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## Director, Operational Test and Evaluation

# FY 2007 Annual Report

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**December 2007**

This report satisfies the provisions of Title 10, United States Code, Section 139. The report summarizes the operational test and evaluation activities (including live fire testing activities) of the Department of Defense during the preceding fiscal year.

  
Dr. Charles E. McQueary  
Director

# Report Documentation Page

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# INTRODUCTION

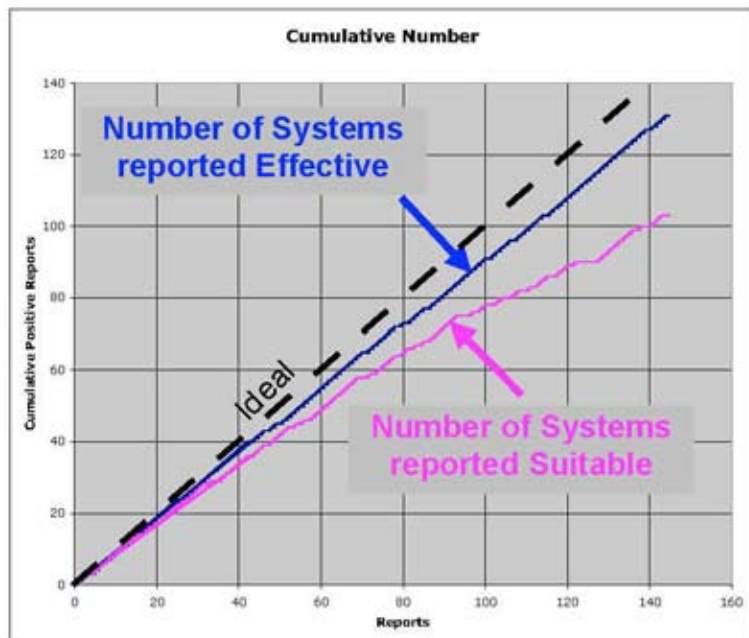
During this year, my office was privileged to monitor 288 Major Defense Acquisition Programs (MDAPs) and special interest programs. I approved 61 Test and Evaluation Master Plans and Test and Evaluation Strategies, one LFT&E Strategy, and 66 Operational Test and Evaluation Plans for specific test events. To the Secretary of Defense and the Congress, DOT&E delivered eight Beyond Low-Rate Initial Production / Live Fire Reports and three Early Fielding Reports, provided a separate report on Missile Defense, and testified at two sessions of congressional meetings.

Since my first report to you last year, I have continued to evolve and strengthen the goals and priorities I wrote about including the internal manpower study. In addition, I addressed emerging test requirements in force protection and net-centric warfare, and the report on policies and practices of test and evaluation directed in the National Defense Authorization Act (NDAA) of 2007, Section 231. The Conference Report to Accompany H.R. 1585 NDAA for Fiscal Year 2008 directs that the results of the manpower assessment be included in this Annual Report. It is included here and in Annex A.

I view these endeavors as key strategic activities and the following discussion of each of them will provide insight into the direction I have set for this organization.

## GOALS IN PRIORITY ORDER

**1. Improve Suitability.** I continue to believe operational test and evaluation should confirm performance, rather than reveal new failure-modes. During 2007, DOT&E worked with key stakeholders, including



industry, to enhance the failure-mode discovery process and eliminate surprises in operational testing. I have concluded that the key issue is inadequate system reliability, which is in turn a key component of suitability. Contributors to reliability problems include: poor definition of reliability requirements, a lack of understanding by the developer on how users will operate and maintain the system when fielded, lack of reliability incentives in contracting, and poor tracking of reliability growth during system development. While we have made progress in identifying the systemic problems causing poor suitability, program performance has not shown improvement. Of the eight

Beyond Low-Rate Initial Production (BLRIP) reports published last year, most systems (88 percent) were operationally effective; but half (50 percent) were not suitable. To further put this in context, DOT&E has sent a total of 144 system reports to Congress since 1983 and we assessed 103 of the systems as suitable (72 percent). This past year's result of 50 percent reveals a continued downward trend as depicted in the chart.

The trend raises two concerns. First, system suitability – especially reliability – directly impacts our warfighter's performance. The DoD needs systems that are effective when needed, not just effective when available. Second, suitability – especially reliability – drives system life cycle costs. Put simply, poor reliability means higher sustainment cost.

As part of our efforts, we analyzed several programs that show a clear linkage between investment to improve reliability and reduced life cycle costs. Our analysis revealed reliability returns-on-investment

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between a low of 2 to 1 and a high of 128 to 1. The average expected return is 15 to 1, implying a \$15 savings in life cycle costs for each dollar invested in reliability. Since the programs we examined were mature, I believe that earlier reliability investment (ideally, early in the design process), could yield even larger returns with benefits to both warfighters and taxpayers.

I am convinced that each step in the development process can be used to improve suitability: the statement of requirements, the contract with industry, the design phase, early discovery of failure modes in developmental and operational test (DT/OT), and the collection of field data. While DOT&E is engaged in the operational testing of systems, we are also teaming with Departmental and industry partners to forge improvements in earlier steps.

Key stakeholders also agree with DOT&E that reliability (and its associated elements availability, and maintainability, together known as RAM) is a primary contributor to sustainment costs. In May 2007, the Joint Staff took a key first step by publishing an updated instruction about system requirements (CJCSI 3170.01F). The Joint Staff declared “Materiel Availability” a mandatory Key Performance Parameter (KPP) with two Key System Attributes (KSA): “Materiel Reliability,” and “Ownership Cost.” These KPP/KSAs make reliability a required metric for system evaluation, and show Departmental consensus that reliability is linked to: 1) System availability – ensuring warfighters have the system they need when they need it and, 2) Reducing total ownership cost.

Along with mandatory metrics, a clear picture must exist as to how the operational concept, the maintenance concept (how users will operate and maintain the system when fielded), and the metrics are intended to align. That picture provides the context for system design tradeoffs, and the conditions for test and evaluation. We call this picture the “Sustainment Requirements Development Report,” and it is being developed to explain the rationale for a system’s Materiel Availability KPP. The Joint Staff, the office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, and DOT&E are collaborating on a handbook on how to develop the metrics and produce the report.

I also believe an effort to define best practices for reliability programs is vital and that these should play a larger role in both the guidance for, and the evaluation of, program proposals. Once agreed upon and codified, reliability program standards could logically appear in both Requests for Proposals (RFPs) and, as appropriate, in contracts. Industry’s role is key in this area. Through an initiative with government and industry, the Government Electronics and Information Technology Association (GEITA) is working to define these best practices. A related project is ongoing work by the National Defense Industrial Association’s (NDIA) Systems Engineering committee. The latter group is examining the impact of current defense acquisition policy and guidance on system suitability. The NDIA plans to deliver recommendations for acquisition policy which should help industry improve suitability. In sum, I see industry’s increased commitment to address reliability and suitability as evidence of growing momentum for improvement.

As a final note, DOT&E understands the key role that operational testing will have in informing decision-makers about the new sustainment KPP. We are working with the Service Operational Test Agencies on how best to gather test data which could provide information about ownership cost. The objective is to use realistic data, from T&E, to support estimates of ownership cost.

In response to DOT&E’s top priority of improving suitability, we have reached out across the DoD and to industry in a variety of initiatives. Each is important, and all – collectively – are necessary to properly set requirements, incentivize industry, oversee system design and development, and finally confirm suitability in operational T&E. The results will not be immediate, but the problem – as this year’s suitability results indicate – must be addressed. If each of these initiatives is successful, over time I expect to report more operationally suitable systems.

**2. Enhance operational realism in early tests, including developmental testing.** During the past year, DOT&E supported a Defense Science Board (DSB) Task Force examining the need to reinvigorate

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developmental test and evaluation. The interim results from that effort suggest that the frequent discovery of technical maturity problems in system operational test and evaluation, can be corrected only by re-instituting a disciplined Systems Engineering process during design and development. As I stated earlier, operational test and evaluation should be a mechanism to confirm performance, rather than one to discover new failure-modes. The DSB suggested, as many others have, that integrating developmental and operational testing could help. Among the suggestions made in the DSB interim report were the following:

- Change OSD and Service policy to mandate integrated DT/OT evaluation planning which defines testing required for all system-level evaluation.
- Enable access to all system-level test data by government DT and OT organizations as well as the prime contractor. (Separate evaluations can be accomplished by prime contractor and government test entities.)
- Give special attention to incorporating test events, where practical, designed to satisfy OT as well as DT requirements.
- Define which testing will be accomplished by the prime contractor, government DT lead, and OT as the lead agency.
- Integrate Operational Test Agencies into the deficiency report process, to include participation on Joint Reliability Maintainability Evaluation Team (JRMET) or Corrective Action Review Board throughout DT.
- Require periodic RAM assessments throughout DT to ensure early identification of problems.

Implementation of the above suggestions will create more realistic and operationally representative conditions in early testing, especially DT.

**3. Provide timely performance information to the warfighters.** Congress stimulated progress on this priority by requiring Early Fielding Reports when a system is committed to operations before a full-rate production decision. In FY07 DOT&E delivered three such reports in compliance with this requirement.

These assessments are provided to decision-makers to help them make informed fielding decisions when systems are fielded for operational use prior to the full-rate production decision. It also helps make joint warfighters and commanders aware of system capabilities and limitations for systems that are fielded early. I believe that early fielding does not remove my responsibility to determine whether a system is effective and suitable for combat before the full-rate production decision. The Early Fielding Report will be followed by the usual Beyond Low-Rate Initial Production Report when the Initial Operational Test and Evaluation (IOT&E) is complete.

The Services have also emphasized T&E responsiveness to deployed warfighters. To support the urgent need to defeat Improvised Explosive Devices (IEDs), the Services conduct rapid testing to provide information on capabilities and limitations of systems issued directly to our warfighters to defeat IEDs. To support the Joint IED Defeat Organization, testers use flexible, streamlined, and tailored test procedures based on standard test protocols such as reusing knowledge and data, sharing data among Services and agencies, and providing concise and timely reports to support decisions. Likewise, the Air Force and Navy provide rapid evaluations of components for urgently needed capabilities such as Integrated Base Defense Security, Global Hawk, and Small Diameter Bomb employment, and Counter-Bomb detection and mitigation systems. When, in order to get equipment to those in harms way, the testing is inadequate, follow-on testing will be required.

#### **4. Examine operational testing resources.**

**A. Results of Assessment of Sufficiency of Test and Evaluation Personnel.** One of the key resources that DOT&E examined this year was very close to home. Title 10 specifies that “the Director shall have sufficient professional staff of military and civilian personnel to enable the Director to carry out the duties and responsibilities of the Director prescribed by law.” Conference language directs a report to Congress. After careful examination I have determined that I do not have sufficient professional staff (military and

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civilian) to adequately carry out the duties and responsibilities outlined for this office in 10 USC 139. Likewise, I am limited in my ability to properly support the acquisition process and to respond quickly to Combatant Commanders' requests for support from our Joint Test and Evaluation Program. The needed capabilities are inherently governmental, i.e., cannot be done by contractors. The senior leadership of the DoD is now reviewing our September request for additional staff.

I attribute the staff shortfall to the 59 percent increase – since 1994 – in programs on the DOT&E oversight list (from 184 to 288), and an increase in responsibilities associated with congressional direction to DOT&E – without a commensurate increase in staff.

The number of Action Officers on our staff has remained almost constant since 1983, despite statutory changes and acquisition initiatives which have significantly increased our workload. As a result of our analysis, we have requested a small increase in our military staff and a somewhat larger increase in our civilian staff. The military billets address the need for a current operational perspective in T&E. More detail is provided in Annex A.

**B. Manpower in the Service OTAs.** I also maintain a perspective of resource issues in the Service OTAs. One current interest is the OTAs' capability to report certain types of data to enable OSD to evaluate the sustainability Key Performance Parameter previously mentioned. Typical T&E events often yield maintenance and repair information and usage data that will contribute to realistic estimates of system sustainment costs. We are working with OSD offices responsible for sustainment cost estimates, and with the OTAs, to contribute relevant data. As with all new missions, there is a question of resources. Depending on results of our pilot work, I may recommend additional resources for OTAs in order to support evaluation of the new Key Performance Parameter.

**5. Training.** To ensure that DOT&E personnel are well trained and prepared to meet the challenges presented by the evolving acquisition and testing environments, DOT&E has revamped its in-house training program. The training program has four levels.

1. Orientation, within two weeks of a new DOT&E staff member arriving, that provides basic understanding of job and duties and where to get further guidance.
2. Action Officer Course offered twice a year to give in-depth instruction on performing their responsibilities.
3. Continuing Education that presents topics intended to keep all personnel abreast of policy changes, lessons learned, new initiatives, and approaches to resolve testing challenges.
4. Professional Development designed to improve the education and leadership of assigned personnel.

As part of the level three training, I sponsored a special training this year related to the DOT&E initiative in system reliability. We arranged for an acknowledged, world-class expert in system reliability to teach best practices for assuring system reliability to select DOT&E staff, OSD Acquisition (systems engineering) staff, and analysts from the Institute for Defense Analyses. This course was designed to enable the OSD staff to interface directly with program offices, as part of the oversight mission, and coach programs on the right ways to achieve reliable systems.

As part of level four (professional development), nine DOT&E staff are participating in the Deputy Secretary of Defense's Lean Six Sigma "Green Belt" training, and my Deputies and I have either taken, or are going to take, executive training in that subject.

## EMERGING TESTING MISSION AREAS

**1. Force Protection Equipment.** Congressional language requires the Director to provide guidance to and consult with DoD officials regarding the operational test and evaluation or survivability testing of force protection equipment, including non-lethal weapons. The language does not however, provide DOT&E the authority to oversee these programs, nor influence the scope of their test and evaluation

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programs. Based upon increased congressional interest in personnel body armor and combat helmets, I believe DOT&E should have traditional oversight authority over these programs both in operational testing and survivability testing. We are working with key partners (who include: Assistant Secretary of the Army (Acquisition, Logistics, and Technology), Army Test and Evaluation Command, Army Research Laboratory, Marine Corps Systems Command, Joint Non-Lethal Weapons Directorate, Human Effects Center of Excellence, Air Force Test and Evaluation, Joint Staff J-8, Special Operations Command, U.S. Navy (Research, Development, and Acquisition), and USD(AT&L)) to develop plans for future engagement in the force protection area.

There were two notable examples of DOT&E involvement in force protection programs this year. The first example addressed congressional concern about body armor that triggered a July 2007 decision to require DOT&E to oversee body armor testing. As this report goes to press, DOT&E continues our involvement with the Army Test and Evaluation Command while they prepare to test vendors for Army body armor. In a related supporting effort, DOT&E, the Army, and the Marine Corps have been working together for some time to select and codify a new test operations procedure.

The second example concerned a July 2007 requirement to assess the ballistic protection of the military Personnel Armor System for Ground Troops helmet in response to a Department of Justice investigation. Within 10 days of the request, DOT&E responded to the Secretary of Defense that the tested helmets met the ballistic protection requirement. Details on these matters are in the Live Fire section of this report.

**2. Net-Centric Systems.** Another emerging challenge is the protection of our networked information systems. The success of the United States and our coalition partners in net-centric warfare has not gone unnoticed by potential adversaries. Today, we see continual probing of our networks, as well as kinetic demonstrations of potential disruptions to our space and net-centric systems. Assessment of these systems must extend beyond preventing intrusion. Additional focus is needed in detecting intrusions, reacting to attacks, and rapidly restoring essential capabilities. We have carried out the congressional mandate to assess fielded systems, as well as our responsibilities to acquisition programs. Future efforts will require an aggressive use of live, virtual, and constructive techniques in concert with the joint training community. In FY08, we will work with our partners at U.S. Joint Forces Command to help align joint testing and training roadmaps in this growing mission area.

## SECTION 231 REPORT ON T&E POLICY AND PRACTICE

Section 231 of the National Defense Authorization Act for Fiscal Year 2007, Public Law 109-364, directed a review and amendment, if appropriate, of DoD policies and practices on test and evaluation. An initial report (July 17, 2007) responding to this task identified policy initiatives under active consideration with respect to both traditional and emerging acquisition approaches:

- Testing and evaluation should concentrate on measuring improvements to mission capability and operational support based on user needs;
- Testing and evaluation programs should experiment in the sense that they should learn and understand the strengths and weaknesses of a system and its components, and the effect on operational capabilities and limitations. Decision-makers (e.g., managers, engineers, and users) can then incorporate test results into corrective actions or system enhancement initiatives;
- Developmental and operational testing should be integrated and continual to the maximum extent feasible;
- Testing and evaluation should begin early, be more operationally realistic, and continue through the entire system life cycle;
- Evaluation should be conducted in the mission context expected at time of fielding to the user and beyond and should be expressed in terms of the operational significance of the test results;
- Evaluations should include a comparison against current mission capabilities so that measurable improvements can be determined;

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- Evaluations should take into account all available data and information;
- Test and evaluation should exploit the benefits of appropriate models and simulations.

