far, the four Senior Reviews hosted by DOT&E have focused on ensuring action items and taskings from the LSS exercises have been, or are in the process of being implemented. DOT&E expects that at future meetings the JTAPIC Program Office will report quantifiable metrics, as they become available, to demonstrate progress, as well as provide contextual demonstrations of how implementing LSS tasks has increased the efficiency of the partners' data sharing and analysis, as well as enhanced the Program Office's management of the partners and their products.

Warrior Injury Assessment Manikin (WIAMan)

Historically, large under-vehicle blast events have not been the predominant threat against which ground combat vehicles were required to protect. Therefore, test and evaluation techniques (including instrumentation and injury criteria) that address occupant injuries from these threats have remained immature. Current ground combat vehicle Live Fire testing is conducted using automotive crash test dummies and their associated injury criteria, all designed and developed for low-speed civilian car crashes. Medical data are required in order to improve the resolution of injury assessments during Live Fire testing of ground combat vehicles.

In August 2010, DOT&E sponsored an Army-led, five-year research and development program to increase the Department's understanding of the cause and nature of injuries incurred in underbody blast combat events and develop appropriate instrumentation to assess such injuries in testing. This program, known as the Warrior Injury Assessment Manikin (WIAMan), utilizes expertise across multiple commands and disciplines within the Army to generate a medical research plan from which data will, at pre-determined times, be transitioned to the materiel and test and evaluation communities. These data will feed the design of a biofidelic prototype anthropomorphic test device (ATD) designed to capture occupant loading from the vertical direction, reflecting the primary load axis to which occupants are exposed in an under-vehicle blast event. The second-generation prototype for this ATD is slated for completion in FY16, with full transition to the test and evaluation community in FY17. Development of a military-specific ATD for use in under-vehicle blast testing will better inform users, materiel developers, analysts, and evaluators about the levels of protection afforded by the vehicle to its occupants, and will ultimately lead to fielding more survivable vehicles. The resolution of current assessments is inadequate to inform users, vehicle designers, and evaluators, about the severity of injuries incurred in under-vehicle blast.

Information Assurance and Interoperability

Information Assurance and Interoperability

Information Assurance (IA) and Interoperability (IOP)

In FY11, the DOT&E IA and IOP Assessment Program performed 23 assessments during combatant command (COCOM) and Service exercises; four of these assessments involved units preparing to deploy (or already deployed) to Iraq or Afghanistan.

The IA posture observed during the assessed FY11 exercises is not sufficient to prevent an advanced adversary from adversely affecting the missions that were being exercised. DOT&E observed modest improvements in certain areas of network defense, but there were also several areas in which prior progress has declined. In general, information technology and personnel were not fully prepared to operate in realistic and contested cyberspace conditions. Red Teams generally overcame defenses during exercises by only moderately increasing their level of effort over previous years.

The cyber threat portrayed during assessed exercises remains consistently below that expected from a nation-state level adversary. Exercise authorities often restricted cyber activities from affecting exercise-training objectives, thus limiting the ability to fully assess operational/fielded network performance against realistic threats. The Chairman, Joint Chiefs of Staff, issued a Red Team Execute Order (EXORD) in February 2011 that directs a more realistic cyber adversary in all major COCOM and Service exercises. Although this expanded play has yet to be observed, a number of COCOMs are developing EXORD implementation plans. DOT&E will work closely with the exercise authorities, U.S. Cyber Command (CYBERCOM), and the Joint Staff to ensure the best possible implementation of the EXORD occurs, and assessments in more representative cyber environments become the norm.

Recognizing that some advanced adversary actions and the effects they may cause are not suitable for live networks, DOT&E is developing methods and pursuing options to examine these effects during offline demonstrations and in appropriate range environments. DOT&E proposed enhancements to cyber assessment capabilities, including enhancements to the infrastructure of the Joint Information Operations Range (JIOR) and the operational and cyber-threat environments that must be available via the JIOR. These enhancements met with a positive reception by senior DoD leadership, but fiscal constraints are likely to limit the speed with which these important capabilities are acquired.

The FY11 IOP assessments found that interoperability issues encountered by the training audience typically hindered, but rarely prevented, mission accomplishment; this is due primarily to operators who developed and executed workarounds that may have preserved the timeliness and accuracy of mission data at the cost of the efficiency or level of effort required. Even though missions were generally accomplished, the workarounds usually increased operator workload, and often resulted in degraded effectiveness in completing mission tasks. Assessment teams documented measurable impacts to the timeliness, accuracy, and efficiency of operational data handling in these assessments.

The majority of problems identified for investigation and reporting via Finding Memoranda in FY11 involved interoperability concerns. While only three Findings Memoranda were published in FY11, DOT&E is currently investigating findings focused on interoperability issues with the use of third-party software (such as JAVA) on DoD networks, as well as unsynchronized system upgrades in federated (i.e. system-of-sytems) environments. The majority of systems observed during exercise assessments lack interoperability certifications.

In summary, unresolved interoperability issues, coupled with low-to-moderate level threats, were observed to be sufficient to adversely affect the quality and security of mission critical information in a way that could, and did degrade, mission accomplishment. Interoperability and IA problems are rarely observed in isolation from each other, but are frequently interrelated. In FY12, DOT&E will continue to support the implementation of more realistic cyber threats in exercises and will report both the IA and IOP results of these assessments.

PARTNERSHIPS AND COORDINATION

DOT&E remains partnered with the Joint Staff and DoD Deputy Chief Information Officer (CIO) on the oversight and coordination of the IA and IOP Assessment Program. Metrics and observations generated from these assessments are provided to the DoD CIO for use in enterprise-wide IA estimates and programs. In addition, DOT&E coordinates program efforts with the USD(AT&L) and the Director, Developmental Test and Evaluation as a means of informing the acquisition and development of information handling systems.

DOT&E has a memorandum of understanding with CYBERCOM that directs a Cyber Assessment Synchronization Working Group. This group is working to synchronize planning, execution, and reporting activities among all cyber assessment activities, and especially those supporting exercise assessments. Enhanced training and certification for "Blue" (cooperative technical/administrative compliance) and "Red" (proxy-adversary penetration) Teams will contribute to more threat-representative cyber activities and assessments, better standardization of measures and methods, as well as enhancing a CYBERCOM exercise support cell.

DOT&E continues the partnership initiated with the Joint Forces Command (JFCOM), Joint System Integration, and Interoperability Laboratory (now Joint Staff activities) to enhance assessments conducted by both organizations during training exercises through coordinated sharing of information and expertise. The partnership collaborated in two assessments in FY11, and further joint assessments are anticipated for FY12.

DOT&E coordinates closely with the intelligence community, the National Security Agency, and the Service Information Warfare centers to improve both the scheduling and portrayal of the representative cyber threats during exercises. The Defense Intelligence Agency (DIA) has made significant progress in the definition of advanced and emerging methods of cyber attack, and was instrumental in mapping known adversary activities to the threat portrayals for several FY11 exercises. DIA will be instrumental in helping implement the Red Team EXORD through the identification of the Red Team assets needed – and the level of cyber threat actually portrayed – in all major exercises.

DOT&E continues to partner with the Naval Postgraduate School to research and develop improved capabilities for network analyses. This partnership includes the design and development of network test tools; instrumentation; training resources and test/evaluation 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 shortfalls.

Additionally, DOT&E collaborates with the Defense Information Systems Agency to improve and expand the level of assistance and training available to assessed organizations, to include the implementation of a cyber-defense training and assessment suite at several COCOMs. This collaboration will focus on improved training resources, community feedback, and operator training tools to help remediate vulnerabilities and shortfalls identified during assessments.

FY11 ASSESSMENT ACTIVITIES

In FY11, the five assessing organizations included the Army Test and Evaluation Command (ATEC), Commander, Operational Test and Evaluation Force, the Marine Corps Test and Evaluation Activity (MCOTEA), the Joint Interoperability Test Command (JITC), and the Air Force 688th Test and Evaluation Squadron. These five assessing organizations completed 23 exercise assessments under the IA and Interoperability Assessment Program. These assessments included 15 COCOM and 8 Service exercise assessments (see Table 1). Four assessments involved units preparing to deploy (or already deployed) to Iraq and Afghanistan.

DOT&E published three Finding Memoranda in FY11, all of which involved IA problems that also had significant interoperability dimensions:

- Joint Task Force Guantanamo support system (classified) – an outdated software version being maintained to ensure interoperability resulted in IA vulnerabilities.
- U.S. Navy/Marine Corps aviation readiness systems – a manual data exchange protocol between two systems resulted in both interoperability shortfalls and IA risks.
- Microsoft SharePoint Server software configuration – a lack of configuration standards resulted in both interoperability shortfalls and IA vulnerabilities.

Finding Memoranda detail specific IA and interoperability concerns that have the potential to significantly degrade operations and warrant senior-level attention. Findings may include system-to-system issues, process/procedure issues, or cross-DoD issues (such as universal use of commercial products). DOT&E identifies shortfalls and vulnerabilities to the cognizant Service or DoD leadership, whose replies detail their proposed or ongoing mitigation efforts; such upgrades and mitigations are subject to subsequent re-evaluation and validation in future assessments.

Additionally, one FY10 Finding Memorandum concerning network trust architectures was answered in FY11, following an extensive DoD effort to re-design the optimal reference architecture for this fundamental process/service. DOT&E is currently developing seven additional Finding Memoranda based on assessments conducted during FY11 that include: management of allied/coalition networks (both IA vulnerabilities and IOP shortfalls); major headquarter software baselines (a system-of-systems interoperability shortfall); security architectures for public key infrastructure use (both IA and IOP); and an array of Service and joint command-and-control systems (both IA and IOP).

In order to enhance the IA posture of acquisitions, DOT&E has prepared templates and established a process for assessing the adequacy of IA testing in acquisition test and evaluation master plans and test plans. These templates facilitate an early review and development of these documents to ensure that IA is addressed prior to approval of these documents. IA testing was specifically addressed in the test and evaluation master plans for the following six systems:

- CVN 78 *Gerald R. Ford* class
- Littoral Combat Ship (LCS)
- Patriot Post-Deployment Build 7 (PDB-7)
- Broad Area Maritime Surveillance (BAMS)
- B-2 Extremely High Frequency (EHF)
- E-2D Advanced Hawkeye

DOT&E reviewed the IA portion of the following operational test plans:

- Patriot PDB-7
- AEGIS 7.1R/Cooperative Engagement Capability (CEC)
- Global Combat Support System – Army
- *Lewis and Clark* Class of Auxiliary Dry Cargo Ships (T-AKE)

DOT&E reviewed completed tests and resulting data for the following six systems:

- General Fund Enterprise Business System (GFEBS)
- Patriot PDB-6.8
- Tomahawk
- Aegis Weapons System
- Ballistic Missile Defense System/Command, Control, Battle Management, and Communications (BMDS/C2BMC)
- Financial Information Resource System Budget Formulation (FIRST BF)

ASSESSMENT

Several developments in FY11 indicate increasing efforts across the DoD to prepare to conduct exercises – and operations – in a contested cyberspace environment. The Chairman, Joint Chiefs of Staff issued an execute order to increase realistic cyberspace conditions in training exercises, and CYBERCOM published operations orders for securing, operating, and defending the Global Information Grid, while increasing support to the COCOMs. Finally, the OSD released a DoD Strategy for Operations in Cyberspace.

As all of these processes have phased implementation, FY11 saw relatively low levels of improvement in threat depictions during training and operations. Most exercise assessments and tests involved operations largely against low- and mid-level cyber threats that created only partially compromised or marginally degraded network conditions. The exercises infrequently portrayed high-level threats, and no operations were seriously disrupted. While data were gathered concerning the actual performance of networks in a hostile cyber environment, and the impacts of this performance were assessed, the majority of data gathered in FY11 concerned the level of preparation and compliance to standards by DoD networks.

Interoperability

The FY11 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 operators generally accomplished missions, the workarounds usually increased operator workload, and often resulted in degraded efficiency of completing tasks, or degraded timeliness/accuracy of the information generated.

Overall, it was found that less than one-third of all systems observed during assessments had been fully certified for interoperability, although configuration management and documentation was satisfactory in almost 9 of 10 systems reviewed. Despite the lack of interoperability testing/certification, local authorities certified these systems for network operation. In some instances, major software suites were found to be in operational use despite having not completed operational testing or interoperability certification. Several of the findings under research by DOT&E are centered specifically on interoperability shortfalls, including:

- A major headquarters federated network (system-of-systems), which has demonstrated multiple operationally significant interoperability shortfalls due to unsynchronized upgrades to individual systems.
- System and echelon interoperability for cyber situational awareness architectures intended to provide coordination for cyber defense and configuration.
- Lack of network configuration standards for coalition and community-of-interest networks, resulting in both IA vulnerabilities and IOP shortfalls.
- DoD network configuration and interoperability standards for the use of public key infrastructure, resulting in IA vulnerabilities.
- Lack of centralized coordination for updates and upgrades to third-party software (such as JAVA, Adobe, and other commercial software commonly used by DoD), resulting in frequent interoperability and IA problems.

These items, reported to DOT&E from FY11 assessments, are currently under review and validation before being formally reported to the cognizant agencies/Services.

Information Assurance

Overall, control of user access to DoD networks improved in FY11, to include the use of proper identification and authentication for users, physical security of network components and access points, and correct configuration management of systems. Nonetheless, IA assessments continued to highlight the relationships between cyber security and other areas such as physical security and operations security. Physical intrusions, as well as online deception/social engineering, continued to be effective avenues of attack.

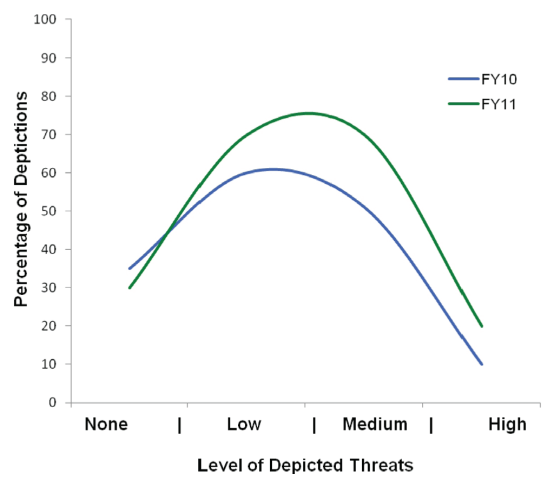


Figure 1: Distribution of threat depictions in assessed exercises.

Most Red Teams reported increased difficulty in penetrating network defenses, but results show that with sufficient time, Red Teams routinely managed to penetrate networks and systems. Detection rates of network intrusions remained low, and the ability of network defenders to detect subsequent exploitations of network data was minimal; most assessments witnessed large exfiltrations of operationally significant data. The extracted data was available, in only a few cases, to the exercise opposition force for tactical/strategic exploitation, which in effect created a more benign exercise environment than postulated by DIA and the intelligence community.

The assessments showed a decrease in the use of backup files and systems, proper audit logging and reviews, logical access controls, incident planning, and vulnerability management. There was an overall increase in high-risk vulnerabilities observed (indicating a decrease in effective patch management), as well as a decrease in effective use of anti-virus tools and software (including failures to routinely update virus signatures). Although the ongoing fielding of the Host Based Security System (HBSS) has resulted in many local improvements in network protection from intrusion as well as intrusion detection, the majority of HBSS suites observed were found to be incorrectly or ineffectively configured.

Experience and formal training levels for network defenders have increased. As shown in Figure 2, the aggregate skill levels of network personnel assessed in several FY09 through FY11 venues indicate an increase in intermediate skills across the DoD and fewer beginner level operators overall. User awareness of IA threats and protections increased in FY11.

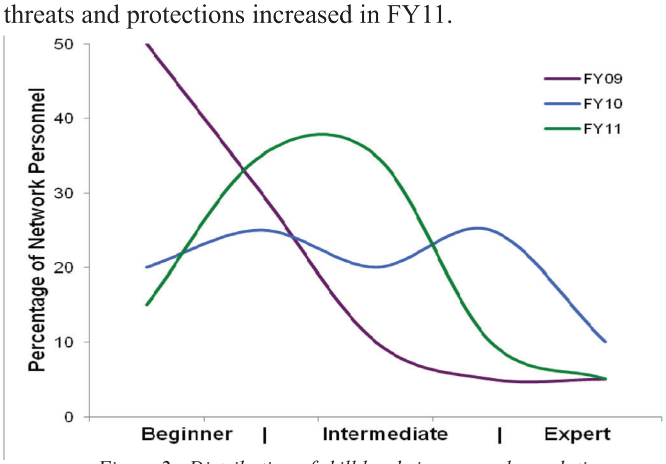


Figure 2: Distribution of skill levels in assessed populations.