Many of these items are similar to the previously discussed Defense Science Board Task Force recommendations. Changes to T&E policy were submitted to the Congress in December. The institutionalization of these policies will require changes to the Department's Acquisition Directives and Regulations.

## **DOT&E OVERSIGHT ACTIVITY FOR FISCAL YEAR 2007**

During this year, my office monitored 288 Major Defense Acquisition Programs (MDAPs) and special interest programs. I approved 61 Test and Evaluation Master Plans and Test and Evaluation Strategies, one LFT&E Strategy, and 66 Operational Test and Evaluation Plans for specific test events.

DOT&E delivered eight Beyond Low-Rate Initial Production Reports to the Secretary of Defense and the Congress:

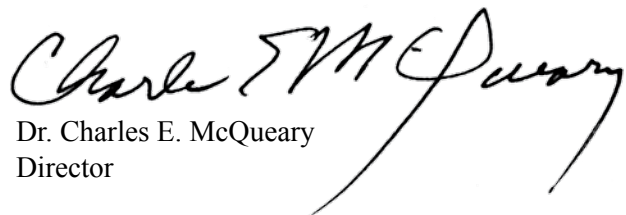
1. Small Diameter Bomb (SDB) - October 6, 2006
2. Global Broadcast Service (GBS) System - December 4, 2006
3. Small Unmanned Aerial System (SUAS) - December 13, 2006
4. APG-79 Active Electronically Scanned Array (AESA) Radar - April 25, 2007 (classified)
5. UH-60M Black Hawk Utility Helicopter - May 17, 2007
6. Common Submarine Radio Room (CSRR) - June 29, 2007
7. CH-47F Block II Improved Helicopter - June 29, 2007
8. UH-72A Lakota Light Utility Helicopter (LUH) - July 27, 2007

DOT&E also delivered three Early Fielding Reports under the requirements of the NDAA for FY07, Section 231:

1. Land Warrior System - April 17, 2007
2. Stryker Mobile Gun System (MGS) - June 4, 2007 (classified)
3. Common Broadband Advanced Sonar System (CBASS) Torpedo - June 7, 2007 (classified)

Finally, in addition to the Missile Defense Agency section of this Annual Report, we provided a separate classified February 15, 2007, report and testified at two sessions of congressional meetings.

It continues to be an honor and a privilege for me to be part of an organization that is the "key to weapons that work." With that in mind, I am pleased to present the 2007 Annual Report that follows.



Dr. Charles E. McQueary  
Director

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# **DOT&E Activity and Oversight**



# **DOT&E Activity and Oversight**

## Activity Summary

DOT&E activity for FY07 involved oversight of 288 programs, including 43 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 FY07 included approval of 61 Test and Evaluation Master Plans (TEMPs) / Test and Evaluation Strategies, as well as 66 Operational Test

Plans. Live Fire Test and Evaluation (LFT&E) activity included the approval of one LFT&E Strategy for inclusion in the TEMP. In FY07, DOT&E prepared 12 reports for the Secretary of Defense and Congress that included eight Beyond Low-Rate Initial Production Reports, three Early Fielding Reports, and one assessment on the Ballistic Missile Defense System (BMDS).

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

### TEST AND EVALUATION MASTER PLANS / STRATEGIES APPROVED

Acoustic Rapid Commercial Off-the Shelf (COTS) Insertion (A-RCI) – Revision A

Airborne and Maritime/Fixed Station (AMF) Joint Tactical Radio (JTRS)

ALQ-99 Low-Band Transmitter – Revision A

AN/WLD-1(V)1 Remote Mine-hunting System Program

Anti-Air Warfare Ship Self Defense Test and Evaluation Enterprise Strategy

B-2 Extremely High Frequency Satellite Communications and Computer Upgrade

Ballistic Missile Defense System (BMDS) Integrated Master Test Plan (IMTP)

Business Systems Modernization Energy

CH-47F Improved Cargo Helicopter – Revision D

Command Post of the Future Maneuver Control System

Commissary Advanced Resale Transaction System (CARTS)

Common Submarine Radio Room – Revision 2

Deployable Joint Command and Control – Version 4.0

DoD Key Management Infrastructure – Version 1.5.4

EA-18G Airborne Electronic Attack Aircraft – Revision B

Excalibur (XM982) Ia-2 Milestone C and Low-Rate Initial Production

F/A-18 Advanced Targeting and Designating Forward Looking Infrared System – Revision A

F/A-18E/F – Revision E

Family of Medium Tactical Vehicles Long Term Armor Strategy

Family of Medium Tactical Vehicles – Revision 3B

Future Nuclear Carrier (CVN 21) – Revision B

Global Broadcast Services (GBS)

Global Combat Support System – Marine Corps / Logistics Chain Management Block 1 – Version 4.0.7.15

Global Combat Support System for Combatant Command / Joint Task Force (GCCS-CC/JTF) – Version 6.0

Global Command and Control System

Guided Multiple Launch Rocket System – Unitary

Heavy Expanded Mobility Tactical Truck (HEMITT) A4 Long Term Armor Strategy (LTAS)

High Performance Computer Modernization Program (HPCMP)

Integrated Strategic Planning and Analysis Network (ISPAN)

Joint Biological Agent Identification and Diagnostic System (JBAIDS)

Joint Cargo Aircraft – Version 2

Joint Chemical Agent Detector (JCAD) – Increment I

Joint Mission Planning System – Maritime

Joint Warning and Reporting Network Block II

KC-130T Hercules Defensive Electronic Countermeasures

Large Aircraft Infrared Countermeasures (LAIRCM) – Revision (Change Pages)

Light Utility Helicopter (LUH)

LPD 17 – Revision C (Change Pages)

MH-60S Multi-Mission Combat Support Helicopter – Revision A

Mine Resistant Ambush Protected Vehicle Program

Mission Planning System (MPS) for F-15 – Version 1.2 Initial Operational Test

Mission Planning Systems

Mk 48 Torpedo Advanced Capability (ADCAP) – Revision 10

Mobile User Objective System

Multi-functional Information Distribution System – Low Volume Terminal Shipboard Integrated – Revision B

Multi-mission Maritime Aircraft – Revision A

# DOT&E ACTIVITY AND OVERSIGHT

## TEST AND EVALUATION MASTER PLANS / STRATEGIES APPROVED

Navy Enterprise Resource Planning	Teleport
Navy Enterprise Resource Planning – Version 3	Transformational Satellite Communications System (TSAT) – Version 5.0
Net-Centric Enterprise Services – Version 1.1	Transformational Satellite System (TSAT)
Ohio Class SSGN Conversion Program – Revision A, Change 1	UH-60M Upgrade
Ship Self Defense System (SSDS) MK 2 Mod 2 Program – Revision A, Change 1	V-22 Osprey
Small Diameter Bomb Increment I	Vertical Takeoff and Landing Tactical Unmanned Aerial Vehicle (VTUAV)
Space-Based Infrared System (SBIRS)	Virginia (SSN 774) Class Submarine – Revision E
Space-Based Infrared System (SBIRS) Annex	

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## OPERATIONAL TEST PLANS APPROVED

Acoustic Rapid Commercial Off-the-Shelf (COTS) Insertion (A-RCI) Advanced Processor Build (APB) Operational Test (OT)-IIIE/F	Deployable Joint Command and Control (DJC2) System Rapid Response Kit (RRK)
Acoustic Rapid Commercial Off-the-Shelf (COTS) Insertion (A-RCI) OT-IIIE/F Change 1	EA-18G Airborne Electronic Attack Aircraft (OT-B1)
Acoustic Rapid Commercial Off-the-Shelf (COTS) Insertion (A-RCI) Sonar System Phase III and IV	EA-18G Airborne Electronic Attack Aircraft OT&E Framework
Acoustic Rapid Commercial Off-the-Shelf (COTS) Insertion (A-RCI) Test Plan	F/A-18A + C/D/E/F System Configuration Set 20X Integrated Test Plan
AGM-154C Joint Standoff Weapon Unitary Variant (JSOW-C) Block II System OT-IIIA	F-22A Increment 2 Operational Flight Program Follow-on Operational Test and Evaluation (FOT&E) Plan
ALQ-99 Low-Band Transmitter OT-IIC	F-22A Lot 5 Operational Utility Evaluation (OUE) Test Plan
AN/WLD-1(V)1 Remote Mine-hunting System Program OT-IIC	F-35 Joint Strike Fighter OA (OT-IIC)
Armed Forces Health Longitudinal Technology Application Block 2 (Dental) Event Design Plan	Family of Medium Tactical Vehicles (SMTV) A1P2 and Heavy Expanded-Mobility Tactical Truck A4 Long-Term Armor Strategy Event Design Plan
Baseline IV Tactical Tomahawk Weapon System (OT-IIID)	Global Broadcast System (GBS) Space System (TP 07-006)
Baseline IV Tactical Tomahawk Weapon System (OT-IIID) Change 1	Multi-Service Operational Test and Evaluation (MOT&E)-2
Business Systems Modernization Energy Operational Assessment (OA) Plan	Global Combat Support System – Joint (GCCS-J) Version 4.1 Joint Planning and Execution System (JOPES) Strategic Server Enclave (SSE)
C-17 Combat Lightning Force Development Test Plan	Global Combat Support System for Combatant Command / Joint Task Force (GCCS-CC/JTF) Version 6.0
C-17 Traffic Collision Avoidance System (TCAS) Overlay	Global Combat Support System for Combatant Command / Joint Task Force (GCCS-CC/JTF) Version 6.1
C-5 Reliability Enhancement and Re-Engining Program (RERP) OA-2	Global Command and Control System Joint Global Version 4.1 Operational Assessment Plan
CH-47F Improved Cargo Helicopter Phase II Test Plan	Global Positioning System (GPS) Architecture Evolution Plan (AEP) OUE Plan
Combat Information Transport System Second Generation Wireless Local Area Network	Global Positioning System (GPS) Architecture Evolution Plan (AEP) OUE Plan AFOTEC TP-05-032
Commissary Advanced Resale Transaction System (CARTS) IOT&E	Integrated Strategic Planning and Analysis Network (ISPAN) OA Plan
Common Submarine Radio Room (CSRR) OT-C-2	Joint Biological Agent Identification Diagnostic System FOT&E Plan
Common Submarine Radio Room (CSRR) OT-C-3	Joint Biological Point Detection System (JBPDS) MOT&E Phase VI Plan
Continuous Evaluation of the Defense Travel System Reservation Refresh Software Release	
CV-22 Osprey OT-IIIC	

# DOT&E ACTIVITY AND OVERSIGHT

Joint Biological Standoff Detection System (JBSDS) Increment 1 MOT&E	Ship Self Defense System (SSDS) MK 2 Mod 2 Program FOT&E (OT-IIID Phase I)
Joint Chemical Agent Detector Increment 1 EDP Production Qualification Test (Interferents With and Without)	Ship Self Defense System (SSDS) Mk 2 Mod IA/3A Program OT-IIID Phase 2
Joint Mission Planning System – Maritime Program IOT&E OT-IIA-AV8B MPE 2.0	Ship Self Defense System (SSDS) Mk2 Mod 2 Program FOT&E
Joint Warning and Reporting System (JWARN) OA 2	Small Diameter Bomb Increment I (SDB I) Data Collection Plan
KC-130T Hercules Defensive Electronic Countermeasures (DECM) Suite FOT&E	Spider Network Command Munition IOT&E
Landing Platform Dock (LPD 17) OT-IIC Phase 1 Test Plan	Stryker Mobile Gun System (MGS)
Light Utility Helicopter (LUH)	Suite of Integrated Radio Frequency Countermeasures AN/ALQ-211(V) IOT&E
MH-60S Block 3A Armed Helicopter Weapon System OT-IIH	Theater Battle Management Core Systems (TBMCS) Unit Level (UL) Operations Spiral 9.1 Force Development Evaluation (FDE) Plan
Mine Resistant Ambush Protected Vehicle Program	Theater Battle Management Core Systems (TBMCS) Combined Test 1.1.3 Service Pack 7
Miniature Air Launched Decoy Test Plan	Transportation Coordinator Automated Information Movement System II Block 3
Mk 48 Advanced Capability Torpedo OT-IIH	UH-60M Blackhawk IOT&E
Multi-functional Information Distribution System - Low Volume Terminal Shipboard Integration	U.S. Air Force Warfare Center F-22A Mission Load Data Optimization Test Plan
Navy Enterprise Resource Planning IOT&E OT-B1 Plan	
Ohio Class SSGN Conversion Program	
Public Key Infrastructure (PKI) Program OA	

## LIVE FIRE TEST AND EVALUATION STRATEGIES AND TEST PLANS

Joint Cargo Aircraft Alternative Live Fire Strategy

## REPORTS TO CONGRESS FOR FY07

Program	Report Type	Date
Small Diameter Bomb	Combined OT / LFT Report	October 2006
Global Broadcast Service (GBS) System	OT Report	December 2006
Small Unmanned Aerial System (SUAS)	OT Report	December 2006
FY06 Assessment of the Ballistic Missile Defense System (BMDS)	Annual Report	February 2007
APG-79 Active Electronically Scanned Array (AESA) Radar System	OT Report	April 2007
Land Warrior System	Early Fielding Report	April 2007
UH-60M Blackhawk Helicopter Upgrade	Combined OT / LFT Report	May 2007
CH-47F Block II Cargo Helicopter	Combined OT / LFT Report	June 2007
Common Submarine Radio Room (CSRR)	OT Report	June 2007
Stryker Mobile Gun System (MGS)	Early Fielding Report	June 2007
Common Broadband Advanced Sonar System (CBASS) Torpedo	Early Fielding Report	June 2007
UH-72A Lakota Light Utility Helicopter (LUH)	OT Report	July 2007

## DOT&E ACTIVITY AND OVERSIGHT

During FY07, DOT&E met with Service operational test agencies, program officials, private sector organizations, and academia; monitored test activities; and provided information to the DAB committees as well as the DAB principals, the Secretary and Deputy Secretary of Defense, the Under Secretary of Defense (Acquisition, Technology and Logistics), the Service Secretaries, and Congress. Active on-site participation in, and observation of, tests and test related activities remain the most effective tools.

In addition to on-site participation and local travel within the national capital region, approximately 547 trips supported the DOT&E mission.

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

## Program Oversight

DOT&E is responsible for approving the adequacy of plans for operational test and evaluation and for reporting the operational test results for all major defense acquisition programs to the Secretary of Defense, Under Secretary of Defense (Acquisition, Technology and Logistics), Service Secretaries, and Congress. For DOT&E oversight purposes, major defense acquisition programs were defined in the law to mean those programs meeting the criteria for reporting under section 2430, Title 10, United States Code (Selected Acquisition Reports (SARs)). The law (sec.139(a)(2)(B)) also stipulates that DOT&E may designate any other programs for the purpose of oversight, review, and reporting. With the addition of such “non-major” programs, DOT&E was responsible for oversight of a total of 288 acquisition programs during FY07.

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

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

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

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

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

DOT&E was responsible for the oversight of 108 LFT&E acquisition programs during FY07.