Mission Assurance

During approximately half of FY11 assessments, assessment teams further the IA and IOP findings to characterize the operational impacts – or potential operational impacts – to specific missions being exercised. Although cyber-adversary activities posed a high risk to critical operations, exercise authorities seldom permitted any disruptions to be fully exercised; the priority to achieve other exercise training objectives remains at odds with exercising in an environment with representative cyber adversaries. Implementation of the Chairman, Joint Chiefs of Staff Execute Order should result in exercises and assessments with more realistic cyber environments and more useful results, regarding mission accomplishment, and mission impact should become available.

Examples of mission impact that were observed included degradation to the timeliness, accuracy, and efficiency of the networks; adverse impacts to the confidentiality, availability, and integrity of operational data were also documented. In many cases, these adverse effects were not due to IA vulnerabilities, but to poor interoperation between systems. A major source of poor interoperability is often found to be an incomplete set of interface requirements, or uncoordinated upgrades and updates to interdependent systems. Some of the observed mission impacts include:

- Delays in critical battlefield situational awareness
- Reductions in forces available for operational tasking due to delays or inaccuracies in planning systems
- Re-allocation of personnel from less critical tasks to support increased manual efforts for critical ones
- Large-scale exfiltration of operationally significant data from force planning systems
- Modification of blue-force operational data by opposition force actors
- Manual transfers of information between systems unable to automatically interoperate.

FY12 PLANNED ASSESSMENT AND GOALS

DOT&E will continue to assess approximately 20 COCOM and Service exercises in FY12, with the goal of performing at least one interoperability and one IA assessment at each COCOM and Service during the fiscal year (see Table 2). One of the planned FY12 assessments will involve units already deployed to Afghanistan. The FY12 assessment program will focus on the following:

- Supporting the three-year implementation of the Chairman, Joint Chiefs of Staff Red Team EXORD, and continuing to improve portrayal of advanced cyber threats during assessments
- Increased coordination with CYBERCOM and other agencies in the scheduling and conduct of assessments
- Improved methods for gathering and assessing mission impacts
- Expanded use of the Joint IO Range and other test facilities in support of exercise assessments
- Linkages to T&E through research and results sharing

TABLE 1. INFORMATION ASSURANCE AND INTEROPERABILITY EXERCISE EVENTS IN FY11

EXERCISE AUTHORITY	EXERCISE	ASSESSMENT AGENCIES
AFRICOM	Judicious Response 2011 (Exercise Cancelled)	ATEC
CENTCOM	AOR Site Assessment #1	ATEC
EUCOM	Austere Challenge 2011	ATEC
JFCOM	Empire Challenge 2011	JITC
NORAD/NORTHCOM	Vigilant Shield 2011	688 IOW
	Vibrant Response 2011	JITC
PACOM	Terminal Fury 2011	COTF
SOUTHCOM	Integrated Advance 2011	ATEC
	Joint Task Force Bravo 2011	ATEC
SOCOM	Emerald Warrior 2011	ATEC
STRATCOM	Bulwark Defender 2011	JITC
	Global Lightning 2011	JITC
TRANSCOM	Assessment During Operations	JITC
	Turbo Challenge 2011	JITC
USFK	Key Resolve 2011	ATEC
	Ulchi Freedom Guardian 2011	ATEC
USA	Unified Endeavor 11-1-III	ATEC
	Unified Endeavor 11-2	ATEC
	Unified Endeavor 11-1-VI	ATEC
USN	JTFEX 11-1	COTF
USAF	Black Demon 2011	688 IOW
	Red Flag 11-3	688 IOW
USMC	Unified Endeavor 11-2 (II MEF)	MCOTEA
	Ulchi Freedom Guardian 2011	MCOTEA

AFRICOM – Africa 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
JTF – Joint Task Force
MCOTEA – Marine Corps Operational Test and Evaluation Activity
MEF – Marine Expeditionary Force
NORAD – North American Aerospace Defense Command
NORTHCOM – Northern Command
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 FY12

EXERCISE AUTHORITY	EXERCISE	ASSESSMENT AGENCIES
AFRICOM	Judicious Response 2012	ATEC
CENTCOM	AOR Site Assessment #1 (Bahrain)	ATEC
	AOR Site Assessment #2 (Afghanistan)	ATEC
CYBERCOM	Cyber Flag 2012	ATEC
EUCOM	Austere Challenge 2012	ATEC
NORAD/NORTHCOM	Vigilant Shield 2012	688 IOW
	Ardent Sentry 2012	688 IOW
	Vibrant Response 2012	JITC
PACOM	Terminal Fury 2012	COTF
SOUTHCOM	PANAMAX 2012	ATEC
SOCOM	Emerald Warrior 2012	ATEC
STRATCOM	Global Lightning 2012	JITC
TRANSCOM	Turbo Challenge 2012	JITC
	Assessment During Operations	JITC
USFK	Key Resolve 2012	ATEC
	Ulchi Freedom Guardian 2012	ATEC
USA	Full Scope Exercise 12-4	ATEC
USN	Bold Alligator 2012	COTF
USAF	Red Flag 12-3	688 IOW
	Ulchi Freedom Guardian 2010 (III MEF)	MCOTEA
USMC	Bold Alligator 2012	MCOTEA

AFRICOM – Africa 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
JITC – Joint Interoperability Test Command
MCOTEA – Marine Corps Operational Test and Evaluation Activity
MEF – Marine Expeditionary Force
NORAD – North American Aerospace 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 and Evaluation Resources

Test and Evaluation Resources

Test and Evaluation Resources

Title 10, U.S. Code requires the Director to assess the adequacy of operational and live fire testing conducted for programs under oversight and to include comments and recommendations on resources and facilities available for operational test and evaluation and levels of funding made available for operational test and evaluation activities. DOT&E monitors and reviews DoD and Service-level strategic plans, investment programs, and resource management decisions to ensure capabilities necessary for realistic operational tests are supported. This report addresses the major areas of concern: test infrastructure, resources, and encroachment.

DOT&E Resources

My highest priority is to satisfy my responsibilities under Title 10 USC to conduct independent, rigorous, and comprehensive evaluation of the operational effectiveness and suitability of the Department's weapons programs. In my interactions over the past two years with the DoD Efficiencies Task Force, I identified the technical analyses I obtain from a federally-funded research and development center (FFRDC) as absolutely critical to meeting those Title 10 responsibilities. The Task Force agreed that support was critical to my mission and was not subject to the Secretary's direction to reduce unneeded and or inappropriate support obtained from contractors.

However, as part of the reductions I implemented in response to the Efficiencies Task Force, I have reduced contractor support obtained for my non-Title 10 activities. My FY11 President's Budget projection for contractor support was $49 million and is now $45 million. This is an 8.2 percent reduction in total contractor support that I took in areas outside my core, high-priority statutory activities. About 90 percent of DOT&E's remaining budget for contractor support funds FFRDC technical evaluations critical to the Office's fulfillment of its statutory responsibilities. Any further reductions to FFRDC support will critically undermine my ability to conduct independent, rigorous, and comprehensive test and evaluation of the Department's weapons systems.

In response to the Efficiencies Task Force, I also eliminated or restructured some of the DOT&E non-core activities. Specifically, I eliminated the Independent Resource Analysis Team, integrating this function into in-sourced government billets. I also eliminated the Target Management Initiative, relying on existing Service efforts to develop and field targets for operational testing. Finally, I reduced and re-structured the Test and Evaluation Threat Resource Activity. These actions resulted in a net saving of $40.7 million across the Future Years Defense Program (FYDP).

If the Department continues efforts to further reduce future levels of funding, it will adversely affect my ability to continue non-core activities. For example, an additional 10 percent reduction to my appropriation (totaling $100.2 million across the FYDP) would require me to reduce substantially or eliminate a non-core activity such as the Joint Test and Evaluation program in order to protect my ability to fulfill my statutory responsibilities.

Test Infrastructure

The DoD budget is currently under severe fiscal pressure, and constrained resources can be expected to continue through the next decade. While cognizant of the need to reduce funding, it is critical that the Department maintain the infrastructure necessary to rigorously, robustly, and efficiently test the systems the Department buys. To this end, DOT&E is working closely with the Deputy Assistant Secretary of Defense, Development Test and Evaluation (DT&E) / Director, Test Resource Management Center (TRMC) to ensure that the Department retains sufficient core capabilities to conduct realistic testing. Future funding decrements to the T&E infrastructure will come from an already declining investment base, as depicted in the figure below.

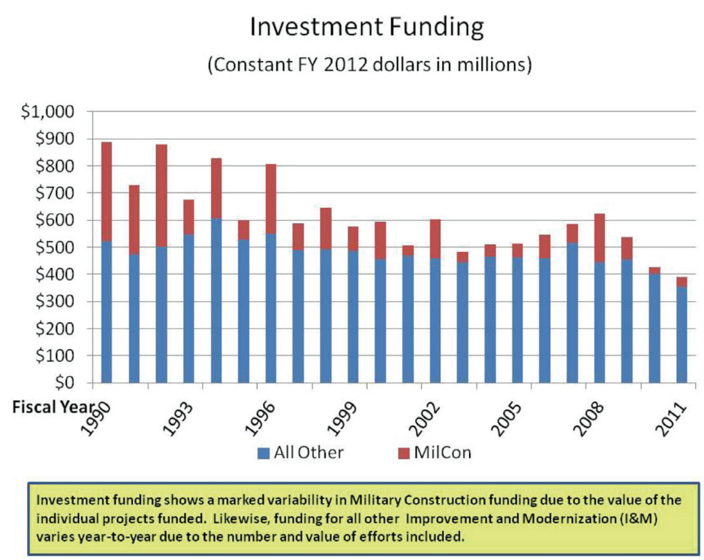


Figure 1: Investment Funding

Accordingly, DOT&E will ensure that the Department's senior leaders are fully informed of potential consequences should a Service or agency identify the need to reduce necessary T&E infrastructure. This is particularly important because the Department's budget process does not permit sufficient time for the Services to fully analyze the effects their budget submissions may have on other Service programs. The Major Range and Test Facility Bases contain many unique test assets such as wind tunnels and remote testing facilities. In many instances the Service Executive Agent is not the primary user of the test assets. Given this period of significant fiscal pressure, it is imperative that the Department's leadership be made fully aware and allowed to assess any proposals made to eliminate assets and determine the impact such proposals might have on all the Services, not just the Service that is the Executive Agent.

Active Electronically Scanned Array Jamming Test Capability
The 2010 Tri-Service Electronic Warfare Test Capability Study, in which DOT&E participated, identified several critical Active Electronically Scanned Array radar jamming capability upgrades needed for the facilities and open-air ranges currently used to evaluate U.S. weapon systems such as the F-35 and the Navy's Next Generation Jammer. These critical upgrades include:

- Next generation electronic warfare environment generator at indoor facilities and on open-air ranges to represent advanced high-fidelity threat emitter digital processing capabilities (DOT&E cost estimate $4 million for open-air range capability; the indoor lab capability has been funded through OSD).
- Implement the capability to measure and characterize advanced U.S. jammers' multi-beam steering accuracy and power distribution at the target location at indoor facilities and on open-air ranges (DOT&E cost estimate $13.3 million for open-air range capability; the indoor lab capability has been funded through OSD).
- Develop next-generation surface-to-air-missile models and simulators that are not currently represented for hardware-in-the-loop facilities and open-air ranges (DOT&E cost estimate $62 million).
- Develop a transportable urban threat representative communications environment that can be used to both stimulate U.S. communication jammers and evaluate jamming effectiveness on open-air ranges (DOT&E cost estimate $17 million).

The OSD-funded Central T&E Investment Program is partially addressing the first two upgrades, allocating $32.9 million to the indoor portions of the threat environment generation and jammer beam characterization capabilities. DOT&E estimates $79 million, in addition to the $8 million supplied by the Navy, to fund the open-air portions of the first two efforts as well as develop two high priority next-generation surface-to-air-missile threat simulators.

Cyber Assessment Capability
The capacity to assess realistically advanced cyber warfighting capabilities must be increased to keep pace with heightened demand for those capabilities, advancing technologies, and the growing cyber threat. In February 2011, the Chairman of the Joint Chiefs of Staff issued a memorandum directing that all major exercises include realistic cyber adversary elements as a training objective. To comply with this order, the cyber content and rigor of exercises executed each year will need to increase. The Joint Information Operations Range offers a multi-level security environment to integrate and conduct simultaneous cyber activities. DOT&E identified a $90 million need over the FYDP to upgrade range operations and capacity to conduct additional events, handle larger amounts of message traffic, and portray cyber threats and responses with increased fidelity. Additionally, DOT&E estimates $59 million over the FYDP is needed to provide additional capabilities for realistic threat development and assessment, as well as additional expertise and training for the Red Teams employing cyber threats during training and test events. Lastly, DOT&E estimates additional funding of $46 million across the FYDP will support assessments during all appropriate Combatant Commander annual exercises.

Fifth Generation Aerial Target
No U.S. aerial target, including the QF-16 currently in development, can replicate fifth generation fighter characteristics such as low observability or embedded electronic attack. The result is operationally realistic testing cannot be accomplished for U.S. air-to-air and surface-to-air weapons systems against fifth generation fighters. Therefore, DOT&E is executing a target design study based on the recommendation of the Defense Science Board with a goal of determining if an affordable Fifth Generation Aerial Target can be developed. A preliminary design and associated cost estimates are anticipated in FY12.

Anti-Ship Ballistic Missile Target
A threat representative Anti-Ship Ballistic Missile (ASBM) target for operational open-air testing has become an immediate test resource need. China is fielding the DF-21D ASBM, which threatens U.S. and allied surface warships in the Western Pacific. While the Missile Defense Agency has exo-atmospheric targets in development, no program currently exists for an endo-atmospheric target. The endo-atmospheric ASBM target is the Navy's responsibility, but it is not currently budgeted. The Missile Defense Agency estimates the non-recurring expense to develop the exo-atmospheric target was $30 million with each target costing an additional $30 million; the endo-atmospheric target will be more expensive to produce according to missile defense analysts. Numerous Navy acquisition programs will require an ASBM surrogate in the coming years, although a limited number of targets (3-5) may be sufficient to validate analytical models.

Advanced Electronic Countermeasures Test Capability
Digital radio frequency memory (DRFM) jamming technology presents one of the biggest challenges to the development and testing of U.S. radar countermeasures. DRFM jamming threats effectively target and disrupt U.S. fighter aircraft, ship-borne, and ground-based radar systems. To support operational testing of U.S. radars, flexible and programmable DRFM jammers that adequately replicate current threats need to be developed. These threat jammers must have the capability to incorporate new and advanced techniques as the threat evolves. In the interim, DoD is pursuing a better understanding of the threat systems and using opportune training events, such as the Northern Edge joint training exercise, to develop aircrew tactics, techniques, and procedures under the Joint Electronic Protection for Advanced Combat organization. Nevertheless, a test resource investment of approximately $10 million in DRFM research and development remains a need.

Joint Urban Test Capability
The U.S. military has a requirement for joint urban testing in an operationally realistic environment with challenges to air, ground, and maritime systems while stressing a systems-of-systems approach. Specifically, threat representative urban test facilities that provide adequate structures, electromagnetic signatures,

and improved instrumentation are needed. Urban training sites are typically scheduled beyond capacity and lack the necessary precise instrumentation to measure the effects from currently employed capabilities. The Joint Urban Test Capability project has been initiated under the Central T&E Investment Program to address this test resource need.

Real Time Casualty Assessment Capability

Real time casualty data collected during live/virtual/constructive force-on-force tests allow for the evaluation of the performance of Soldiers and their weapons using a systems-of-systems approach for realistically assessing the degree of battlefield damage, particularly in a Joint Urban Environment. The challenge is understanding weapon systems interactions during these engagements and the fidelity of instrumentation required to be effective yet affordable. An enterprise strategy to include real-time casualty assessments in the ongoing Network Integration Evaluations would leverage the dismounted Soldier's use of integrated resources under test. Generating such a strategy would help resolve the competing Army test priorities for the initial $71 million it programmed in 2010.

Hostile Fire Indication Capability

The DoD's Helicopter Survivability Task Force, in response to helicopter combat losses due to unguided hostile ground fires, determined that there is a vital need for a comprehensive, standardized instrumentation package to be used on live-fire Hostile Fire Indication gun, Rocket Propelled Grenade (RPG), and Man-Portable Air-Defense (MANPAD) events for gathering critical data for development of aircraft protective systems and mission tactics. Standardized high-resolution data will support model development for use in digital simulation models, installed system test facilities, and open-air simulators; and, provide validated data to assess Aircraft Survival Equipment performance. DOT&E, authorized by Congress, is facilitating standardization by obtaining a limited amount of threat articles and exploring alternatives to conventional (continental) U.S. data collection and testing practices through the Foreign Cooperative Program, and assisting the Services in obtaining the requisite data.