## PROGRAMS UNDER DOT&E OVERSIGHT CALENDAR YEAR 2007 (As taken from the April 2007 Official T&E Oversight List)

### ARMY PROGRAMS

- Abrams Tank Upgrade (M1/M2)
- Advanced Threat Infrared Countermeasures / Common Missile Warning System (ATIRCM/CMWS)
- Aerial Common Sensor (ACS)
- Apache Block III (AB3)
- Armed Reconnaissance Helicopter (ARH) Program
- Army Integrated Air and Missile Defense (AIAMD)
- Biometrics
- Black Hawk Upgrades (UH-60M) – Utility Helicopter Upgrades
- Bradley Upgrade – M2/M3 Fighting Vehicle Systems
- CH-47F – Cargo Helicopter
- Distributed Common Ground System – Army (DCGS-A)
- Excalibur (Family of Precision, 155 mm Projectiles)
- Extended Range / Multi-purpose Unmanned Aircraft System (ER/MP UAS) including Hellfire Missile upgrade
- Family of Medium Tactical Vehicles (FMTV) (including armor modifications)
- Force XXI Battle Command Brigade and Below (FBCB2) Program
- Future Combat System (FCS) and all associated systems (and active protective systems), including:
  - Armed Robotic Vehicle (ARV) Assault (ASLT)
  - Armed Robotic Vehicle (ARV) Assault Light (ASLT(L))
  - Armed Robotic Vehicle (ARV) Reconnaissance and Surveillance Target and Acquisition (RSTA)
  - Command and Control Vehicle (C2V)
  - FCS Recovery Maintenance Vehicle (FRMV)
  - Infantry Carrier Vehicle (ICV)
  - Medical Vehicle (MV) (Treatment and Evacuation Variant)
  - Mid-Range Munitions (MRM)
  - Mk 44 Cannon 30 mm Ammunition
  - Mounted Combat System (MCS)
  - Multifunction Utility / Logistics and Equipment Vehicle (MULE) Transport
  - Multifunction Utility / Logistics and Equipment Vehicle (MULE) Countermine
  - Network Battle Command
  - Recon and Surveillance Vehicle (R&SV)
  - Small Manpackable Unmanned Ground Vehicle (SUGV)
  - UAV Class I
  - UAV Class II
  - UAV Class III
  - UAV Class IV (Fire Scout)
- Unattended Ground Sensors (UGS) (Tactical and Urban UGS)
- Non-Line-of-Sight Cannon (NLOS-C)
- Non-Line-of-Sight Mortar (NLOS-M)
- Non-Line-of-Sight Launch System (NLOS-LS)
- Global Combat Support System – Army (GCSS-A)
- Global Command and Control System – Army (GCCS-A)
- Ground Soldier System
- Guided Multiple Launch Rocket System (GMLRS) – Dual Purpose Improved Conventional Munitions (DPICM)
- Guided Multiple Launch Rocket System (GMLRS) – Unitary
- High Capacity Communications Capability (HC3)
- High Mobility Artillery Rocket System (HIMARS) including HIMARS Armored Cab
- High Mobility Multi-purpose Wheeled Vehicle (HMMWV) Armor
- Intelligent Munitions System (IMS)
- Javelin Antitank Missile System – Medium
- Joint Air-to-Ground Missile System (JAGM) (replaces Joint Common Missile)
- Joint Heavy Lift Program
- Joint Land Attack Cruise Missile Defense Elevated Netted Sensors (JLENS)
- Joint Mission Planning System (JMPS)
- Joint Network Transport Capability-Spiral (JNTC-S) / Joint Network Node (JNN)
- Land Warrior – Integrated Soldier Fighting System for Infantrymen
- Light Utility Helicopter (LUH)
- Long Term Armoring Strategy (LTAS) including:
  - Fuel Tankers
  - Heavy Equipment Transporter (HET)
  - Heavy Expanded Mobility Tactical Truck (HEMTT)
  - M915A3 Family of Vehicles
  - M939 General Purpose Truck
  - Palletized Loading System (PLS)
- Maneuver Control System (MCS) / Joint Tactical Common Operational Picture (COP) Workstation (JTCW)
- Mark XIIA Identification Friend or Foe (IFF) Mode 5
- One – Tactical Engagement Simulation System (One-TESS)
- Patriot / Medium Extended Air Defense System Combined Aggregate Program (PATRIOT/MEADS CAP)

## ARMY PROGRAMS (continued)

Patriot Advanced Capability 3 (PAC-3) Missile

Precision Guided Mortar Munitions (PGMM)

Shadow Unmanned Aircraft System (Shadow UAS)

Small Unmanned Aircraft System (Raven UAS)

Spider XM7 Network Command Munition (formerly Anti-Personnel Landmine Alternative (APLA)/Spider)

Stryker – Armored Vehicle and all associated systems (and active protective systems), including:

- Stryker – Anti-Tank Guided Missile Vehicle
- Stryker – Commander’s Vehicle
- Stryker – Engineer Squad Vehicle
- Stryker – Fire Support Vehicle
- Stryker – Infantry Carrier Vehicle

- Stryker – Medical Evacuation Vehicle
- Stryker – Mortar Carrier
- Stryker – Reconnaissance Vehicle
- Stryker – Mobile Gun System
- Stryker – Nuclear, Biological, and Chemical (NBC) Reconnaissance Vehicle

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

Transportation Coordinators' Automated Information for Movements System II (TC-AIMS II)

Warfighter Information Network – Tactical (WIN-T)

XM307 25 mm Close Combat Armament System

XM1022 Long-Range Sniper Ammunition

## NAVY PROGRAMS

21" Mission Reconfigurable Unmanned Undersea Vehicle (21" MRUUV)

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

Active Electronically Scanned Array (AESA)

Advanced SEAL Delivery System (ASDS)

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

AIM-9X – Air-to-Air Missile Upgrade including AIM-9X P3I

Airborne Mine Neutralization System (AMNS)

Airborne Resupply / Logistics for SeaBasing (AR/LSB)

Aegis Cruiser Conversion Program

AN/AAR-47 V2 Upgrade Missile / Laser Warning Receiver

AN/APR-39 Radar Warning Receiver

AN/WQR-3 Advanced Deployable System (ADS)

AN/WSQ-11 Countermeasure Anti-Torpedo

Assault Directed Infrared Countermeasures (DIRCM)

Broad Area Maritime Surveillance (BAMS)

BYG-1 Fire Control (Weapon Control and Target Motion Analysis)

CG(X) – Next Generation Cruiser

CH-53K Heavy Lift Replacement (HLR) Program

Close-In Weapon System (CIWS) including SeaRAM

Cobra Judy Replacement (CJR) – Ship-based Radar system

Common Link Integration Processor (CLIP)

Consolidated Afloat Network and Enterprise Service (CANES)

Cooperative Engagement Capability (CEC) (including P3I effort)

CVN 21 – Next Generation Nuclear Aircraft Carrier

DDG 51 Guided Missile Destroyer

DDG-1000 *Zumwalt* Class Destroyer (formerly DD(X) Future Surface Combatant) including Long-Range Land Attack Projectile

Deployable Joint Command and Control (DJC2)

Digital Modular Radio (DMR)

Distributed Common Ground System – Marine Corps (DCGS-MC)

Distributed Common Ground System – Navy (DCGS-N)

E-2D Advanced Hawkeye (AHE) / E-2C Radar Modernization Program (RMP)

EA-6B Improved Capabilities (ICAP) III and Multiple Upgrades (Low Band Transmitter, Band 7-8 Transmitter, USQ-113 Communications Jammer)

EA-18G Airborne Electronic Attack (AEA) variant of F/A-18

Evolved Sea Sparrow Missile (ESSM)

Expeditionary Fighting Vehicle (EFV)

Extended Range Munition (ERM)

F/A-18 E/F Hornet Naval Strike Fighter (All Upgrades)

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

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

H-1 Upgrades (4BW/4BN) – Marine Corps Upgrade to AH-1W Attack Helicopter and UH-1N Utility Helicopter

Integrated Defensive Electronic Countermeasure (IDECM)

Joint High Speed Vessel (JHSV)

Joint Mission Planning System – Maritime (JMPS-M)

Joint Primary Aircraft Training System (JPATS)

Joint Standoff Weapon (JSOW) Baseline Variant and Unitary Warhead Variant

## NAVY PROGRAMS (continued)

KC-130J Aircraft	Rolling Airframe Missile (RAM) including RAM Block 1A Helo-Air-Surface (HAS) and RAM Block 2 Programs
LHA Replacement – New Amphibious Assault Ship	Ship Self Defense System (SSDS)
LHD 8 Amphibious Assault Ship	Ship to Shore Connector – Joint Assured Maritime Access (Planned replacement for Landing Craft Air Cushion and Landing Craft Utility)
Littoral Combat Ship (LCS) (includes 57 mm ammunition and Non-Line-of-Sight Launch System (NLOS-LS))	SSGN <i>Ohio</i> Class Conversion
Logistics Vehicle System Replacement	SSN 774 <i>Virginia</i> Class Submarine
LPD 17 Amphibious Transport Dock (Includes 30 mm ammunition)	Standard Missile 2 (SM-2) Block IIIB
Maritime Prepositioning Force (Future) (MPF (F))	Standard Missile 6 (SM-6)
Mark XIIA Identification Friend or Foe (IFF) Mode 5	Submarine External Communications System (SubECS) / Common Submarine Radio Room (CSRR)
MH-60R Multi-Mission Helicopter Upgrade	Surface Electronic Warfare Improvement Program (SEWIP)
MH-60S Fleet Combat Helicopter	T-AKE <i>Lewis &amp; Clark</i> Class of Auxiliary Dry Cargo Ships
Mk 48 Torpedo Mods	Tactical Tomahawk Weapon System (TTWS) (including Tactical Tomahawk All Up Round (AUR), Tactical Tomahawk Weapons Control System (TTWCS), and Tomahawk Command and Control System (TCCS))
Naval Integrated Fire Control – Counter Air (NIFC-CA)	Trident II Missile
Navy Advanced Extremely High Frequency (EHF) Multi-Band Terminal (NMT)	V-22 Osprey Joint Advanced Vertical Lift Aircraft
Navy Enterprise Resource Planning (ERP) (includes Navy Enterprise Maintenance Automated Information System (NEMAIS))	Vertical Take-Off Unmanned Aircraft System (VTUAS) (also called Fire Scout) include Tactical Control System (TCS)
Navy Unmanned Combat Air System (NAVY UCAS) (Previously called J-UCAS)	VH-71 Presidential Helicopter Fleet Replacement Program
P-8A Multi-Mission Maritime Aircraft (MMA)	
Rapid Airborne Mine Clearance System (RAMICS)	
Remote Mine-hunting System (RMS)	

## AIR FORCE PROGRAMS

20 mm PGU-28/B Replacement Combat Round	C-5 Avionics Modernization Program (AMP)
Advanced Extremely High Frequency Program (AEHF)	C-5 Reliability Enhancement and Re-engining Program (RERP)
Advanced Medium-Range Air-to-Air Missile (AMRAAM)	C-17A – Globemaster III Advance Cargo Aircraft
Air Operations Center – Weapons System (AOC-WS)	C-130 Avionics Modernization Program (C-130 AMP)
Airborne Signals Intelligence Payload (ASIP)	C-130J Hercules Cargo Aircraft
Airborne Warning and Control System (E-3 AWACS) Upgrades, including Block 40/45, Identification Friend or Foe (IFF) Mode 5, and Integrated Architectural Behavioral Model Integration	Combat Information Transport System (CITS)
ALR-56M Radar Warning Receiver	Combat Search and Rescue Replacement Vehicle (CSAR-X) (formerly Personnel Recovery Vehicle (PRV))
ALR-69A Radar Warning Receiver	Combat Survivor Evader Locator (CSEL) and the PRC family of handheld survivor radios
B-2 SPIRIT Advanced Extremely High Frequency Satellite Communications Capability (B-2 EHF)	Combatant Commanders Integrated Command and Control System (CCIC2S)
B-2 Radar Modernization Program (B-2 RMP)	Deliberate and Crisis Action Planning and Execution Segments (DCAPES)
Battle Control System – Fixed (BCS-F)	Distributed Common Ground System – Air Force (DCGS-AF) Block 10
Battle Control System – Mobile (BCS-M) (formerly the Tactical Air Control System (TACS))	Distributed Common Ground System – Air Force (DCGS-AF) Increment II

## AIR FORCE PROGRAMS (continued)

E-8 Joint Surveillance Target Attack Radar System (JSTARS) (including Affordable Moving Surface Target (AMST) Engagement)	Mark XIIA Identification Friend or Foe (IFF) Mode 5
Enhanced Polar System (EPS)	MILSTAR – Satellite Low/Med Data Rate Communications
Evolved Expendable Launch Vehicle (EELV)	Miniature Air Launched Decoy (MALD), including MALD – Jammer (MALD-J)
Expeditionary Combat Support System (ECSS)	Minuteman III GRP – Guidance Replacement Program
F-15 Mark XIIA Integration	Minuteman III PRP – Propulsion Replacement Program
F-15E Radar Modernization Program	Mission Planning System (MPS) including the Joint Mission Planning System (JMPS)
F-22A – Advanced Tactical Fighter	Mobile User Objective System (MUOS)
F-35 Joint Strike Fighter (JSF)	Multi-Platform Radar Technology Insertion Program (MP RTIP)
Family of Advanced Beyond Line-of-Sight Terminals (FAB-T)	National Airspace System (NAS)
Full-Scale Aerial Target	National Polar-Orbiting Operational Environment Satellite System (NPOESS)
Global Broadcast Service (GBS)	NAVSTAR Global Positioning System (GPS)
Global Combat Support System – Air Force (GCSS-AF)	Navy Extremely High Frequency (NESP) Satellite Communications (SATCOM) Program
Global Command and Control System – Air Force (GCCS-AF)	Next Generation Long-Range Strike (NGLRS)
Global Command and Control System – Air Force (Infrastructure) (GCCS-AF(I))	Reaper MQ 9 Hunter Killer Unmanned Aircraft System (UAS) (formerly called Predator)
Global Hawk High Altitude Endurance Unmanned Aircraft System	Small Diameter Bomb Increment I (SDB I)
Global Positioning System III (GPS III)	Small Diameter Bomb Increment II (SDB II)
HC/MC-130 Recapitalization Program	Space-Based Infrared System Program, High Component (SBIRS HIGH)
Integrated Strategic Planning and Analysis Network (ISPAN)	Space-Based Space Surveillance (SBSS)
Joint Air-to-Surface Standoff Missile (JASSM) and JASSM Extended Range (ER) (including Electronic Safe and Fire Fuze (ESAF))	Space Radar (SR)
Joint Direct Attack Munition (JDAM)	Theater Battle Management Core System (TBMCS)
Joint Precision Approach and Landing System (JPALS)	Transformational Satellite Communications (SATCOM) System (TSAT)
Joint Primary Aircraft Training System (JPATS)	Ultra High Frequency (UHF) Follow-on Satellite
KC-X Tanker Replacement Program	Wideband Global Satellite Communications (SATCOM)
Land-Based Strategic Deterrent (LBSD)	
Large Aircraft Infrared Countermeasures (LAIRCM)	

## OTHER DoD PROGRAMS

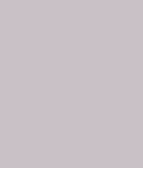
Ballistic Missile Defense System Program (BMDS)	Armed Forces Health Longitudinal Technology Application (AHLTA) (formerly Composite Health Care System II)
<ul style="list-style-type: none"> <li>• Aegis Ballistic Missile Defense (BMD) and SM-3 all Blocks</li> <li>• Command, Control, Battle Management, and Communications (C2BMC)</li> <li>• Ground-Based Midcourse Defense Segment</li> <li>• Kinetic Energy Interceptor (KEI)</li> <li>• Multiple Kill Vehicle (MKV)</li> <li>• Space Tracking and Surveillance System (STSS)</li> <li>• Terminal High-Altitude Area Defense (THAAD)</li> <li>• YAL-1 Airborne Laser (ABL)</li> </ul>	Ballistic Missile Technical Collection (BMTC)
	Business Systems Modernization (BSM)
	Chemical Demilitarization Program – Assembled Chemical Weapons Alternatives (CHEM DEMIL-ACWA)
	Chemical Demilitarization Program – Chemical Materials Agency (CHEM DEMIL-CMA)

## OTHER DoD PROGRAMS (continued)

Chemical Demilitarization Program – Chemical Materials Agency Newport (CHEM DEMIL-CMA NEWPORT)	Joint Service Lightweight NBC Reconnaissance System (JSLNBCRS)
Commissary Advanced Resale Transaction System (CARTS)	Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD)
Defense Enterprise Accounting and Management System (DEAMS)	Joint Tactical Radio System (JTRS) Airborne / Maritime / Fixed Station (AMF)
Defense Integrated Military Human Resources System (Personnel and Pay) Program (DIMHRS)	Joint Tactical Radio System (JTRS) Ground Mobile Radios (GMR)
Defense Travel System (DTS)	Joint Tactical Radio System (JTRS) Handheld and Manpack Radio and Small Form Radio (HMS)
Global Combat Support System Combatant Commander / Joint Task Force (GCSS (CC/JTF))	Joint Tactical Radio System (JTRS) Network Enterprise Services (formerly JTRS Waveform)
Global Command and Control System – Joint (GCCS-J)	Joint Warning and Reporting Network (JWARN)
Global Electromagnetic Spectrum Information System (GEMSIS)	Key Management Infrastructure (KMI)
General Fund Enterprise Business System (GFEBS)	Mine Resistant Ambush Protected Family of Vehicles (MRAP)
Integrated Air and Missile Defense (IAMD) Roadmap programs	Multi-Functional Information Distribution System (MIDS) (Includes Low Volume Terminal and Joint Tactical Radio System)
Integrated Data Environment / Global Transportation Network 21 (Convergence)	Multi-National Information Sharing (MNIS)
Internet Protocol version 6 (IPv6)	Net-Centric Enterprise Services (NCES)
Joint Battle Management Command and Control (JBMC2) Joint Test and Assessment	Net-Enabled Command Capability (NECC) (formerly Joint Command and Control (JC2))
Joint Biological Agent Identification and Diagnosis System (JBAIDS)	Public Key Infrastructure (PKI)
Joint Biological Point Detection System (JBPDS)	Single Integrated Air Picture (SIAP)
Joint Biological Stand-Off Detection System (JBSDS)	Suite of Integrated Radio Frequency Countermeasures (SIRFC) (AN/ALQ-211)
Joint Cargo Aircraft (JCA)	Teleport Generation I/II (Teleport)
Joint Chemical Agent Detector (JCAD)	Theater Medical Information Program (TMIP)
Joint Lightweight Tactical Vehicle (JLTV)	



# **DOD Programs**



## **DoD Programs**

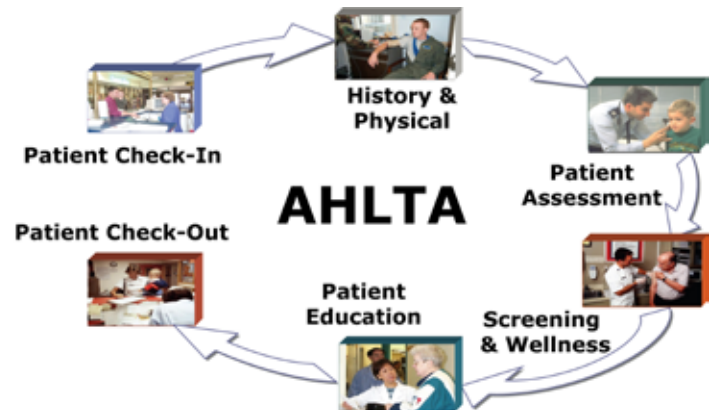
# Armed Forces Health Longitudinal Technology Application (AHLTA)

## Executive Summary

- The Army Test and Evaluation Command (ATEC) and the Army Medical Department Board (AMEDDBD) conducted the operational test of Armed Forces Health Longitudinal Technology Application (AHLTA) Block 2 Dental release at six dental clinics located in California, Oklahoma, Texas, and Washington from May to July in 2007. The Air Force 92nd Information Operations Squadron conducted information assurance penetration testing concurrent with the operational testing. The OT&E results showed that the Dental release is operationally effective, operationally suitable, and operationally survivable, but with limitations.
- One operational effectiveness issue precludes immediate full fielding of the Block 2 Dental release. The Dental Readiness Classification functionality does not always work properly. The program manager will correct this deficiency prior to a full fielding decision review scheduled for January 2008.
- Although the Program Management Office drafted a new Acquisition Strategy, milestones and decision review dates have not been set for Block 3.