Frequency Spectrum

The T&E community competes with commercial and other Federal entities for access to the radio-frequency (RF) spectrum. There has been an increase in RF spectrum allocated to commercial uses via congressional reallocation of the government spectrum and from petitioning the Federal Communications Commission (FCC) for additional frequency assignments. The result is insufficient spectrum to support T&E telemetry operations (primarily in the L and S frequency bands) and FCC restrictions on DoD RF emissions and jamming operations. This problem is exacerbated by the growth in data transmission rates needed as more complex weapon systems are developed and the military's need to demonstrate RF spectrum exploitation to disrupt and deny spectrum access by adversaries. To offset these problems, funding and support from Congress as well as other federal agencies is needed. The objective would be to pursue the following:

- Protect critical T&E RF spectrum bands from reallocation.
- Acquire additional RF spectrum to offset reallocated spectrum. This would include development of a multi-Service implementation plan to ensure acquisition programs and range facilities also utilize the additional spectrum to facilitate spectrum compatibility.
- Develop methods and technologies that more efficiently use the RF spectrum.
- Develop mobile T&E range assets that can be employed to areas where RF spectrum encroachment and interference are minimized.

Sustainable Range Initiative

Live testing of weapons systems is dependent on the continued availability of land, air, sea, undersea areas, and test instrumentation capabilities to measure the performance of systems under test. The Sustainable Range Initiative, as chartered by DoD in 2001, provides the framework for the Department to address and mitigate issues that may degrade test and training mission capabilities. For instance, renewable energy infrastructure, such as wind turbines, has been documented to interfere with range instrumentation capabilities. To address mission compatibility with renewable energy developments, Congress authorized DoD to issue procedures to address these impacts on military operations. DOT&E, along with the Deputy Under Secretary of Defense for Installations and Environment, and the Deputy Under Secretary of Defense for Readiness have co-led the DoD process to develop procedures to evaluate, and mitigate, where possible, the effects of renewable energy developments on military operations. A DoD Energy Siting Clearinghouse has been established and has reviewed the backlog of renewable energy projects from the Federal Aviation Administration Obstruction Evaluation process, as well as some projects that were proposed on Bureau of Land Management (BLM) lands. Of the 249 projects reviewed, 238 were found either to not to interfere with DoD mission operations or that acceptable mitigation options were available. The remaining 11 projects require further evaluation and currently are being addressed along with new renewable energy project proposals that have come to the Department's attention.

Joint Test and Evaluation

Joint Test and Evaluation

Joint Test and Evaluation Program

The primary objective of the Joint Test and Evaluation (JT&E) program is to provide rapid solutions to operational deficiencies identified by the joint military community. The program achieves this objective by developing new tactics, techniques, and procedures (TTPs) and rigorously measuring the extent to which their use improves operational outcomes. JT&E projects may develop products that have implications beyond TTPs. These products are submitted to the appropriate Service or combatant command as a doctrine change request. The Joint Requirements Oversight Council reviews these suggested changes for inclusion as joint doctrine. The project's products may also be submitted to the Air, Land, Sea Application Center that promulgates multi-Service tactical documents. Additionally, the program develops operational testing methods that have joint application. The program is complementary to, but not part of, the acquisition process. Projects annotated with an asterisk (*) closed in FY11.

The program managed seven joint tests in FY11 that focused on the needs of operational forces:

- Joint Air Defense Operations-Homeland (JADO-H)*
- Joint Civil Information Management (J-CIM)*
- Joint Cyber Operations (JCO)
- Joint Data Integration (JDI)*
- Joint Integration of Maritime Domain Awareness for Homeland Defense (JIMDA)
- Joint Jamming Assessment and Mitigation (JJAM)
- Joint Unmanned Aircraft Systems (UAS) Digital Information Exchange (JUDIE)

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 14 QRTs in FY11:

- Afghanistan Mission Network Coalition Battlespace Management (AMN-CBM)
- Airborne Maritime Moving Target Indicator (AMMTI)
- Foreign Humanitarian Assistance/Disaster Relief (FHA/DR)*
- Host Based Security System (HBSS)*
- Joint Analytical Network Assessment (JANA)
- Joint Exploitation of Modern Surface-to-Air Missile Systems (JEMS)
- Joint Maritime Evaluation of Transit Escort (J-METE)*
- Joint Military Working Dog (JMWD)
- Joint Modular Protection System (JMPS)*
- Joint Passive Electronic Radio Frequency Emission Classification and Tracking (J-PERFECT)*
- Joint Passive Electronic Radio Frequency Emission Classification and Tracking II (J-PERFECT II)
- Joint Rapid Attack Process (J-RAP)*
- Joint Vehicle Protection and Survivability System (JVPSS)
- Rapid Development and Sustainment of Enterprise Mission Services (RDEMS)

The program executes special projects, as directed by DOT&E, which address problems DoD-wide. The program managed one special project in FY11, the Joint Test and Evaluation Methodology-Transition (JTEM-T).*

JOINT TESTS

JOINT AIR DEFENSE OPERATIONS-HOMELAND (JADO-H)*

(Closed December 2010)

Sponsor/Charter Date: North American Aerospace Defense (NORAD) and U.S. Northern Command (USNORTHCOM)/ August 2007

Purpose: To develop joint TTPs and planning processes for deployable, integrated air defense systems (D-IADS)

Products/Benefits: Standardized collaborative planning tools used to counter emerging air threats to the homeland.

These collaborative tools included:

- 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)*

(Closed June 2011)

Sponsor/Charter Date: U.S. Special Operations Command/ 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 nongovernmental organizations to support the joint force commander's operational planning.

Products/Benefits: A J-CIM users guide that:

- Improves sharing of unclassified civil information
- Standardizes collection, consolidation, and sharing of civil information
- Identifies senior leader and staff requirements for the integration of civil data to support planning, operations, and assessments in support of non-lethal operations

* Project closed in FY11

- Enables commanders, senior leaders, and other stabilization and development partners to better share, identify, prioritize, and apportion civil affairs resources

JOINT CYBER OPERATIONS (JCO)

Sponsor/Charter Date: U.S. Pacific Command (USPACOM)/ August 2010

Purpose: To assess, develop, and evaluate joint TTPs to employ a virtual secure enclave strategy, an adaptive cyber defense concept, and to ensure the protection and availability of critical command and control services in support of joint task force (JTF) commanders in operational environments.

Products/Benefits: The JCO-developed concept of operations (CONOPS), TTPs, quick reference guides, and related training will:
- Address network vulnerabilities of critical command and control services by enabling JTF commanders to employ the virtual secure enclave architecture to protect against, detect, and respond to cyber threats to specific services at the operational level
- Provide the commander with situational awareness and cyber defense options to maintain a proactive defensive posture
- Facilitate a systematic approach to implement the principles of war in the cyber domain
- Test and validate operational effectiveness of a JTF implementation.

JOINT DATA INTEGRATION (JDI)*
(Closed April 2011)

Sponsor/Charter Date: U.S. Joint Forces Command and 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 combatant and JTF commanders with an effective common tactical picture.

Products/Benefits: The JDI project developed a data management handbook with quick reference guides for developing and sharing the common tactical picture. These products provide new command and control data management procedures that improve the quality of the common tactical picture used by combatant and JTF commanders to support force employment decisions. Other benefits:
- Improved policies and procedures for implementation emphasizing common tactical picture management
- USPACOM, U.S. European Command (USEUCOM), and U.S. Southern Command (USSOUTHCOM) established and now routinely use the Joint Data Network Operations Cell at JTF headquarters.
- U.S. Strategic Command (USSTRATCOM) reported a marked overall improvement in USPACOM and USEUCOM theater inputs to the Global Common Operating Picture after JDI recommendations were adopted within those commands.

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
- JFC Handbook for Developing and Sharing MDA across the NORAD and USNORTHCOM Command and Control Network
- Implementing a maritime central access portal for NORAD and USNORTHCOM operational use

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 SATCOM 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
- Shorter timelines to mitigate SATCOM purposeful interference
- Incorporation of SATCOM mitigation training and procedures into joint exercises
- Enhanced operations in a SATCOM degraded environment
- Recommendations on needed changes to joint publications, USSTRATCOM instructions, and user checklists

JOINT UNMANNED AIRCRAFT SYSTEMS DIGITAL INFORMATION EXCHANGE (JUDIE)

Sponsor/Charter Date: Air Force Joint Test and Evaluation Program Office/August 2010

Purpose: To develop, test, and evaluate cross-component UAS information exchange TTPs used to improve joint battlespace situational awareness and target prosecution capabilities for the supported and supporting commanders at the tactical level of brigade and below.

Products/Benefits:
- Standardize UAS information exchange TTPs and checklists
- Standardize terminology for UAS information exchange
- Utilize 561st Joint Tactics Squadron's Flash Bulletin process to deliver interim TTPs

* Project closed in FY11

QUICK REACTION TESTS

AFGHANISTAN MISSION NETWORK COALITION BATTLESPACE MANAGEMENT (AMN-CBM)

Sponsor/Charter Date: U.S. Central Command (USCENTCOM) and Defense Information Systems Agency (DISA)/January 2011

Purpose: To apply a test methodology that can adequately measure and evaluate the battlespace management TTPs for both joint and coalition forces.

Products/Benefits: Development of TTPs for the Afghanistan Mission Network testing organizations to enable them to develop reliable, mission-based measures and metrics for coalition mission threads under test, and to execute repeatable test events that answer these mission-based measures.

AIRBORNE MARITIME MOVING TARGET INDICATOR (AMMTI)

Sponsor/Charter Date: USSOUTHCOM/July 2011

Purpose: To develop and test TTPs to employ an AMMTI capability that can detect and track self-propelled semi- and fully-submersible vessels.

Products/Benefits:
- Tactics Bulletin submitted to the 561st Joint Tactics Squadron for subsequent integration into Air Force TTP 3-1 (JSTARS), Air Force TTP 3-3 (JSTARS), and Combat Aircraft Fundamentals at scheduled review and rewrite conferences.
- New AMMTI section added to the Joint Interagency Task Force–South standard operating procedure and managed by the task force Air Component Coordination Element.

FOREIGN HUMANITARIAN ASSISTANCE/DISASTER RELIEF (FHA/DR)*

(Closed July 2011)

Sponsor/Charter Date: USSOUTHCOM/July 2010

Purpose: To develop, assess, and validate CONOPS and TTPs for DoD operational and tactical forces tasked to conduct foreign disaster relief missions subsequent to a natural disaster in support of the Department of State and U.S. Agency for International Development and in coordination with intergovernmental and nongovernmental organizations.

Products/Benefits: The Department of Defense Support to Foreign Disaster Relief Handbook for the Joint Task Force Commander and Below contains CONOPS and TTPs that enable Title 10 forces to effectively integrate disaster response efforts with the Department of State and the U.S. Agency for International Development, as well as international organizations (such as the United Nations and Red Cross and Crescent Societies), intergovernmental, and nongovernmental organizations. The handbook will improve interagency coordination, cooperation, collaboration, and communication to foster unity of effort.

HOST BASED SECURITY SYSTEM (HBSS)*

(Closed January 2011)

Sponsor/Charter Date: USSTRATCOM and DISA/January 2010

Purpose: To develop, assess, and validate standard enterprise HBSS configurations and TTPs that will give 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 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 ANALYTICAL NETWORK ASSESSMENT (JANA)

Sponsor/Charter Date: USPACOM, USNORTHCOM, and DISA/January 2011

Purpose: To develop, test, and validate a mission essential circuit list (MECL) for all inter-landmass command circuit service designators in the Pacific theater supporting operations plans and critical mission operations, both inside and outside of the USPACOM area of responsibility.

Products/Benefits:
- A methodology utilizing an analytical hierarchy process to develop standardized inter-landmass MECLs and TTPs for use of MECLs during strategic communication restoration.
- The benefits to the commander will be properly sequenced restoration efforts based on inter-landmass MECLs and TTPs to ensure the most important capabilities are restored first.

JOINT EXPLOITATION OF MODERN SURFACE-TO-AIR MISSILE SYSTEMS (JEMS)

Sponsor/Charter Date: Naval Air Weapons Center-Weapons Division; Naval Strike and Air Warfare Center; U.S. Air Force Warfare Center/January 2011

Purpose: To develop and test TTPs that will outline the characteristics of effective countermeasures to modern surface-to-air missile systems for improving aircrew survivability.

Product/Benefits: The JEMS project is anticipated to provide updates to the Joint Research Assessment and Analysis Center for inclusion in applicable computer simulations. It will also produce generic TTPs and training outlines for incorporation by the Services into applicable tactics and training products.

* Project closed in FY11

JOINT MARITIME EVALUATION OF TRANSIT ESCORTS (J-METE)*
(Closed January 2011)

Sponsor/Charter Date: U.S. Transportation Command and U.S. Coast Guard Forces Command/January 2010

Purpose: To develop and test the CONOPS 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 and restricted waterways in the continental United States.

Products/Benefits:
- A J-METE handbook outlining the TTPs to detect and interdict asymmetric underwater threats to ships in transit
- Enhancement of mission success against asymmetric underwater threats for commanders responsible for escorting high value ships transiting militarily significant ports and restricted waterways

JOINT MILITARY WORKING DOG (JMWD)

Sponsor/Charter Date: USCENTCOM/April 2011

Purpose: To develop, test, and validate TTPs to support the ground tactical commander's use and support of military working dogs while performing counter-IED missions.

Products/Benefits: The JMWD QRT will transition TTPs to USCENTCOM to support the ground tactical commander's use and support of military working dogs while performing counter-IED missions. In addition, the project will develop a multi-Service tactical manual for use in the field by commanders and units receiving military working dogs for the same mission.

JOINT MODULAR PROTECTION SYSTEM (JMPS)*
(Closed July 2011)

Sponsor/Charter Date: USCENTCOM/July 2010

Purpose: To develop and validate Modular Protective System TTPs that enhance force protection to military personnel deployed in potentially hazardous areas.

Products/Benefits: TTPs that articulate the proper employment and deployment of the Modular Protective System in USCENTCOM's area of responsibility.

JOINT PASSIVE ELECTRONIC RADIO FREQUENCY EMISSION CLASSIFICATION & TRACKING (J-PERFECT)*
(Closed March 2011)

Sponsor/Charter Date: NORAD and USNORTHCOM/March 2010

Purpose: To develop joint CONOPS and TTPs for sustained air vigilance operations against aviation threats to the homeland.

Products/Benefits: A standard, globalized CONOPS and TTPs that optimize the execution and employment of multi-Service, combatant command, and national agency capabilities to detect, identify, track, and evaluate air threats to the United States.

JOINT PASSIVE ELECTRONIC RADIO FREQUENCY EMISSION CLASSIFICATION & TRACKING II (J-PERFECT II)

Sponsor/Charter Date: NORAD and USNORTHCOM/May 2011

Purpose: To develop and evaluate CONOPS and TTPs based on DoD intelligence, surveillance, and reconnaissance capabilities that have the potential to improve near real-time situational awareness for decision-makers in support of tactical operations against modern air threats to the United States.

Products/Benefits: Test results will provide enhanced CONOPS and TTPs for air defense employment to the joint operational community.

JOINT RAPID ATTACK PROCESS (JRAP)*
(Closed March 2011)

Sponsor/Charter Date: USSTRATCOM/January 2010

Purpose: To investigate, evaluate, and make recommendations to improve cyber mission planning methods used to employ alternative approaches of current capabilities against complex targeting challenges.

Products/Benefits:
- Cyber playbook
- Operational TTPs to improve cyber mission planning, rehearsal, execution, and assessment

JOINT VEHICLE PROTECTION AND SURVIVABILITY SYSTEM (JVPSS)

Sponsor/Charter Date: USCENTCOM/July 2011

Purpose: To develop, test, and validate TTPs to support the ground tactical commander's focus on vehicle survivability, protection, and detailed safety design features and enhancements.

Products/Benefits: The JVPSS tactical level handbook will focus on survivability, protection, and detailed vehicle safety design features and enhancements.

RAPID DEVELOPMENT AND SUSTAINMENT OF ENTERPRISE MISSION SERVICES (RDEMS)

Sponsor/Charter Date: DISA/July 2011

Purpose: To develop, validate, and document new processes and TTPs that will contribute to DoD's move from its legacy information systems to a modern enterprise services environment.

Products/Benefits: RDEMS test products will include:
- Updated CONOPS and revised technical and operational TTPs
- A use-case reference with process implementation guidance
- Lessons learned captured in an enterprise "how to" process document

* Project closed in FY11

SPECIAL PROJECT

JOINT TEST AND EVALUATION METHODOLOGY TRANSITION (JTEM-T)*

(Closed April 2011)

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 DOT&E Testing in a Joint Environment Roadmap, with particular emphasis placed on enhancing and improving current operational test agency test processes.