## System

- AHLTA, formerly Composite Health Care System II, is a Major Automated Information System that is used in military medical treatment facilities worldwide to support patient care. AHLTA is a key enabler to the DoD's Force Health Protection Initiative.
- AHLTA links multiple commercial off-the-shelf medical products and introduces new techniques and procedures for recording patient encounters. It standardizes medical and dental information and makes it immediately available to military health care professionals worldwide.
- The system manages and records patient encounters, enables calculation of third-party billing, and performs or integrates various clinical operations that include order entry, order monitoring, and results retrieval.
- AHLTA consists of three major functional blocks:
  - Block 1 provides outpatient encounter documentation, order entry, and medical information retrieval.
  - Block 2 integrates medical, dental, and optometry information.



- Block 3 will replace legacy functions such as pharmacy, laboratory, and radiology functionality. It will also provide inpatient charting and documentation.
- In addition to the three major functional blocks, AHLTA also provides a Local Cache capability and a Clinical Data Repository/Health Data Repository (CHDR) interface. The Local Cache capability enables health care providers to continue electronic patient encounter documentation during wide area network outages. The CHDR interface is a joint venture that provides two-way data exchange between DoD's Clinical Data Repository and Veterans Affairs' Health Data Repository. AHLTA also interfaces with the Theater Medical Information Program to provide patient record continuum between wartime and peacetime.

## Mission

- The military health care providers equipped with AHLTA can create and maintain uniform, comprehensive, legible, secure, electronic health records for all beneficiaries of the Military Health System.
- A comprehensive, integrated electronic medical and dental record is critical to satisfy readiness requirements and provide quality health care services.

## Activity

- ATEC and AMEDDBD conducted the operational test of AHLTA Block 2 Dental release from May to July in 2007 at six test sites. The test sites included Budge and Rhoades Dental Clinics, Fort Sam Houston, Texas; 23rd

Dental Company, Marine Corps Air Ground Combat Center, Twentynine Palms, California; Whidbey Island Naval Air Station Dental Clinic, Oak Harbor, Washington; 72nd Dental Squadron, Tinker AFB, Oklahoma; and 82nd Dental

Squadron, Sheppard AFB, Texas. The OT&E was conducted in accordance with the DOT&E-approved Test and Evaluation Master Plan and Event Design Plan.

- In conjunction with the OT&E, the Air Force's 92nd Information Operations Squadron conducted information assurance penetration testing at selected dental clinics, mid-tier server sites, and the Clinical Data Repository operated and maintained by the Defense Information Systems Agency in Montgomery, Alabama.
- Although the Program Management Office drafted a new Acquisition Strategy, milestones and decision review dates have not been set for Block 3.

## Assessment

- The OT&E results showed that AHLTA Dental release is operationally effective, operationally suitable, and operationally survivable, but with limitations.
- One operational effectiveness deficiency precludes immediate full fielding of the Block 2 Dental release. The Dental Readiness Classification functionality does not always work correctly. The program manager will correct this deficiency prior to a full fielding decision review scheduled for January 2008.
- There are two holdover problems from previous OT&E: productivity and user friendliness. These concerns are now substantially mitigated and do not preclude mission accomplishment. Nevertheless, the design of the human system integration has made health care providers' interaction with the electronic health records more cumbersome and slower than it is with paper records. In addition, system response times are sometimes slow.
- The Block 2 Dental release OT&E did not include the testing of an alternate computing facility for ensuring continuity

of operations because this capability has not been fully implemented. Given the importance of maintaining continuity of operations for such a critical system, the implementation of an alternate computing facility should be given increased priority and required resources.

- The re-baselining of Block 3, with critical milestone and decision dates still undetermined, has effectively put test planning for Block 3 on hold. The draft Acquisition Strategy needs to be completed and approved so that work on the Block 3 Test and Evaluation Master Plan can resume.

## Recommendations

- Status of Previous Recommendations. The program manager has taken action on all of the FY06 DOT&E recommendations.
- FY07 Recommendations.
  1. The program manager should continue correcting the problems with the Dental Readiness Classification functionality and ATEC should verify the corrective action.
  2. The program manager should continue to improve user friendliness and system response times of both the medical and the dental modules in order to increase productivity.
  3. The program manager needs to examine the information assurance penetration test findings, determine the risk for each vulnerability, and mitigate those risks that are not acceptable.
  4. The Assistant Secretary of Defense (Health Affairs) should continue to provide sufficient resources to complete the implementation of an AHLTA alternate computing facility. In addition, this alternate computing facility should undergo OT&E.

# Business Systems Modernization (BSM)

## Executive Summary

- The Joint Interoperability Test Command (JITC) completed two operational assessments in October and December of 2006 to evaluate Business Systems Modernization (BSM) Release 2.2. In addition, JITC completed an operational assessment in March 2007 to evaluate BSM Release 2.2.1.
- The operational assessments confirmed that BSM continued to be operationally effective and suitable in supporting the Defense Logistics Agency's (DLA's) missions.
- The Army 1st Information Operations Command (1st IOC) completed a Red Team penetration test in July 2007. The 1st IOC found the DLA network to be very well fortified and did not find any significant Information Assurance (IA) vulnerabilities with network protection. However, improvements are needed in the areas of intrusion detection and response.
- BSM continues to be a model for a successful event-driven acquisition of DoD Enterprise Resource Planning (ERP) systems. Program management offices (PMO) for other ERP systems should be encouraged to seek advice from the BSM PMO to leverage lessons learned from the BSM implementation.

## System

- BSM is a supply chain management system designed to support the DLA, its customers, and its suppliers worldwide.
- BSM consists of a suite of commercial off-the-shelf (COTS) hardware and software products. An ERP package serves as the backbone system providing procurement, finance, and order fulfillment business functions.
- An Advanced Planning and Scheduling (APS) COTS package is combined with the ERP package to provide supply and demand planning functions. These two packages support the majority of functional requirements.
- Additional functional requirements are satisfied by a combination of additional COTS applications, existing

## Activity

- JITC completed two operational assessments in October and December of 2006 to support the evaluation of BSM Release 2.2.
- JITC also completed an operational assessment in March 2007 to evaluate BSM Release 2.2.1. All three Defense Supply Centers participated in the assessments, which were accomplished in accordance with the DOT&E-approved Test and Evaluation Master Plan and Operational Test and Evaluation Plan.



government off-the-shelf software, and specific software extensions to the ERP package.

- BSM supports approximately 8,500 DLA employees worldwide, with users primarily located at three Defense Supply Centers in Columbus, Ohio; Philadelphia, Pennsylvania; and Richmond, Virginia.
- BSM has replaced the Defense Integrated Subsistence Management System and the Standard Automated Material Management System.

## Mission

- The DLA supply centers equipped with BSM will be able to provide the best value logistics and contract management support to U.S. Armed Forces.
- The DLA uses BSM to manage specific outcomes, to allow optimization within given levels of resources, and to enable focused support on product and operating-cost reductions.
- The DLA intends to use BSM to continuously re-engineer its logistics processes to reflect best business practices.

- The Army 1st IOC completed a Red Team penetration test in July 2007 to comply with the DOT&E IA policy for acquisition programs.

## Assessment

- The operational assessments confirmed that BSM continued to be operationally effective and suitable in supporting the DLA's missions.

- Based on user response to surveys, minor issues with the quality and currency of BSM online help remain, although little or no impact to mission accomplishment is expected. Furthermore, users expressed the desire to better communicate with each other on task-related information from their own work experiences.
- The vulnerability assessment conducted by Army 1st IOC did not find any appreciable IA vulnerabilities in the DLA's ability to protect against unauthorized users, and noted that the network was very well fortified from attacks originating from outside the DLA.
- Some IA areas need improvements. DLA should incorporate more robust intrusion detection systems and/or intrusion prevention systems on critical subnets to detect malicious activity, increase IA training for users and administrators, develop a Concept of Operations for IA intrusion response and restoration, and consider the migration to a thin-client architecture.

## **Recommendations**

- Status of Previous Recommendations. The program manager has taken action on the FY06 DOT&E recommendations.
- FY07 Recommendations.
  1. DLA should consider providing BSM users with an online forum for sharing task-related information derived from their work experiences. The training program and online help should be revised periodically to leverage user experience.
  2. DLA should address the IA areas of concern noted above.

# Business Systems Modernization (BSM) – Energy

## Executive Summary

- The Joint Interoperability Test Command (JITC) completed an operational assessment of Business Systems Modernization (BSM)-Energy in August 2007.
- Test results showed that BSM-Energy was operationally effective but not operationally suitable, principally due to Information Assurance (IA) deficiencies.
- In conjunction with the operational assessment, the Defense Logistics Agency Computer Emergency Response Team (DLA CERT) completed a Red Team penetration test. Test results showed that IA deficiencies existed at both the Enterprise and Base Level systems.
- The Defense Logistics Agency (DLA) is developing a Plan of Actions and Milestones to address the IA issues identified by the DLA CERT and JITC.
- After the IA issues have been addressed, the DLA CERT and JITC will verify the correction of the deficiencies.

## System

- BSM-Energy is an integrated database system using an open systems architecture design, which consists of two levels, the Base Level and the Enterprise Level.
- The Base Level system collects transaction data at the fuels distribution point, while the Enterprise Level processes ordering, supply, and financial functions.

## Mission

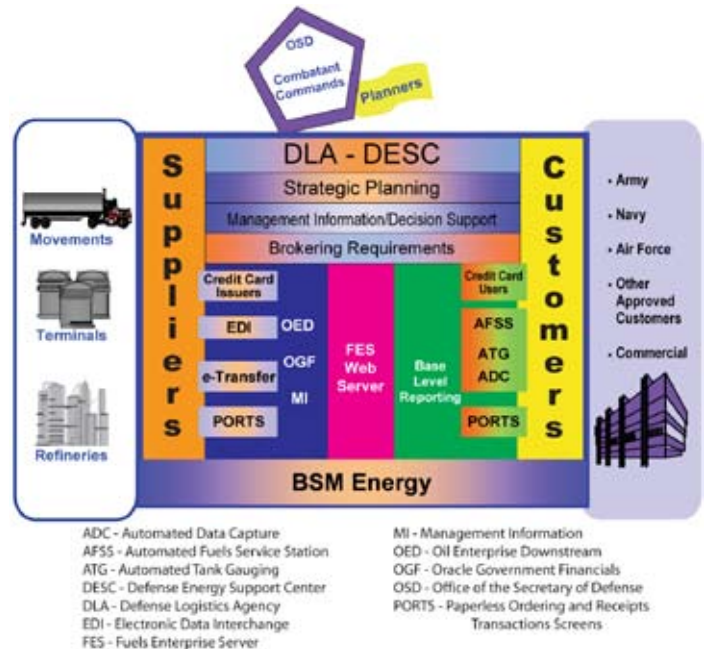
The Defense Energy Support Center (DESC), the designated DLA agent in conducting DoD management of energy, uses

## Activity

- The JITC completed an operational assessment of BSM-Energy in August 2007 in accordance with the DOT&E-approved Test and Evaluation Master Plan and Operational Assessment Plan.
- In conjunction with the operational assessment, the DLA CERT completed a Red Team penetration test to determine the IA posture of BSM-Energy.

## Assessment

- The operational assessment did not find any significant operational effectiveness concerns. DOT&E considered BSM-Energy operationally effective. However, test results showed that IA deficiencies requiring resolution existed at both the Enterprise and Base Level systems. DOT&E considered BSM-Energy not operationally suitable.
- The DLA CERT penetration test, corroborated by the JITC operational assessment findings, identified a number of IA



BSM-Energy to collect point-of-sale data, manage fuels inventory and war reserves, execute purchase orders, conduct financial and accounting management, and administer fuels distribution management.

vulnerabilities both at the Enterprise and Base Level systems that could be exploited to gain unauthorized access:

- The authentication mechanism implemented was inadequate, which could allow unauthorized users to gain full control of the systems.
- Training for both system administrators and users was lacking, specifically in the areas of intrusion detection and reaction.
- There were no periodic perimeter defense checks of the system firewalls to ensure adequate IA protection.
- The IA Concept of Operations for the system was deficient.

## Recommendations

- Status of Previous Recommendations. There were no previous recommendations for BSM-Energy.
- FY07 Recommendations.

## DOD PROGRAMS

1. DLA should finalize and execute a Plan of Actions and Milestones to address IA issues identified by the DLA CERT and JITC. Major remediation actions required include:
  - DLA must mitigate or eliminate vulnerabilities caused by inadequate authentication (e.g., passwords, Public Key Infrastructure certificates) that could allow unauthorized users to gain full control of the systems.
  - Training should be improved to enable system administrators to more effectively detect and react to attempts at unauthorized entry.
  - System administrators should perform periodic perimeter defense checks of the system firewalls to ensure adequate IA protection.
2. After the IA issues have been addressed, the DLA CERT and JITC should verify the correction of the deficiencies.
  - The program manager should develop a more comprehensive IA Concept of Operations that addresses major IA functions of protection, detection, reaction, and restoration for BSM-Energy. Additionally, intrusion response training and drills should be conducted periodically to improve incident reporting procedures and intrusion responses.

# Chemical Demilitarization Program (CHEM DEMIL)

## Executive Summary

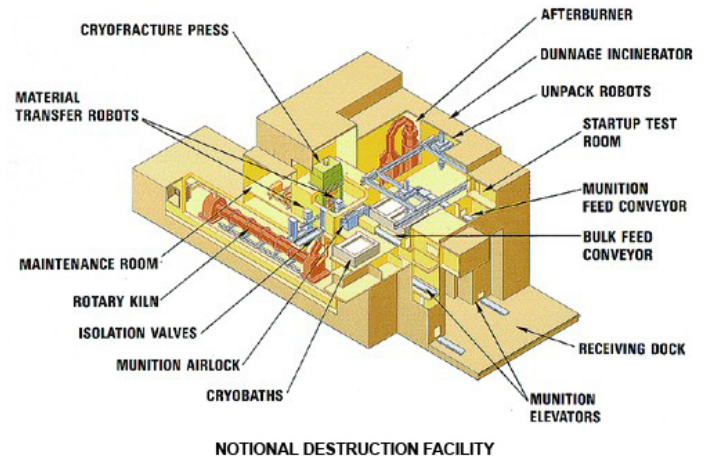
- Army testing of stockpile and nonstockpile systems in the Chemical Demilitarization Program has been adequate to ensure the safe disposal of chemical warfare material.
- All operational testing (OT) was conducted in accordance with DOT&E-approved test plans.
- The Army conducted successful testing at Anniston, Alabama; Umatilla, Oregon; and Pine Bluff, Arkansas; stockpile facilities.
- The Army conducted successful testing of nonstockpile programs for two Explosive Destruction Systems as well as for the Large Item Transportable Access and Neutralization System, the Munitions Assessment and Processing System, and the Pine Bluff Ton Container Decontamination Facility.
- Binary agent precursor destruction operations were completed at the Pine Bluff Arsenal, Arkansas, facility.
- Based on the current program schedule, disposal operations of the U.S. chemical stockpile failed to meet the original Chemical Weapons Treaty deadline of April 2007 and will fail to meet the extension to April 2012.

## System

- The Chemical Demilitarization Program involves the destruction of lethal chemical agents, chemical munitions, and nonstockpile chemical warfare material.
- Four stockpile disposal facilities are employing the baseline chemical weapons disassembly and incineration process:
  - Anniston, Alabama
  - Pine Bluff, Arkansas
  - Tooele, Utah
  - Umatilla, Oregon
- Three stockpile disposal facilities are employing, or plan to employ, chemical neutralization of agents followed by post-treatment of the neutralized products:
  - Blue Grass, Kentucky
  - Newport, Indiana
  - Pueblo, Colorado
- There are two nonstockpile fixed facilities:
  - Ton Container Decontamination Facility at Pine Bluff Arsenal

## Activity

- Chemical Demilitarization Programs are not traditional acquisition programs for DOT&E oversight. DOT&E oversight began in 1999 when Congress directed that DoD oversee these programs as major defense acquisition programs due to cost and schedule overruns.



- Munitions Assessment and Processing System Facility at Aberdeen Proving Ground, Maryland
- There are four nonstockpile transportable systems:
  - Explosive Destruction System – 1
  - Explosive Destruction System – 2
  - Large Item Transportable Access and Neutralization System
  - Transportable Detonation Chamber

## Mission

- The United States is using the Chemical Demilitarization Program to comply with the Chemical Weapons Convention. This is an arms control and nonproliferation treaty that requires the destruction of the U.S. stockpile of lethal chemical agents, chemical munitions, and nonstockpile chemical warfare material.
- The Nonstockpile Chemical Material Project is responsible for the destruction of nonstockpile chemical warfare material, including the components of binary chemical weapons, miscellaneous chemical warfare material, recovered chemical weapons, former production facilities, and buried chemical warfare material.

- The test and evaluation program for each stockpile incineration disposal facility consists of several phases:
  - The developmental testing (DT) phase consists of subsystem component testing without agent.

# DOD PROGRAMS

- The DT/OT phase employs surrogate agents in all test events, culminating in trial burns of the furnaces and end-to-end operations of the facility.
- The OT phase consists of agent trial burns and initial operations with agent.
- OT supports a decision to proceed to full operational status for a specific agent/munition campaign. For example, one campaign would destroy 8-inch projectiles equipped with Sarin nerve agent, another would destroy M55 rockets with Sarin, and a third would destroy 1-ton containers of mustard blister agent. After completion of each campaign, the facility reverts to OT status for the next planned campaign. This process is repeated until destruction of all agent/munition configurations in the site's stockpile is complete. DOT&E monitors the test activity and independently analyzes test data for all stockpile facilities and nonstockpile systems.
- The Aberdeen stockpile destruction facility completed closure operations, where all of the destruction equipment and buildings were dismantled or destroyed, in December 2006. The Pine Bluff Binary Destruction Facility completed binary agent precursor destruction operations in November 2006, and the facility has been completely destroyed and the site cleared.
- As of July 29, 2007, approximately 46 percent of the total U.S. chemical weapons stockpile (originally 31,498 agent tons) had

been destroyed. FY07 test activity for stockpile facilities and nonstockpile systems is summarized in the table below.

### Assessment

- Army testing of stockpile and nonstockpile systems in the Chemical Demilitarization Program has been adequate to ensure the safe disposal of chemical warfare material. The U.S. Army Material Systems Analysis Activity is providing effective independent oversight of the testing of both stockpile and nonstockpile programs. Their expertise and vigilance resulted in early identification and resolution of problems as they occur. Fully integrated operational demonstrations that confirm all phases of operations (including preparation, destruction/neutralization, and disposal) remain critical prerequisites before transition to operations with live agents.
- Based on the current program schedule, disposal operations of the U.S. chemical stockpile failed to meet the original Chemical Weapons Treaty deadline of April 2007 and will fail to meet the extension to April 2012.

### Recommendations

- Status of Previous Recommendations. There were no FY06 recommendations for the Chemical Demilitarization Program.
- FY07 Recommendations. None.

**Chem Demil Test and Evaluation Activity**

Facility/System	Technology	FY07 Activity	Agent Tested	Planned FY08 Activity
Anniston	Incineration	OT	VX 155 mm Projectiles	OT
Umatilla	Incineration	OT	VX (a.k.a. GB) M55 Rockets	OT
Pine Bluff	Incineration	OT	VX M55 Rockets	OT
Newport	Neutralization	Operations	VX Neutralization and Ton Container Processing	OT
Explosive Destruction System Version 1	Neutralization	OT	Mustard (a.k.a. HD) 4.2-inch Mortar	OT
Explosive Destruction System Version 2	Neutralization	OT	Mustard (a.k.a. HD) 4.2-inch Mortar; Arsenicals German Traktor Rockets	OT
Large Item Transportable Access and Neutralization System	Neutralization	OT	Phosgene (a.k.a. CG) M-78 500-pound bomb M-79 1,000-pound bomb (simulated munitions)	OT
Controlled Detonation Chamber	Thermal Decomposition	Test Plan Development	Phosgene (a.k.a. CG) 155 mm or 75 mm Projectiles (Recovered)	DT/OT
Munitions Assessment and Processing System	Neutralization	OT	Phosgene (a.k.a. CG) 75 mm Recovered Projectiles	None Program Suspended
Pine Bluff Binary Destruction Facility	Neutralization	Operations Facility Destruction	Binary Chemical Munition Precursors in Large Storage Drums	None Operations Completed
Pine Bluff Ton Container Decontamination Facility	Magnetic Induction Heating	DT/OT	Trace Agents during Ton Container Processing	OT, DT/OT

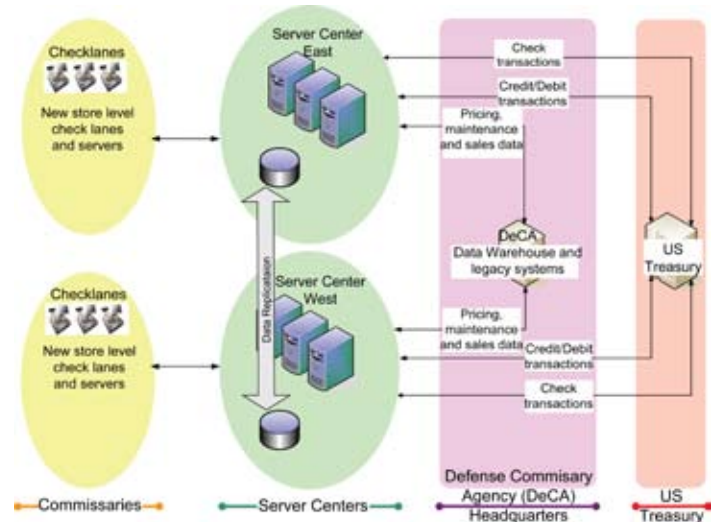
# Commissary Advanced Resale Transaction System (CARTS)

## Executive Summary

- The Joint Interoperability Test Command (JITC) conducted the IOT&E of the Commissary Advanced Resale Transaction System (CARTS) in February and March of 2007.
- The IOT&E results showed that the system was neither operationally effective nor operationally suitable for full deployment.
- JITC conducted a Follow-on Operational Test and Evaluation (FOT&E) in June and July 2007 to verify the correction to the deficiencies found during the IOT&E.
- The FOT&E results showed that the CARTS performance improved significantly; however, the system remained not operationally effective or operationally suitable, principally due to deficiencies related to the self-checkout (SCO) registers. The Milestone Decision Authority approved only limited fielding pending demonstration that major SCO deficiencies have been resolved.

## System

- CARTS links individual commissaries with one of the two server centers and the Defense Commissary Agency (DeCA) Headquarters.
- The two server centers provide centralized services to the customer checkout and back office functions within each commissary in addition to providing backup support for each other.
- CARTS interfaces with the following external systems:
  - DeCA Enterprise Data Warehouse
  - DeCA Electronic Records Management and Archive System
  - Treasury Electronic Verification and Imaging System
  - Plastic Card Network
- CARTS will comply with applicable DoD and grocery industry standards and protocols to maintain an open systems architecture.



## Mission

- DoD commissaries worldwide will use CARTS to support the management and operations for the resale of groceries and household supplies to the members of the Military Services, their families, and other authorized patrons.
- Commissary personnel, using CARTS, will be able to:
  - Perform customer checkout functions that involve processing merchandise transactions; sidewalk or special case lot sales; and cash cage activities where funds management is performed in support of cashier functions.
  - Complete back office functions that include system administration functions, financial management functions, file maintenance, report generation, and other functions necessary to maintain and operate the system.

## Activity

- JITC conducted IOT&E from February 5 through March 2, 2007, in accordance with a DOT&E-approved Test and Evaluation Master Plan and Operational Test and Evaluation Plan.
- JITC conducted FOT&E from June 18 through July 2, 2007, to verify the correction to the deficiencies found during IOT&E.

## Assessment

- Based upon the IOT&E, DOT&E found CARTS to be not operationally effective or suitable, principally due to unreliable SCO register performance, deficient system supportability, and usability issues.
- Other significant operational issues identified during the IOT&E included problems interfacing with the Plastic Card Network and the Treasury Electronic Verification and Imaging

# DOD PROGRAMS

System, information assurance vulnerabilities, employee training shortfalls, and system installation and integration problems.

- The FOT&E results showed that system performance had improved significantly since the IOT&E; however, significant shortfalls still existed in the performance and availability of the SCO registers. As a result, CARTS remained not operationally effective or suitable. Additional testing with special emphasis on the SCO registers is needed prior to full fielding of CARTS.

## **Recommendations**

- Status of Previous Recommendations. There were no previous recommendations for CARTS.

- FY07 Recommendations.
  1. The CARTS program manager should correct the unresolved deficiencies identified during the IOT&E and FOT&E.
  2. Until the program manager can demonstrate the performance of the SCO registers at the required level of availability, reliability, and usability, their use should be restricted.
  3. JITC should conduct another verification of correction to the deficiencies to determine the operational effectiveness and suitability of CARTS prior to full fielding.

## Defense Travel System (DTS)

### Executive Summary

The Army Test and Evaluation Command (ATEC) conducted an OT&E on the Reservation Refresh release from November 2006 to January 2007. ATEC considered the new release operationally effective, suitable, and survivable. In February 2007, DOT&E recommended the new release be placed into the production environment.

### System

- The Defense Travel System (DTS) is a Major Automated Information System designed to automate and streamline the DoD travel process, support DoD travel requirements, and reduce the associated cost for the DoD. With DTS, travelers perform many of the administrative tasks themselves.
- DTS integrates commercial travel reservation systems and DoD accounting and disbursing systems using secure networks and procedures.
- Originally, there were two blocks of software development. Block 1 focuses on Temporary Duty travel. Block 2, which was to focus on Permanent Change of Station travel, has been deferred.
- The program manager is developing DTS in releases of increasing functionality. Each Block 1 release was named after a U.S. president. The Monroe release (the final Block 1 presidential release) has been fielded. DTS will continue to use a spiral development strategy during FY08 to develop the remaining functionality that was not included in the presidential releases.

### Mission

DoD travelers use DTS as a single interface to process their end-to-end travel requirements via an Internet connection or a



Non-classified Internet Protocol Router Network connection using a Common Access Card with Public Key Infrastructure certification. It offers an automated mechanism for travelers to prepare travel authorizations and vouchers, get the documentation approved, and be reimbursed once their travel is completed.

### Activity

ATEC conducted an OT&E on the Reservation Refresh release from November 2006 to January 2007, in accordance with the DOT&E-approved Test and Evaluation Master Plan and Operational Test and Evaluation Plan.

### Assessment

- For a Major Automated Information System, operational testers typically conduct an OT&E at selected operational sites with a production system prior to a full-fielding decision. Since DTS is a web-based system, the traditional way of conducting OT&E is not practical. Any new DTS release placed on the enterprise web server for operational testing is in fact already fielded.

- To mitigate risks for such a system, ATEC typically conducts an OT&E in an end-to-end test environment with production-representative hardware and software. Representative users execute operationally realistic test scenarios developed by ATEC. If the test results are satisfactory, the new release is placed on the production server for all users. ATEC then conducts a follow-on operational assessment at selected operational sites to confirm the performance of the new release and to identify opportunities for improvement.
- The test results of the Reservation Refresh release showed that it was operationally effective, suitable, and survivable, with limitations. Even though the DTS Program Management

# DOD PROGRAMS

Office resolved all high priority deficiencies identified during the OT&E, some low priority deficiencies that affected the usability of the system remained.

- ATEC plans to conduct an OT&E for a Technical Refresh release in 3QFY08. After the new release is placed into the production environment, ATEC also plans to conduct a follow-on operational assessment at selected operational sites. The Technical Refresh release will install new servers, convert the DTS software code to Java programming language (with an Oracle database), and incorporate additional minor functional enhancements.

## **Recommendations**

- Status of Previous Recommendations. The Program Management Office has taken action on all FY06 recommendations.
- FY07 Recommendation.
  1. The Program Management Office should complete the Test and Evaluation Master Plan update as soon as possible to facilitate the planning and execution of follow-on operational tests and evaluations.

# Global Combat Support System Combatant Commanders / Joint Task Force (GCSS CC/JTF)

## Executive Summary

- The Joint Interoperability Test Command (JITC) conducted an IOT&E for Global Combat Support System Combatant Commanders / Joint Task Force (GCSS CC/JTF) version 6.0 in November 2006 and identified several deficiencies with suitability and survivability. All deficiencies were satisfactorily resolved and version 6.0 received a favorable fielding decision in January 2007.
- Version 6.1 adds new capabilities such as the ability to use Non-secure Internet Protocol Router Network (NIPRNET) as well as improving the user interfaces through incorporation of commercial off-the-shelf (COTS) products.
- JITC will operationally test GCSS CC/JTF version 6.1 in FY08.

## System

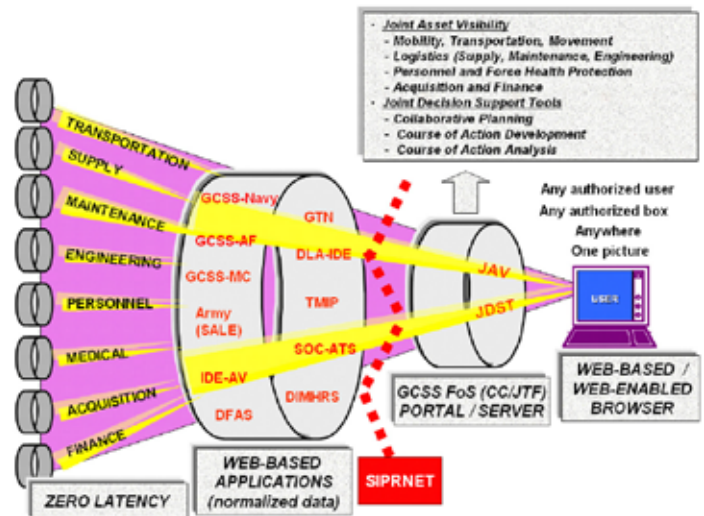
- GCSS CC/JTF is a web portal that enables users at combatant command and joint task force to access joint logistics applications.
- The system is comprised of strategic servers located in Montgomery, Alabama, and Pearl Harbor, Hawaii, a COTS-based infrastructure, and Public Key Infrastructure (PKI) enabled capabilities that support planning, execution, and control for engineering, health services, logistics services, supply, and distribution.
- GCSS CC/JTF provides the following applications: reports capability; watchboard (allowing rapid comparison of planned actions with actual event); electronic battlebook (organizing files and web pages into categories), knowledge management; business intelligence; mapping capability; joint engineer planning; and execution capability.

## Mission

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

## Activity

- JITC completed operational testing of GCSS CC/JTF version 6.0 on November 17, 2006. Testing occurred at two Defense Enterprise Computing Center operational server sites (Montgomery, Alabama, and Pearl Harbor, Hawaii) with users located at U.S. Central Command (CENTCOM), U.S. Southern Command (SOUTHCOM), and the Defense Information Systems Agency (DISA) Eagle building. Participants included CENTCOM, U.S.



- CC - Combatant Command
- DFAS - Defense Finance and Accounting Service
- DIMHRS - Defense Integrated Military Human Resources System
- DLA-IDE - Defense Logistics Agency - Integrated Data Environment
- FoS - Family of Systems
- GCSS-AF - Global Combat Support System-Air Force
- GCSS-MC - Global Combat Support System-Marine Corps
- GCSS-Navy - Global Combat Support System-Navy
- GTN - Global Transportation Network
- IDE-AV - Integrated Data Environment - Asset Visibility
- JAV - Joint Asset Visibility
- JDST - Joint Decision Support Tool
- JTF - Joint Task Force
- SALE - Single Army Logistics Enterprise
- SIPRNET - Secret Internet Protocol Routed Network
- SOC-ATS - Special Operations Command - Asset Tracking System
- TMIP - Theater Medical Information Program

- Combatant Command and Joint Task Force commanders and logistics staffs use the GSS CC/JTF to gain end-to-end visibility of Combat Support (CS) capability up through strategic level, facilitating information flow across and between CS and command and control functions.

European Command (EUCOM), U.S. Joint Forces Command (JFCOM), U.S. Northern Command (NORTHCOM), U.S. Pacific Command (PACOM), SOUTHCOM, U.S. Strategic Command (STRATCOM), U.S. Transportation Command (TRANSCOM), the Joint Staff (J4), and the 416th Engineering Command representatives. JITC conducted a limited test to assess the alternate server's ability to take control from the primary server on November 22, 2006.