Products/Benefits:

- Documented improvements to operational test agency 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
- Fundamental elements of JTEM were the basis of successfully assessing Afghanistan Mission Network operational shortfalls.

* Project closed in FY11

Center for
Countermeasures

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) T&E activities of U.S. and foreign weapon systems, subsystems, sensors, and related components in support of the DOT&E, Deputy Assistant SECDEF (DASD) Developmental Test & Evaluation (DT&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 aircraft survivability equipment (ASE) used on rotary-wing and fixed-wing aircraft.
- Determines effectiveness of precision guided weapon (PGW) systems and subsystems when operating in a CM degraded environment.
- Develops and evaluates CM/CCM techniques and devices.
- Tests and develops new CMs as they are discovered on the modern battlefield in operationally realistic environments.
- Provides analysis and recommendations on CM/CCM effectiveness to Service Program Offices, DOT&E, DASD(DT&E) and the Service member.
- Supports Service member exercises, training, and pre-deployment activities.

During FY11, the Center tested, analyzed, and reported on more than 40 DoD electro-optical systems or subsystems with special emphasis on rotary-wing survivability. The Center participated in operational/developmental tests for rotary- and fixed-wing ASE testing, PGWs, hostile fire indicator (HFI) data collection, experimentation tests, and pre-deployment/exercise support related to the CM/CCM mission area.

Approximately 66 percent of the Center's efforts were spent on ASE and HFI systems, and 18 percent of the Center's efforts were focused on overseas contingency operations (OCO) support with emphasis on CM-based, pre-deployment training for rotary-wing units. About 4 percent of the Center's efforts were spent on PGW testing, and 12 percent were applied to internal improvement and modernization efforts to enhance test capabilities and efforts to develop test methodologies for use across the Services.

The Center continued to develop multiple test tools for evaluating ASE infrared countermeasure (IRCM) systems and hostile fire signature (HSIG) models used to support development of HFI systems. In addition to leading test tool development efforts, the Center also developed an ASE T&E methodology guidebook to provide DoD with guidance for planning, executing, and reporting on ASE test events. The Center remains an active participant in providing subject matter expertise to numerous working groups and task forces.

The following activities are representative of those conducted by the Center during the past year.

ASE AND HFI ACTIVITIES

ROTARY-WING TEST EVENTS

Navy: Department of the Navy Large Aircraft Infrared Countermeasure (DoN LAIRCM) Laser Warning Sensor Lab Test

- **Sponsor**: Navy Program Executive Officer, Advanced Tactical Aircraft Protection Systems Program Office (PMA 272)
- **Activity**: The Center provided laser test assets, facility, and crew to perform developmental testing of a laser detector assembly.
- **Benefit**: The data collected from this effort were used to determine the sensor response characteristics of a modified laser warning sensor circuit card assembly and to collect data for use in laser detection algorithm development against threat-representative laser assets across multiple spectral bands.

OSD: Rotorcraft Aircraft Survivability Equipment (RASE) Experiment

- **Sponsor**: Assistant SECDEF (Research and Engineering) ASD(R&E)
- **Activity**: The Center served as Experiment Director and radiometric data collector during the RASE event at Yuma Proving Ground, Arizona. Twenty-two different systems mounted on Maverick Unmanned Aerial Vehicles and/or a fixed tower participated in the experiment.
- **Benefit**: The RASE Experiment is a venue focused on ASE that enhances decision makers' understanding of ASE performance and advances the ASE state of the art testing. The RASE Experiment is expected to improve realism and standardization in the testing of ASE, improve the extent of testing prior to fielding, and provide an opportunity for multiple developers to save costs overall.

Army: Hostile Fire Indicting System (HFIS) – Army Flight Test 1

- **Sponsor**: U.S. Special Operations Command (USSOCOM), Technology Applications Program Office
- **Activity**: The Center provided the Joint Mobile IRCM Test System (JMITS) for missile simulation to support a flight data collection event with a USSOCOM MH-47 equipped with the HFIS system in Yuma Proving Ground, Arizona.
- **Benefit**: The sponsor used this event to collect background and live fire data from the AN/AAR-57 Common Missile Warning System (CMWS), AN/AVR-2B Laser Detecting Set, Helicopter Alert Threat Termination-Acoustics, and BAE Systems acoustic detection ring for HFIS development systems installed on a representative aircraft.

Navy: DoN LAIRCM GPS Antenna Regression Test

- **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 to determine if the new GPS antenna integrated into the CH-46E degraded the performance of the DoN LAIRCM system; testing was conducted at White Sands Missile Range.
- **Benefit**: The assessment of this threat detection and Directed Infrared Countermeasures system resulted in verification that the new GPS antenna did not degrade the performance of the DoN LAIRCM system.

Army: Reduced Optical Signature Emissions Solution VI

- **Sponsor**: Department of the Army Technology Applications Program Office, Systems Integration and Maintenance Office (SIMO) Aircraft Survivability Equipment Cell
- **Activity**: The Center provided test assets and crew to perform effectiveness testing of flares and flare sequences against reactive captive infrared (IR) missiles. This data was used to finalize flare sequences on 160th Special Operations Aviation Regiment rotary-wing aircraft.
- **Benefit**: The outcome of this combined effort resulted in verification of the effectiveness of flare sequences used on both aircraft deployed in-theater and under development.

Navy/Marine Corps: CH-53E, MV-22, and MH-60R Flight Tests

- **Sponsor**: Naval Surface Warfare Center – Crane Division, with funding from the Aircraft Self-Protection Optimization program
- **Activity**: The Center provided test assets and crew to perform effectiveness testing of flares and flare sequences against reactive captive IR missiles. These tests evaluated new CM sequences, variations of current CM sequences using improved flares, or different flares within the sequences.
- **Benefit**: The test results on flare sequence effectiveness are being used to enhance the protection of these aircraft against IR Man-Portable Air Defense Systems (MANPADS).

Army: Intelligent Decision-aiding for Aircraft Survivability (IDAS)

- **Sponsor**: Department of the Army, Aviation Applied Technology Directorate
- **Activity**: The Center provided JMITS test equipment as well as captive-carry IR missiles and crews to support end-to-end, open-air T&E of an AH-64 rotary-wing aircraft equipped with IDAS.
- **Benefit**: The IDAS prototype testing contributed to critical future IRCM protection of Army rotary-wing aircraft.

<u>FIXED-WING TEST EVENTS</u>

Air Force: C-130 Avionics Modernization Program

- **Sponsor**: Department of the Air Force, 418th Flight Test Squadron
- **Activity**: The Center provided laser test assets, the JMITS, and crew to support the sponsor in their effort to determine the functionality of the C-130 AMP integrated defensive avionics software with the legacy defensive system.
- **Benefit**: The data collected were used to verify the integrated system performance between the legacy defensive system and the new integrated defensive avionics system.

Air Force: LAIRCM Next Generation Phase II C-17A Developmental Test (DT)/Operational Test (OT)

- **Sponsor**: 654th Aeronautical Systems Squadron, Wright Patterson AFB
- **Activity**: The Center provided missile simulation test assets and crew to perform end-to-end testing of the LAIRCM Next Generation system installed on the C-17A operating in an open-air environment.
- **Benefit**: This testing contributed to critical protection of Air Force heavy-lift capability during OCO operations.

Air Force: LAIRCM Next Generation Phase II C-17A IOT&E

- **Sponsor**: AFOTEC Detachment 2, Eglin AFB
- **Activity**: The Center provided the JMITS and Towed Aerial Plume Simulator (TAPS) missile simulators and crew to perform end-to-end testing of the LAIRCM Next Generation system installed on the C-17A operating in an open-air environment.
- **Benefit**: This testing contributed to critical protection of Air Force heavy-lift capability during OCO operations.

ROTARY- AND FIXED-WING TEST EVENTS

Army, OSD: Seeker Bowl VI

- **Sponsors**: U.S. Army Research Development and Engineering Command , and the Office of the SECDEF-Joint Electronic Advanced Technology
- **Activity**: The Center provided test assets and crew to collect test data on flare protection effectiveness for five fixed-wing and two rotary-wing aircraft against reactive captive IR missiles. The effectiveness of new flare CM sequences or variations of current flare CM sequences were evaluated.
- **Benefit**: Sponsors are using these test results on flare sequence effectiveness to enhance the protection of various aircraft against IR MANPADS.