- JITC and the Defense Intelligence Agency concluded security testing of GCSS CC/JTF v6.0 on October 13, 2006, with a follow-on Security Test and Evaluation completed on December 15, 2006.
- Operational testing of GCSS CC/JTF version 6.1 was deferred from September 2007 until FY08.

## Assessment

- Operational testing of GCSS CC/JTF 6.0 was adequate.
- Primary and Back-up version 6.0 suites were fully functional with access to authoritative data sources. Enterprise Systems Management support provided centralized processes/tools for systems administration and visibility on the health and status of the system.
- Testers were successful in demonstrating mission accomplishment using the new capabilities. All critical interfaces performed satisfactorily.
- JITC evaluated GCSS CC/JTF version 6.0 to be operationally effective and suitable, but not survivable due to critical information assurance deficiencies. After successful mitigation of the critical Information Assurance deficiencies

and downgrading of the system to Mission Assurance Category (MAC) II, the Designated Approving Authority granted an Authority to Operate, and the Milestone Decision Authority approved fielding of version 6.0.

- The automated failover process for switching users from the primary server in Montgomery, Alabama, to the secondary server located in Pearl Harbor, Hawaii, was not implemented. This shortfall requires users to switch over manually; however, the manual switch over can be completed within the required time for a MAC II system.

## Recommendations

- Status of Previous Recommendations. There are no previous recommendations.
- FY07 Recommendations. The GCSS CC/JTF program manager should:
  1. Implement automated failover processes for full compliance as a MAC II system.
  2. Continue to develop and field corrections for remaining Information Assurance findings.

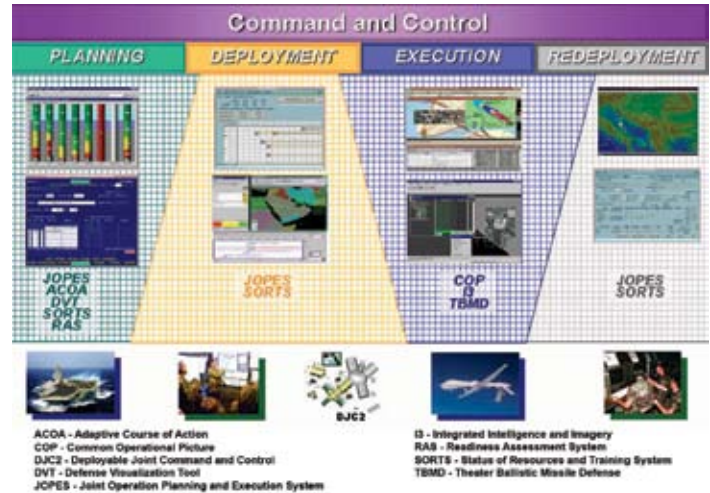
## Global Command and Control System – Joint (GCCS-J)

### Executive Summary

- The Joint Interoperability Test Command (JITC) tested a significant update to the Global Command and Control System - Joint (GCCS-J) Global Release version v4.1 at multiple sites during January 2007.
- JITC conducted operational testing of the GCCS-J Joint Operation Planning and Execution System (JOPES) v4.1 at multiple sites during September 2007.
- The operational testing was conducted in accordance with a DOT&E-approved Test and Evaluation Master Plan and operational test plans.
- The GCCS-J Global Release v4.1 is operationally effective, suitable, and survivable.

### 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 provides 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 v4.1 Global Release (Force Protection, Situational Awareness, Intelligence applications)
  - JOPES v4.1 (Force Employment, Projection, Planning and Deployment/ Redeployment applications)
  - Status of Resources and Training System v4.0 (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
  - 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 warfighter a fused battlespace picture

### Activity

- JITC conducted operational testing of the GCCS-J Global Release v4.1 from January 25-31, 2007, at U.S. Central Command, U.S. Pacific Command, and the Joint Staff Support Center in the Pentagon. Testing focused primarily on the situational awareness and intelligence mission areas.
- JITC conducted operational testing of the GCCS-J JOPES v4.1 from September 17-21, 2007, at multiple sites, including U.S. Transportation Command, U.S. Joint Forces Command, U.S. Southern Command, U.S. Northern Command, U.S. Pacific Command, U.S. European Command, U.S. Special Operations Command, and at the Joint Staff Support Center, Pentagon. Several combatant command components and Service major commands also participated in GCCS-J JOPES v4.1 operational testing.
- The Defense Intelligence Agency and JITC conducted security testing of both GCCS-J Global Release and JOPES.
- JITC conducted interoperability testing of GCCS-J Global Release v4.1 and JOPES v4.1.

### Assessment

- Operational testing of GCCS-J Global Release v4.1 and its critical interfaces was adequate. GCCS-J Global Release v4.1 system performance met or surpassed that of the legacy system, GCCS-J Global Release v4.0.2. The GCCS-J Program Management Office corrected software problems detected during operational testing and performed regression testing to validate fixes.

- The Navy Integrated Tactical Environmental System (NITES) did not perform correctly during operational testing. The Navy PMO for NITES developed corrective actions and JITC conducted regression testing and validated fixes.
- JITC successfully conducted interoperability testing of critical interfaces. Interoperability testing with the Marine Corps' Command and Control Personal Computer (C2PC), a non-critical interface widely used for displaying the common operational picture on a personal computer, was not successful. The DISA GCCS-J and the Marine Corps C2PC PMOs did not develop fixes for problems found during the operational testing. Joint users must continue using the legacy version of C2PC until the two program offices coordinate corrective actions.
- Operational testing of GCCS-J JOPES v4.1 was adequate with some exceptions for non-critical interfaces. JITC used a deliberate planning scenario to generate, source, and validate JOPES movement requirements. All key performance parameter requirements were successfully demonstrated. The JOPES system also demonstrated the capability to handle loading well beyond the specified requirement using an artificial loading tool.
  - Core JOPES v4.1 functionality performed very well. As part of the JOPES v4.1 release, the DISA GCCS-J PMO moved the Advance Course of Action and the Deployment Visualization Tool Web-based applications from a local server environment to the JOPES strategic server enclaves. Moving these applications increased the time to load and execute these applications for some users to an operationally unacceptable level.
  - JITC adequately performed interoperability testing on 12 critical interfaces and one non-critical interface with JOPES v4.1; all performed satisfactorily except the Joint Forces Requirements Generator II (JFRG II). The JFRG interface had one critical failure that the Marine Corps JFRG II Program Management Office subsequently fixed and successfully regression tested.
- The Defense Intelligence Agency and JITC conducted information assurance evaluations of all GCCS-J releases tested in FY07. GCCS-J has no outstanding critical security deficiencies.
- The GCCS-J Global Release v4.1 system is operationally effective, suitable, and survivable.
- DOT&E has not made an operational effectiveness, suitability and survivability determination of JOPES 4.1. The operational test revealed the need for software changes. The evaluation of changes is ongoing.

### Recommendations

- Status of Previous Recommendations. The GCCS-J Program Management Office is making progress on DOT&E's two FY06 recommendations.
- FY07 Recommendations.
  1. The DISA GCCS-J PMO and JITC should improve JOPES operational testing by locating the four test servers in the same geographical locations as the strategic server enclaves.
  2. After fielding GCCS-J Global Release v4.1 and JOPES v4.1, JITC should examine the performance of the fielded system and its key interfacing systems and then use that information to improve operational test adequacy.
  3. The Joint Staff J3 should review legacy combatant commander systems/applications designated as having non-critical interfaces with GCCS-J to ensure that all critical interfaces are addressed in future GCCS-J operational testing.

# Joint Biological Agent Identification and Diagnostic System (JBAIDS)

## Executive Summary

- Based on Follow-on Operational Testing and Evaluation (FOT&E) in April-May 2007, Joint Biological Agent Identification and Diagnostic System (JBAIDS) is operationally effective, but not suitable due to poor reliability. The Joint Project Manager (JPM) took corrective actions to resolve the poor reliability with system software modifications. DOT&E verified that JBAIDS now meets requirements for mission reliability, operational availability, and mean time between operational mission failures following a demonstration at the Air Force Institute for Operational Health Applied Technology Center (AFIOH/ATC) in September 2007.
- The FOT&E followed a full-rate production decision for ground-based medical units, based on Multi-Service Operational Test and Evaluation in April-June 2005, which found the JBAIDS is operationally effective for ground-based units. Timely identification of an agent (3-4 hours versus 24-48 hours from traditional culturing methods) aids in improved situational awareness, isolation of personnel, and reduced exposure to the agent.
- JBAIDS is useful in shipboard operations for situational analyses and implementation of countermeasures and force protection actions.
- When a single JBAIDS is deployed in a medical unit in accordance with Service concepts of operation, and cannot be repaired by the operator, the unit has complete loss of this biological identification capability. This impacts the Air Force, Marine Corps, and Navy, as their medical units are each authorized only one JBAIDS.

## System

- JBAIDS provides biological agent identification and diagnostic capability for fixed-site, mobile (shelter, man portable, and trailer), and shipboard applications.
- The Services intend the JBAIDS to be a reusable, portable, biological agent identification and diagnostic system capable of identifying multiple biological warfare agents (BWAs) simultaneously.
- JBAIDS provides enhanced capabilities to the warfighter to identify conventional infectious organisms that occur naturally in the environment and BWAs.

## Activity

- The Joint Program Executive Officer for Chemical and Biological Defense in March 2006 approved full-rate production of JBAIDS for ground-based units, but did not



- JBAIDS is intended to satisfy a need to rapidly identify these BWAs in environmental samples and in clinical samples after Food and Drug Administration certification.
- It consists of an analytical device, sample preparation kits, reagent kits, laptop computer, and other support equipment weighing up to 1,500 pounds and occupying up to 227 cubic feet.
- JBAIDS is intended to be employed in units such as:
  - Army Area Medical Laboratories
  - Army Combat Support Hospitals
  - Army Veterinary Service Food Analysis Laboratories
  - Navy Environmental Preventive Medical Units, and aboard aircraft carriers, amphibious assault ships, and amphibious command ships
  - Marine Corps Preventive Medicine units
  - Air Force Forward-Deployed or Forward-Positioned Medical Biological Augmentation Teams
  - Air Force Homeland Defense Laboratories

## Mission

- Units equipped with JBAIDS identify biological agents to support a commander's force protection decisions by providing timely information for determining appropriate treatment, preventive measures, prophylaxis, and operational decisions.
- Units with JBAIDS will be tasked to provide rapid confirmatory identification of specific BWAs detected or identified by other biological detection systems employed in operational environments.

approve fielding until extraction and inhibition (process quality) controls were developed. JBAIDS production was not approved for shipboard use due to the size of the centrifuge,

which was subsequently replaced by an alternate sample preparation protocol.

- Fielding to Air Force units is underway at the request of the Air Force Office of the Surgeon General. Fielding to Army units began upon completion of extraction and inhibition controls testing in March 2007.
- The four Service Operational Test Agencies (OTAs) evaluated revised sample preparation protocols in FOT&E they conducted in two phases in April-May 2007. All four OTAs validated ground unit medical laboratory operations at Brooks City Base, Texas. The Navy OTA conducted a second phase aboard a ship at Norfolk Naval Base, Virginia.
- The AFIOH/ATC conducted seven weeks of reliability testing in July-August 2007 following corrective actions implemented by the JPM after the FOT&E, observed by the Army Evaluation Center.
- The Joint Program Executive Officer for Chemical and Biological Defense will make a full-rate production decision for shipboard JBAIDS in 1QFY08.

## Assessment

- JBAIDS is effective in identifying BWAs in a timely manner (3-4 hours versus 28-48 hours from traditional culturing methods) and aids in improved situational awareness, isolation of personnel, and reduced exposure to the agent.
- JBAIDS is operationally suitable. The JPM is making hardware and software changes to address reliability, availability, and maintainability issues remaining from the August 2007 reliability demonstration. The failure of the JBAIDS during FOT&E Navy shipboard phase prevented mission accomplishment, yet testing continued using a spare

JBAIDS. Only one JBAIDS is authorized in Air Force, Marine Corps, and Navy medical units, and most Army units.

- The inclusion of extraction and inhibition controls provides greater confidence on the part of operators and reduces false positives and false negative results. The JBAIDS analytical report sent to the laboratory physician did not indicate when the JBAIDS operator applied inhibition controls when preparing samples. Inclusion of this information would improve physician interpretation of the analytical report.
- JBAIDS software can be improved to translate the measured crossing threshold data into estimates of concentration for each BWA against different media (agent/matrix) combinations.
- The revised sample preparation protocols are effective. One of the protocols reduces the footprint and volume of sample required but processing time increases. Additional operator training may improve techniques to limit sample contamination.

## Recommendations

- Status of Previous Recommendations. All earlier DOT&E recommendations have been resolved.
- FY07 Recommendations.
  1. The Services should reassess quantities of JBAIDS in units to provide redundant capability.
  2. The product manager should modify the JBAIDS analytical report to indicate use of inhibition controls and associated results.
  3. The product manager should refine the algorithm that translates the measured crossing threshold data into estimates of concentration for the different BWA/matrix combinations.

# Joint Biological Point Detection System (JBPDS)

## Executive Summary

- The project manager for Joint Biological Point Detection System (JBPDS) demonstrated successful corrective actions to findings identified from earlier Multi-Service Operational Testing and Evaluation (MOT&E) and system development tests. The Service Operational Test Agencies (OTAs) will retest these in MOT&E Phase VI in August-November 2007. MOT&E Phase VI follows the first phase of Whole System Live Agent Testing (WSLAT) that includes testing against four biological warfare agents (BWAs). These four agents represent different classes of biological warfare agents.
- The Army OTA leads the testing of new simulants in the WSLAT program. WSLAT is consistent with recommendations from a 2004 Committee Report from the National Academy Sciences/National Research Council for improved BWA simulant development.
- WSLAT is a combined developmental/operational test with the objectives to provide performance of JBPDS against BWAs and simulants in closed chamber and correlate JBPDS performance against simulants in field environments.



1 - Man-portable 2 - Shelter 3 - Trailer 4 - Shipboard

## System

- The JBPDS provides biological agent point detection, identification and sampling capability for fixed-site, mobile (shelter, man portable, and trailer), and shipboard applications in one of four variants:
  - Man-portable and trailer variants for the Air Force
  - Shelter variant for the Army and the Marine Corps; this variant is integrated into the Stryker Nuclear, Biological, and Chemical (NBC) Reconnaissance Vehicle for the Army and Joint NBC Reconnaissance System for the Marine Corps
  - Shipboard variant for the Navy
- The JBPDS consists of a basic biological suite that has a trigger (Biological Aerosol Warning Sensor), collector, fluid transfer system, and identifier. The identifier inoculates assays that contain antibodies of specific BWA antigens.

- The trigger detects presence of a biological mass in less than 1 minute and the identifier identifies the BWA in less than 15 minutes.
- JBPDS provides the capability to collect and preserve samples for confirmatory analyses to support follow-on courses of action including treatment, quarantine, countermeasures, and litigation.
- Depending on Service employment concept and particular mission, JBPDS is considered either a detect-to-warn or a detect-to-treat system.

## Mission

Units equipped with the JBPDS support U.S. forces by providing early warning and identification of various aerosolized biological warfare agents.

## Activity

- The Joint Project Manager (JPM) and the Service OTAs conducted whole system live agent testing (WSLAT) methodology development and initial testing in FY06-07 to establish the detection and identification performance of JBPDS against BWAs and new simulants. These new simulants are inactivated vaccine strains and toxoids of those BWAs. Testers and test units may safely use the simulants in open air operational testing, as recommended by a Committee

Report in 2004 from the National Academy Sciences/National Research Council. The WSLAT methodology development established the relationships of four inactivated vaccine strains and toxoids to their BWA counterparts. Progress met entrance criteria to begin MOT&E Phase VI as scheduled. The Army OTA intends to conduct record field testing of the new simulants of the four BWAs in 1QFY08.

# DOD PROGRAMS

- The Air Force Operational Test and Evaluation Center is leading the four Service OTAs in MOT&E Phase VI in August-November 2007 at Dugway Proving Ground (DPG), Utah, and in an Air Force/Navy phase at Eglin Air Force Base, Florida. During the DPG phase, the multi-Service test team will conduct open air operational testing with the new simulants and a simulant for spore-forming BWAs.
- The Joint Program Executive Officer for Chemical and Biological Defense (JPEO(CBD)) plans to make a full-rate production decision in June 2008 with a competitive procurement. The Army OTA will continue WSLAT for additional BWAs that JBPDS is required to detect and identify after the full-rate production decision.

## Assessment

- JBPDS provides capability to detect biological warfare agents when deployed in an array, or set of JBPDSs, to provide coverage of a “protected” area based on the area topography and current meteorological conditions.
- Early BWA identification provides opportunity for improved medical treatment. Units use this information to quarantine,

decontaminate, and plan for impact on forces by donning protective equipment, isolating personnel, and restricting troop movement.