Air Force, Navy: Advanced Strategic and Tactical Infrared Expendables

- **Sponsors**: Naval Surface Warfare Center – Crane Division; Air Force Special Operations Command; 46th Test Wing; and Air Mobility Command
- **Activity**: The Center provided test assets and crew to collect test data on eight different aircraft against reactive captive IR missiles. These tests evaluated new flare CM sequences, variations of current flare 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 MANPADS.

HOSTILE FIRE INDICATOR (HFI) DATA COLLECTION EVENTS

Navy: AAR-47 HFI upgrade and Multi-Function Threat Detector Live-Fire Data Collection

- **Sponsor**: Navy Program Executive Officer, Advanced Tactical Aircraft Protection Systems Program Office (PMA-272)
- **Activity**: The Center provided radiometric instruments and crew during the testing of the AAR-47 and Multi-function Threat Detector at China Lake Naval Weapons Test Center, California.
- **Benefit**: This activity provided a venue for testing of HFI systems for rapid fielding deployment and collected threat signature data for use in developing hostile fire models.

Army: Hostile Fire Detection System Signature Ammo Study (SAS)

- **Sponsor**: Program Manager-Aircraft Survivability Equipment (PM–ASE)
- **Activity**: The Center provided radiometric equipment and test crews to collect and reduce signature data on small arms (muzzle, hardbody and tracer) and rockets (eject, boost, and tracer characteristics) on three separate test events: SAS-1, SAS-2, and SAS-W.
- **Benefit**: The measured data results will determine the variability within ammunition types and country of origin. The measured data will be used to develop the DOT&E Threat Resource Activity (TETRA)-sponsored hostile fire signature (HSIG) model. The Center will develop the HSIG model that will integrate into T&E Modeling and Simulation facilities and support Hostile Fire Detection System foreign ammunition purchases to support test events.

PGW CM ACTIVITIES

Army: 66 mm Red Phosphorous Grenade IR Characterization

- **Sponsors**: U.S. Army Joint Attack Munition System Project Office, Joint Air-to-Ground Missile (JAGM) Program Office and U.S. Army Edgewood Chemical Biological Center
- **Activity**: The Center planned, coordinated, and executed a field test to characterize the 66 mm vehicle launched, self-screening grenade. The characterization consisted of various physical property and IR measurements, including the ability to conceal a target.
- **Benefit**: The characterization of the 66 mm red phosphorus grenades will provide data to support the selection of suitable battlefield obscurants for use during DT efforts to reach acquisition milestone C for the JAGM program.

CM-BASED PRE-DEPLOYMENT TRAINING FOR ROTARY-WING UNITS

Mission Employment Exercise – Nellis AFB, Nevada
HH-60 Surface Attack Training – Nellis AFB, Nevada
Enhanced Mohave Viper – Twentynine Palms, California
Emerald Warrior – Eglin AFB, Florida
Combat Search and Rescue Joint Integration Exercise – Nellis, AFB, Nevada

- **Sponsors**: Various
- **Purpose**: The Center's equipment and personnel provided a simulated threat/CM environment and subject matter expertise to observe aircraft sensor/ASE systems and crew reactions to this environment. Emphasis was placed on providing simulated MANPAD engagements for participating aircraft.
- **Benefit**: Provides realism to the training threat environment for the pilots and crews to facilitate understanding and use of CM equipment, especially ASE. Data collected are provided to the trainers for assisting units in the development/refinement of tactics, techniques, and procedures to enhance survivability.

SURVIVABILITY INITIATIVES

HSIG Model

The Center is leading development of an HSIG model to support HFI T&E and modeling efforts. The HSIG Model project is sponsored by the TETRA and will develop a physic-based, electro-optical model that produces signatures for the 12.7 mm Armor Piercing Incendiary Tracer round and rocket-propelled grenade. After initial development and validation, the HSIG model will be expanded to include more hostile fire threats.

Annual Hostile Fire Indicator Conference

The Center held an HFI symposium and workshops that included current HFI program briefings, "break-out" coordination sessions, and DoD and international partner information exchange. This Center-led initiative provides a venue for cross-Service discussion on the common problem of Service member protection from hostile fire in theater.

Joint Countermeasures T&E Working Group (JCMT&E WG)

The JCMT&E WG is co-chartered by DOT&E and DASD(DT&E) to improve the integration of aircraft self-protection developmental, live-fire and operational T&E through standardized test methodologies, instrumentation and standards. This group includes DOT&E, DASD(DT&E), all four of the U.S. Services, Australia, Canada, New Zealand, United Kingdom and NATO Air Force Armaments Group Sub-Group 2, as members of a coalition warfare sub-WG. The group is tasked with actively seeking mutually beneficial T&E opportunities to measure valid performance and suitability data necessary to provide relevant operational information to deploying Joint/Coalition Warfighters and for U.S. acquisition decision makers. Specific efforts include the following:

- The Center was instrumental in developing, coordinating and implementing an eight-year bilateral Cooperative Test and Evaluation ASE Project Arrangement with the United Kingdom. Both nation's defense organizations, ASE program offices, DT, OT and LFT&E agencies, will now be able to collaborate on common test equipment and procedures, measure operationally relevant ASE data, and improve Service member survivability.
- The JCMT&E WG has scheduled official negotiations with Australia on a bilateral ASE Project Arrangement to expand our T&E capabilities and cooperation.
- In support of former SECDEF, HON. Robert Gates, and NATO Secretary General, HON. Anders Fogh Rasmussen's High-Level NATO Multinational Approaches Initiatives, the Center developed and delivered Dr. Gilmore's DOT&E initiatives to NATO and is now leading an exploratory technical team to develop alliance-wide solutions.
- The Center is collaborating with DOT&E's TETRA in defining ASE/HFI data needs for a NATO accessed, interactive web page, and establishing a centralized location for the Coalition's HFI data that will be accessible by Service members and U.S. Service program managers.

Helicopter Survivability Task Force (HSTF)

The Center participated in the Assistant SECDEF for Research and Engineering-led HSTF discussions that examined helicopter survivability for DoD project selection (out-of-cycle funding request to Congress and the Future Years Defense Program in FY11). The Center's three recommended projects were ranked in the top four by the Services.

Aircraft Survivability Equipment Test and Evaluation Methodology Guidebook

DOT&E tasked the Center to create an ASE T&E Methodology Guidebook to provide the DoD with guidance for planning, executing, and reporting on ASE systems' test events. The ASE systems addressed in this guidebook include IRCM, UV and IR passive Missile Warning Systems (MWS), HFI, and Laser Warning Receiver systems.

The guidebook is intended to provide program managers, T&E leads, test directors, and test team members with a process for ASE system testing. Such a guide is especially critical for program managers and test managers/leads new to ASE testing. This guidebook provides suggested processes and procedures for collecting test data, as well as suggested data formats and products for presenting test data to aid the T&E community in achieving consistency and expectations.

THREAT SIMULATOR TEST AND EVALUATION TOOLS

The Center, in conjunction with the Test Resource Management Center, is leading the IRCM Test Resource Requirements Study (ITRRS) "refresh." The end product from this effort will be an updated roadmap of prioritized projects necessary to perform T&E of advanced IRCM and HFI systems. The original ITRRS roadmap was completed in 2007, which led to several projects being funded by Central Test and Evaluation Investment Program to fill the identified IRCM T&E gaps. Each product will have a functional description of the project; the priority is based upon Program of Record need dates, test requirements, and Service input.

The Center has continued to develop tools for test and evaluation of IRCM systems funded by the USD(AT&L) Test Resource Management Center, Central Test and Evaluation Investment Program. Currently, the Center is leading the development of the following test tools:

- The TAPS is used to resolve shortfalls of emulating spatial/temporal signatures for testing 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 test in a realistic IR clutter environment. TAPS development was completed in FY11 and supported the operational testing of LAIRCM Next Generation.

- The Multi-Spectral Sea and Land Test Simulator is a small, mobile missile simulator that can fire while moving 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 Next Generation, DoN LAIRCM, and Joint and Allied Threat Awareness System.
- The Center is developing the functional requirements for the Joint Standard Instrumentation Suite (JSIS). The JSIS is to be a comprehensive, turn-key instrumentation package that can be used during hostile fire testing and MANPADS missile firing events to support model development and validation. The JSIS will provide calibrated signature measurements for T&E (enhanced test adequacy), and post-test anomaly resolution. All data collected using JSIS will be archived and made available to the Services for current and future IRCM programs.

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