- Earlier MOT&E highlighted high false alarm rate and communication failures. System level demonstrations indicated problems were resolved adequately to enter MOT&E Phase VI.
- A Joint Program Executive Office for Chemical and Biological Defense competitive procurement for JBPDS may invalidate prior MOT&E results and conclusions.

## Recommendations

- Status of Previous Recommendations. The JPM and Service OTAs implemented prior DOT&E recommendations.
- FY07 Recommendations.
  1. The JPM and Army Test and Evaluation Command should continue field testing and characterization of new simulants for the BWAs that JBPDS is required to detect and identify.
  2. Regardless which vendor successfully competes for the full-rate production, operational effectiveness and suitability must be confirmed with an operational test.

## Joint Chemical Agent Detector (JCAD)

### Executive Summary

- Developmental and Operational Testing (DT/OT) results and an Operational Assessment (OA) supported a Milestone C low-rate initial production (LRIP) decision for Joint Chemical Agent Detector (JCAD) Increment 1 in June 2007.
- The Service operational test agencies (OTAs) conducted the JCAD Multi-Service Operational Test and Evaluation (MOT&E) in July-August 2007. The Service OTAs are reducing data. Additional DT/OT of JCAD Increment 1 against chemical warfare agents in the presence of interferents must be completed before the OTAs will complete their JCAD system evaluation.
- The Joint Program Executive Officer for Chemical and Biological Defense (JPEO (CBD)) scheduled the JCAD full-rate production decision for 60,000 Increment 1 detectors for March 2008.
- JCAD Increment 2 downselection testing among three vendors is scheduled to begin January 2008.

### System

- JCAD is a hand-held device that automatically detects, identifies, and alerts warfighters of the presence of nerve, blister, and blood chemical agents, and some toxic industrial chemicals, including chlorine.
- JCAD Increment 1 is a non-developmental item modified from a commercially available device. It will operate as a stand-alone detector. It will be carried by personnel and placed onto various platforms, including ground vehicles, fixed site installations, and collective protection shelters. It supplements or replaces existing fielded chemical agent vapor detectors.
- JCAD Increment 2 is a commercially available device designed to detect lower levels of chemical agents and will have a networking capability.
- The total quantity of Increment 1 systems is 60,000 detectors, with 6,000 low-rate initial production. The planned Joint Acquisition Objective for JCAD is 145,150 detectors.
- The JCAD will be issued to:
  - Army squads
  - Marine platoons

### Activity

- The JPEO (CBD) rebaselined the JCAD program in 2003 to acquire a non-developmental item. The Single Acquisition Management Plan was approved in September 2005 and updated for the Milestone C low-rate initial production decision in June 2007.



- Air Force aircraft, base reconnaissance, and ground-service personnel
- Navy shore installations, and riverine or land-based units

### Mission

- Units use JCAD to provide hazard level indication of chemical warfare agent and toxic industrial chemical vapors to alert personnel to take personal protection measures including masking, and unit force protection measures.
- JCAD will be employed in a wide variety of tasks including:
  - Personal chemical vapor detector
  - Monitor in and around a vehicle or shelter's interior and exterior, or aircraft interior
  - Survey instrument for cargo surveillance
  - Survey instrument for effectiveness of decontamination of personnel and equipment
  - Fixed installation monitor or array of monitors to provide remote alarming

- The Joint Project Manager (JPM) with the Service OTAs conducted a comprehensive DT/OT program for the non-developmental JCAD Increment 1 in FY06 and FY07. They conducted the DT/OT events to provide data for decision by the JPEO(CBD) to determine readiness to start MOT&E.

Additional DT/OT is scheduled in FY08 to determine JCAD's capability to discriminate, detect, and identify chemical agents in the presence of several potential interferents.

- The four Service OTAs conducted the JCAD Increment 1 OA in FY06. From the OA results, the JPM modified the non-developmental item to add a toxic industrial chemicals detection capability and increased sampling rate for use in a new mode for survey operations.
- The Service OTAs conducted the JCAD Increment 1 MOT in July-August 2007 at Dugway Proving Ground, Utah, and McGuire Air Force Base, New Jersey. The Service OTAs are reducing data and completing the JCAD system evaluation. DOT&E will evaluate in November 2007.
- Developmental testing did not determine if calibration is required to maintain over time the detection and identification capabilities of JCAD within specifications. The JPM is developing a test plan to assess JCAD long term calibration and replacement requirements.
- The JPM is addressing all shortcomings identified in DT/OT, the OA, and the MOT.
- The JPM is planning laboratory testing of JCAD Increment 2 commercial devices.

## Assessment

- JCAD detected eight chemical agents greater than 90 percent of the time and another agent 88 percent of the time.

However, detection response times for very low levels of agent contamination need to improve.

- In developmental testing, JCAD displayed acceptable performance in a wide variety of extreme environmental conditions, with the exception of:
  - Salt Fog Testing
  - Full Immersion Testing
  - Low Temperature Operations
- JCAD is easy to operate, troubleshoot, and maintain. JCAD is lightweight and its small size makes it more portable than currently fielded chemical warfare agent point detectors.
- Surveillance testing may be required to determine calibration and replacement requirements in order to ensure users have confidence that JCADs maintain performance after fielding and use.

## Recommendations

- Status of Previous Recommendations. The JPM accepted DOT&E's previous recommendations.
- FY07 Recommendations. The JPM should conduct testing to develop an appropriate surveillance, inspection, and calibration program for fielded JCADs.

## Joint Mission Planning Systems (JMPS)

### Executive Summary

- Initial Joint Mission Planning System (JMPS) Mission Planning Environments (MPEs) have shown mixed results in OT&E.
- Service JMPS developers must give more attention to fixing critical deficiencies and improving system stability prior to submitting MPEs for OT&E.

### System

- There are two different JMPS programs. Air Force JMPS (also referred to as AF MPS) is an Acquisition Category level 1 (ACAT I) program managed by the Electronic Systems Command at Hanscom AFB, Massachusetts. Navy JMPS-M (Maritime) is an ACAT IV program managed by individual platform program offices.
- JMPS is a Windows 2000 and Windows XP, PC-based common solution for aircraft mission planning for all the Services.
- A JMPS MPE is a total set of developed applications built from modules. The basis of a JMPS MPE is the framework, to which a Unique Planning Component is added for the specific aircraft type (e.g., F-15E or F/A-18). Other Common Components that can support multiple users are added as well (e.g., Global Position System-guided weapons, navigation planner, etc.) to complete the MPE.
- The system operates as either a stand-alone PC or laptop, or as a secure, networked system supported by servers.
- The Navy and Air Force are initial users of MPEs built on JMPS framework versions 1.1, 1.2, and 1.3.



### Mission

- Aircrews use JMPS to plan all phases of their missions and then save required aircraft, navigation, threat, and weapons data on a data transfer device so they can load it into their aircraft before flight.
- All JMPS users will eventually be able to collaborate on mission planning, even when operating from different bases.
- The Army and U.S. Special Operations Command eventually plan to transition to JMPS.

### Activity

#### Air Force

- The Air Force Operational Test and Evaluation Center (AFOTEC) conducted an operational test of the F-15 MPE version 1.2 during FY07. The test was conducted in accordance with the DOT&E-approved Test and Evaluation Master Plan (TEMP) and Test Plan. DOT&E monitored its execution.
- The Electronic Systems Center Program Manager for AF MPS conducted user tests of the B-1B bomber MPE during FY07. DOT&E monitored the conduct of this pre-Developmental Test event.

#### Navy

- The Commander, Operational Test and Evaluation Force (COMOPTEVFOR) conducted two operational tests of the Joint Mission Planning System-Maritime MV-22 MPE during FY07 and early FY08. DOT&E monitored the first test. The second operational test on MV-22 MPS was conducted

by the deployed Marine MV-22 Squadron while on a Navy amphibious ship enroute to support combat operations in Southwest Asia. DOT&E did not monitor the second test.

### Assessment

- DOT&E published a Beyond Low-Rate Initial Production Report supporting the fielding decision for the Air Force F-15 Version 1.2 MPE. The test was adequate to demonstrate that the F-15 MPE was operationally effective but not operationally suitable. Aircrews could use the Mission Planning System to plan missions although there were some human factors and data fidelity issues with some of the F-15 MPE software modules. It was not operationally suitable based in large part on system instability, reliability, maintenance, system administration training, and logistics supportability. A comprehensive evaluation of Information Assurance vulnerabilities indicated additional development

is needed to support direct interface with classified communications networks.

- DOT&E's observations of the B-1B bomber MPE user tests (conducted during developmental testing) indicated the aircrews were generally receptive of the implementation although some of the air-to-ground weapons software modules require additional development before Operational Test. The system also experienced instability with six failures recorded during 36 hours of operation. The segment of the test where the planned mission information is inserted into the B-1B bomber's host computer was not observed.
- The Navy proceeded with the JMPS-M MV-22 MPE operational test in accordance with an approved TEMP but without a DOT&E-approved Test Plan. The test concept appeared adequate, but the plan was not submitted until after the operational testing completed. The emerging results indicate the system was stable and supported required aircrew mission planning needs during the first operational test conducted at Yuma Proving Ground, Arizona. A second operational test was prompted by a change in host aircraft avionics software requiring changes to the mission planning software. This test is being conducted with operational MV-22 aircraft onboard an amphibious ship enroute to Southwest Asia and is still ongoing. No meaningful test data has been received by DOT&E for independent analysis.

## Recommendations

- Status of Previous Recommendations. All previous recommendations have been addressed.
- FY07 Recommendations.
  1. The Air Force, Navy, and Army Mission Planning System Program Managers and operational test agencies should establish a forum to collaborate on opportunities for shared or joint testing of their products to reduce test cost and schedule as well as exchange lessons learned.
  2. The Navy should apply additional test planning and management resources to manage and conduct the numerous JMPS-M host platform MPE tests planned for FY08. These additional personnel should be sufficient to prepare and update required TEMP annexes and operational test plans in a timely manner for DOT&E review and approval.
  3. All Services should review the results of the Information Assurance vulnerability evaluation from the F-15 Version 1.2 MPE testing and implement designs and procedures to allow direct connection of JMPS to classified communications networks, to speed access to intelligence and other data needed to plan missions, and reduce the proliferation of copies of classified data media.
  4. Future MPE operational testing should focus on the following areas:
    - Continuous evaluation of system stability during more complex operational scenarios
    - Larger sample size of participating aircrew
    - Live flight of the planned missions in the host aircraft to verify the fidelity of the transferred mission planning data

# Joint Nuclear, Biological, and Chemical Reconnaissance System (JNBCRS)

## Executive Summary

- The Joint Service Light Nuclear, Biological, and Chemical Reconnaissance System (JSLNBCRS) Increment 1 completed First Article Testing and government production verification testing to assess readiness for Multi-Service Operational Test and Evaluation (MOT&E) in FY06. The Joint Program Executive Officer for Chemical and Biological Defense (JPEO(CBD)) shortened the program name to JNBCRS to match updated capabilities documents.
- The Army, Marine Corps, and Air Force operational test agencies conducted the JNBCRS Increment 1 MOT&E in April 2006. They conducted the MOT&E for Marine Corps and Air Force units employing Service-unique JNBCRS variants. They conducted the MOT&E in accordance with the DOT&E-approved test plan with one major exception. The exception was that testers released simulants, used to test Marine Corps JNBCRS crews employing the Joint Services Lightweight Standoff Chemical Agent Detector (JSLSCAD), in quantities much larger than approved in the test plan.
- The Joint Services Lightweight Standoff Chemical Agent Detector (JSLSCAD) performance against chemical warfare agents (CWAs) in different operational environments is evaluated with aid of modeling and simulation.
- The Air Force withdrew from the JNBCRS Increment 1 program based on a changed threat environment for airbases.
- The Marine Corps requested additional operational testing of JNBCRS Increment 1 for which planning is ongoing to conduct in FY08.
- The JPEO (CBD) plans to make a full-rate production decision for the JNBCRS Increment 1 in 1QFY09.
- The Joint Project Manager is developing an Increment 2 program using emerging technologies from the Joint Chemical Dismountable Reconnaissance System Limited Objective Experiment and the Chemical Unmanned Ground Reconnaissance Advanced Concept Technology Demonstration.

## System

- The JNBCRS Increment 1 is a mobile suite of chemical, biological, radiological, and nuclear (CBRN) reconnaissance



and surveillance sensors with communications integrated onto a Light Armored Vehicle (LAV) for the Marine Corps. The suite was integrated onto the High Mobility Multi-purpose Wheeled Vehicle (HMMWV) for the Air Force.

- A JNBCRS crew uses this suite to locate, detect, identify, mark, sample, and report CBRN hazards while the LAV's filtering and over-pressure system provides protection from CBR threats.
- The CBRN mission equipment package includes:
  - Joint Biological Point Detection System
  - Chemical and Biological Mass Spectrometer (CBMS) to detect liquid CWAs on the ground collected by a Dual Wheeled Sampling System (DWSS)
  - NATO standard markers and deployment system
  - Automatic Chemical Agent Alarm to provide point detection of CWA vapors
  - Radiological detectors
  - JSLSCAD has been removed from the JNBCRS Increment 1 configuration.

## Mission

- Marine Corps NBC reconnaissance squads (two JNBCRS) conduct searches, surveys, surveillance, sampling, and reconnaissance (route and area) to confirm the presence or absence of CBRN hazards.
- These squads report CBRN information to the supported Marine Air Ground Task Force.

## Activity

- The Army, Marine Corps, and Air Force operational test agencies conducted the JNBCRS MOT&E in April 2006 at Dugway Proving Ground, Utah, with Marine Corps and Air Force JNBCRS teams performing CBRN reconnaissance

missions under realistic field conditions and simulant challenges. Testers executed the test plan as approved by DOT&E except they released simulants in larger quantities than approved in a threat test support package.

- The JSLSCAD project manager conducted modeling and simulation of the JSLSCAD's performance against CWAs in different operational environments.
- The Air Force withdrew from the JNBCRS Increment 1 program in March 2007 based on a changed threat environment for airbases. The Air Force desires an autonomous CBRN reconnaissance capability on unmanned air or ground vehicles.
- The Marine Corps requested to terminate integration of JSLSCAD onto the JNBCRS Increment 1 LAV in September 2007. The JSLSCAD meets the JNBCRS requirement for chemical standoff surveillance for some CWAs that produce vapor clouds, but does not detect and identify other CWAs.
- The Joint Requirements Oversight Council intends to review the JSLSCAD requirement in November 2007.
- The Marine Corps requested additional operational testing for the JNBCRS Increment 1. Planning is ongoing to test in FY08.
- The project manager added a rear-viewing camera and modified the DWSS for the CBMS. With procedural changes, these were customer-tested to improve the CBMS/DWSS reliability and availability.

- The JPEO(CBD) plans to make the full-rate production decision for JNBCRS Increment 1 in 1QFY09.

## **Assessment**

- Although government and contractor technical testing verified key system performance parameters, software stability, and integration of the CBRN sensors were effective and suitable with limitations, the Marine Corps requested JNBCRS Increment 1 operational effectiveness and suitability be reconfirmed in additional operational testing.
- Naturally occurring atmospheric interferences degrade JSLSCAD detection performance.
- The Joint Biological Point Detection System provided very limited capability to detect biological warfare agents because the two JNBCRSs were not operated as part of a larger array.

## **Recommendations**

- Status of Previous Recommendations. There were no previous recommendations.
- FY07 Recommendations. Confirm reliability improvements in the planned FY08 JNBCRS Increment 1 IOT requested by the Marine Corps.

# Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD)

## Executive Summary

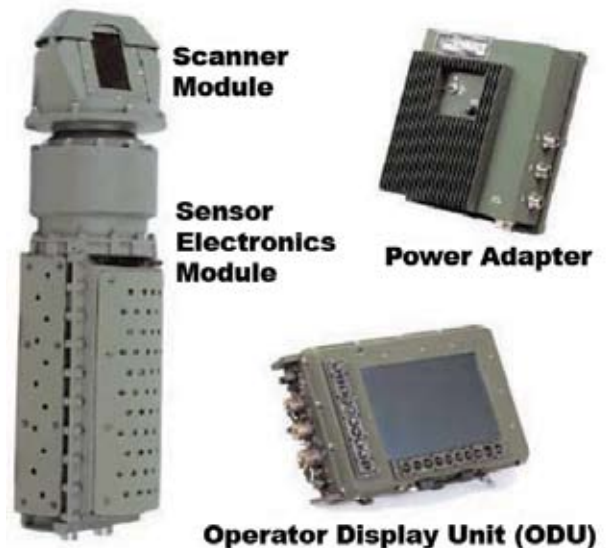
- Operational testing of the Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD) using simulants resumed in August-October 2006 in conjunction with the Army Stryker Nuclear, Biological, and Chemical Reconnaissance Vehicle (NBCRV) Initial Operational Test. Modeling and simulation studies continued in 2007 that began in 2004 to understand how the JSLSCAD functions in different operational environments against chemical warfare agents.
- The JSLSCAD did not meet its operational requirement and was rebaselined in 2003. The Joint Requirements Oversight Council reduced the original requirements for JSLSCAD to reflect the system's performance as demonstrated using simulants in an Army Limited User Test in 2004.
- Initial operational testing of JSLSCAD took place in March-April 2006 in conjunction with the Joint Service Light Nuclear, Biological, and Chemical Reconnaissance System (JSLNBCRS) Multi-Service Operational Test and Evaluation (MOT&E). The JSLSCAD is no longer included in that system's configuration.

## System

- JSLSCAD is an infrared passive detector that detects chemical warfare agent (CWA) vapors.
- JSLSCAD is vehicle-mounted onto the Army Stryker NBC Reconnaissance Vehicle.
- The project manager stopped development of new increments of JSLSCAD because evaluation of commercial candidates did not demonstrate a performance improvement over the

## Activity

- The Joint Program Executive Office for Chemical and Biological Defense (JPEO (CBD)) rebaselined the JSLSCAD program in 2003.
- In 2005, the Services revised, and the Joint Requirements Oversight Council validated, that JSLSCAD must detect blister agent vapor with 70 percent probability and nerve agent vapor with 29 percent probability up to 500 meters while the platform is moving or stationary. The requirement had been 90 percent probability of detection out to 5,000 meters.
- The Army and Marine Corps operational test agencies tested JSLSCAD as part of the JSLNBCRS MOT&E in March-April 2006. The Army conducted additional operational



current JSLSCAD. The project office is studying new techniques to improve JSLSCAD performance.

## Mission

Army Chemical Biological Radiological Nuclear (CBRN) reconnaissance platoons use JSLSCAD to conduct standoff chemical warfare agent vapor detection while conducting CBRN reconnaissance or surveillance missions to provide warning to supported commanders of the impending arrival of CWA vapor clouds.

- testing of JSLSCAD integrated onto the Stryker NBCRV in August-October 2006 based on a DOT&E-approved test plan.
- The project manager sponsored modeling and simulation studies from 2004 through 2007 to gain understanding of how the JSLSCAD functions in different operational environments against CWAs that produce vapor clouds. From this modeling and simulation, JSLSCAD has the capability to detect large operationally realistic threat vapor clouds of specific CWAs at ranges up to 2,000 meters under certain environmental conditions.
- In July 2007, the Marine Corps decided to not integrate JSLSCAD on the Light Armored Vehicle variant of the JNBCRS because JSLSCAD capability is limited to some

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nerve and blister agents. The Air Force withdrew from the JSLSCAD program in 2005.

- To support the Stryker NBCRV development and fielding, the JPEO (CBD) will acquire 458 JSLSCAD systems.
- The Joint Requirements Oversight Council will review the JSLSCAD requirements in November 2007.
- DOT&E evaluation is ongoing of the JSLSCAD in the current Stryker NBCRV operational configuration.

## Assessment

- Evaluation of early field tests against simulants led to decrease of line-of-sight detection requirement from 5,000 to 500 meters. Field tests results have shown simulant detection under some conditions out to 2,000 meters. This level of performance and detection range with simulants confirmed modeling and simulations with CWAs over a range of conditions and operating environments.

- When used in the Stryker NBCRV at about 35 miles per hour, the JSLSCAD may provide very limited warning time before entering a chemical vapor cloud based on the 500 meter detection requirement.
- Simulant releases in the NBCRV Initial Operational Test provided validation of soldier training to operate the JSLSCAD on the NBCRV and that the JSLSCAD integrated on the NBCRV can detect chemical vapor clouds on-the-move.
- Modeling and simulations indicate that water vapor and ozone are natural interferents for the JSLSCAD. This may hamper operational use of this system.

## Recommendations

- Status of Previous Recommendations. All previous recommendations were accepted.
- FY07 Recommendations. None.

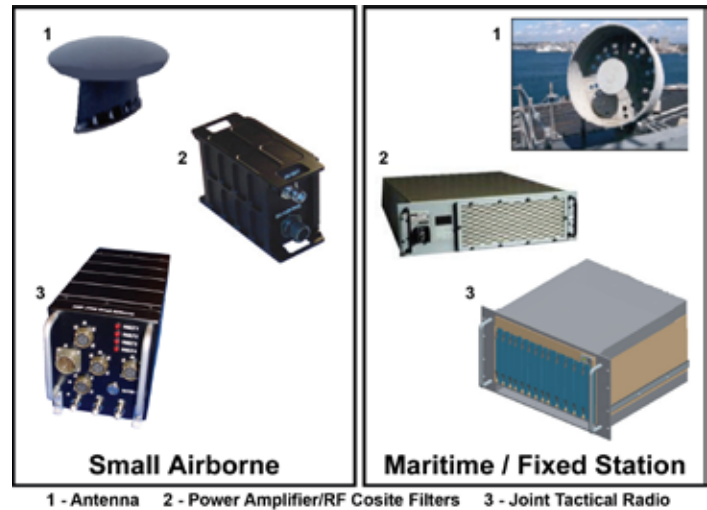
# Joint Tactical Radio System (JTRS) Airborne / Maritime / Fixed Station (AMF)

## Executive Summary

- The Airborne / Maritime / Fixed Station (AMF) Joint Tactical Radio System (JTRS) program is in the pre-Milestone B phase of acquisition. The Milestone B was postponed until November 2007 due to a reassessment of the AMF development and acquisition strategy caused by funding shortfalls in the program.
- DOT&E approved the AMF JTRS Test and Evaluation Master Plan (TEMP) in March 2007. Proposed program funding reductions for Milestone B resulted in cuts in the number of host platforms, test sites, and engineering design models available for test. These reductions have not had a significant impact on the overall test strategy outlined in the TEMP.
- Any significant re-structuring of the AMF JTRS program will necessitate a review of the continued adequacy of the current TEMP.

## System

- AMF JTRS is one of the product lines in the JTRS family of software configurable radios.
  - Communications waveforms operating in the radio frequency range of 2 Megahertz to 2 Gigahertz can be implemented in the AMF JTRS radio terminal, depending upon host platform communications requirements.
  - The AMF JTRS radio terminals are not intended to be standalone communications systems but must be integrated into host platforms, along with peripherals such as antennas, controls, displays, and high-power amplifiers to perform the communications mission.
  - The current production concept calls for two form factors, a Small Airborne and a larger Maritime/Fixed Station. The Small Airborne form factor has a requirement for two separate full duplex channels and the Maritime/Fixed Station has a minimum requirement of four separate full duplex radio channels.
- Development and acquisition will be evolutionary, resulting in increased communications and networking waveform capabilities. The AMF JTRS Increment 1 radio terminal



will include legacy and next-generation Internet Protocol networking voice, data, and video communications capabilities.

- AMF JTRS Increment 1 initial host platforms include the AH-64 and CH-47 helicopters, the C-130 airlift aircraft, and Guided Missile Destroyers.

## Mission

- Joint Force Component Commanders employ AMF JTRS to provide interoperable communications with maritime, land component, and aviation assets using legacy cumulative waveforms including Link-16 (a tactical data link) and future waveforms, including the Mobile User Objective System and the Soldier Radio Waveform, data link and digital voice communications, and networking capabilities.
- Commanders and platform operators use AMF JTRS to provide increased Service, joint, and Allied force communications interoperability resulting from the integration of shared communications waveforms in the AMF JTRS.

## Activity

- The AMF JTRS TEMP Annex, developed as a collaborative effort with the Air Force, Army, and Navy test agencies, was approved by DOT&E in March 2007 to support entry into Milestone B.
- The Milestone B was postponed until December 2007 to permit a comprehensive review of the AMF JTRS program. The re-assessment focused on the total ownership costs

- associated with the proposed AMF form factors, platform integration costs, and program funding shortfalls.
- No testing was conducted during FY07.

## Assessment

- In May 2007, the planned procurement of engineering development models for contractor and developmental testing

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was reduced and the number of test locations consolidated to off-set shortfalls in program funding. These changes did not impact the basic test strategy outlined in the approved TEMP. The revised procurements include sufficient low-rate initial production units to support the IOT&E.

- To make efficient use of resources and reduce the time needed for operational test where appropriate, the AMF JTRS test strategy includes early involvement by Operational Test Agencies in planning and collecting data during contractor and developmental testing. Operational Test Agencies and DOT&E will independently evaluate applicable integrated test results along with dedicated operational test data.
- The AMF JTRS test strategy progresses from radio terminal box-level testing to host platform integration testing, and

culminates in multi-Service testing. The multi-Service testing will focus on interoperability and network stressing scenarios.

- Any significant re-structuring of the AMF JTRS program will necessitate a review of the continued adequacy of the current TEMP.

## **Recommendations**

- Status of Previous Recommendations. The AMF JTRS program has addressed FY06 recommendations with the development of the AMF JTRS Acquisition Strategy Report and the TEMP.
- FY07 Recommendation.
  1. The Program Office should update the TEMP following contract award.

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

## Executive Summary

- The Joint Tactical Radio System (JTRS) Ground Mobile Radio (GMR) product line continues progress within its Increment 1 program baseline, including finalizing acquisition documentation and movement toward operational test.
- The prime contractor is conducting a series of field tests on waveform software using pre-Engineering Developmental Model sets.
- The program's testing effort needs to determine the number of radios and associated platforms required to assess networking scalability, performance of the networking waveforms, and network enterprise services appropriate for the GMR.
- The Joint Program Executive Office (JPEO) should examine JTRS enterprise level testing requirements and establish responsibilities between GMR, the Networking Enterprise Domain, and other JTRS product lines for testing the performance of large-scale JTRS networks as the tactical component of the Global Information Grid.

## System

- JTRS is a family of software-programmable and hardware-configurable digital radios designed to provide increased interoperability, flexibility, and adaptability to support many diverse warfighter communications requirements.
- JTRS GMR components include control display devices, universal transceivers, network/information security interface



1 - Control Display Device  
2 - Universal Transceivers with Network / Information Security Interface Unit  
3 - Power Amplifiers

units, and power amplifiers, which combine to create radio sets for Army, Marine Corps, and Air Force ground vehicle installations.

## Mission

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

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

## Activity

- The JTRS GMR program continues progress in its Systems Development and Demonstration phase and Acquisition Program Baseline (APB) reset. The program is finalizing acquisition documents including the GMR annex to the JTRS Enterprise Acquisition Strategy and the GMR Test and Evaluation Master Plan (TEMP). However, the program is working an issue with the National Security Agency that might impact TEMP approval and their overall T&E schedule.
- The prime contractor continued a series of field experiments using pre-Engineering Developmental Model (pre-EDM) hardware versions of the GMR. The program uses recurring field experiments to test incremental improvements in software and waveforms to mitigate risk to Production Qualification Testing.
- The prime contractor started the design of the Engineering Developmental Model versions of GMR radios.
- DOT&E approved the JTRS Enterprise Test and Evaluation Strategic Guidance in July 2007.

## Assessment

- The JTRS GMR program is making progress toward completing the Increment 1 baseline under the restructured JTRS program. Update of all acquisition documents is planned prior to a Milestone C decision (4QFY10).
- The Test and Evaluation Working Integrated Product Team (T&E WIPT) is identifying and resolving issues affecting test adequacy as part of the process for updating the GMR TEMP. The most significant issue is determining the numbers of radios and associated platforms necessary to adequately assess network scalability, performance of the networking waveforms, and network enterprise services appropriate for GMR.
- JTRS GMR field experiments with pre-EDM radios are providing insights on the performance of the software waveforms and experience in testing software-defined radios.

## Recommendations

- Status of Previous Recommendations. JTRS GMR is making good progress in creating a TEMP and supporting an enterprise strategy as published in the 2007 JTRS Enterprise Test and Evaluation Strategic Guidance (FY06).
- FY07 Recommendations. The JTRS JPEO should:
  1. Identify and resolve potential test adequacy issues across the areas of network scalability, waveform performance, and enterprise services.
  2. Examine enterprise level testing requirements and establish responsibilities for testing the performance of large-scale JTRS networks.

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

## Executive Summary

- The Joint Tactical Radio System (JTRS) Handheld, Manpack, and Small Form Fit (HMS) product line continues progress within the new program baseline started in 2005 under the direction of the Joint Program Executive Office (JPEO), including updating acquisition documents and transferring program management to San Diego, California.
- The Handheld and Manpack variants are proceeding with test plans in compliance with U.S. Code Title 10 and DoD policies.
- The seven Small Form Fit (SFF) variants present challenges in coordinating test opportunities with their associated host platforms. The program has not yet identified SFF test events to support proposed acquisition decisions.



## System

- The JTRS is a family of software-programmable and hardware-configurable digital radios designed to provide increased interoperability, flexibility, and adaptability to support the many diverse warfighter communications requirements.
- The JTRS HMS product line provides handheld and manpack radios for Army, Marine Corps, Navy, and Air Force personnel, and SFF variants to be embedded in Army host platforms such as the Intelligent Munitions System, Unattended Ground Sensors, Ground Soldier System, Unmanned Aerial Vehicle (Class I and Class IV), and the Non-Line-of-Sight Launch System.

## Mission

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

- JTRS handheld and manpack radios to communicate and create networks to exchange voice, video, and data using legacy waveforms or the newly developed Soldier Radio Waveform during all aspects of military operations
- JTRS SFF variants to provide a networked communications capability for users engaged in land combat operations to support voice, video, and data across the immediate battlespace

## Activity

- The JTRS HMS program continues baseline efforts under the restructured JTRS program and transfer of the program office from Fort Monmouth, New Jersey, to San Diego, California. The Program Office is reestablishing its Acquisition Programming Baseline and updating acquisition documents, including the HMS annex to the JTRS Enterprise Acquisition Strategy and the HMS Test and Evaluation Master Plan (TEMP).
- Contractor testing of the SFF variants intended for integration into the Intelligent Munitions System and the Unattended Ground Sensor began in 3QFY07; testing of the SFF variant intended for integration into the Ground Soldier System began in 4QFY07.
- The Program Office is updating its Acquisition Strategy and developing a TEMP to support Milestone C in 1QFY09.
- The HMS Program Office is coordinating with host platform program offices to identify host platform operational tests that could provide data to support HMS program decisions.
- In July 2007, DOT&E approved the JTRS Enterprise Test and Evaluation Strategic Guidance.

## Assessment

- The Handheld and Manpack variants of the HMS product line continue to progress through development in accordance with the JTRS Joint Program Executive Office schedule.
- The synchronization of operational testing for the SFF sets within their host platforms remains a concern. The 1QFY09 Milestone C will require operational testing of SFF sets integrated into host platforms. The program continues to

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work to identify host platform tests to support SFF operational testing requirements.

- The program is determining an acceptable and executable strategy to operationally test SFF radios for inclusion in the updated Acquisition Strategy and HMS TEMP.

## Recommendations

- Status of Previous Recommendations. JTRS HMS is making good progress in creating a TEMP and supporting an enterprise strategy as published in the 2007 JTRS Enterprise Test and Evaluation Strategic Guidance (FY06).

- FY07 Recommendations. The JTRS JPEO should:

1. Develop an operational test strategy for each SFF variant that supports JTRS HMS program decisions and is coordinated with the program test schedules of associated host platforms.
2. Examine enterprise level testing requirements and establish responsibilities for testing the performance of large-scale JTRS networks.

# Mine Resistant Ambush Protected (MRAP) Vehicles

## Executive Summary

- The Mine Resistant Ambush Protected (MRAP) Joint Program Office, led by the Marine Corps Systems Command, was established in November 2006.
- DOT&E approved the MRAP Test and Evaluation Master Plan (TEMP) in 2007.
- In July 2007, the MRAP program initiated a request for proposals for an MRAP II vehicle. The MRAP II is intended to provide increased ballistic protection against Explosively Formed Penetrators (EFPs). Additionally, the program also has developmental efforts underway to integrate armor protection against EFPs on existing MRAP vehicles.

## System

- MRAP vehicles are a family of vehicles designed to provide increased crew protection and vehicle survivability against current battlefield threats, such as improvised explosive devices (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 are to replace the High Mobility Multi-purpose Wheeled Vehicle (HMMWV) in current combat operations, providing improved vehicle and crew survivability.
- There are two basic types of MRAP vehicles. The MRAP Category I (CAT I) vehicle is designed to transport no less than six persons while the MRAP Category II (CAT II) vehicle is designed to transport no less than 10 persons. An ambulance variant of the MRAP vehicle is also being developed.
- MRAP vehicles will incorporate current Service command and controls systems and counter-IED systems. Additionally, MRAP vehicles will incorporate gun mounts with gunner protection kits capable of mounting a variety of weapons systems such as the M2 .50 caliber machine gun and the MK-19 grenade launcher. Also, the program has developmental efforts underway to integrate armor protection against EFPs on existing MRAP vehicles.
- Five commercial vendors have been awarded ongoing production contracts for MRAP CAT I and CAT II vehicles:



MRAP Category I

MRAP Category II

Force Protection Industries, General Dynamics Land Systems-Canada, International Military and Government, BAE-Tactical Vehicle Systems (formerly Armor Holdings), and BAE. Additionally, DoD purchased an initial 160 CAT I vehicles from Oshkosh Truck and Protected Vehicles; however, no subsequent purchases have been made from these two vendors.

- As of September 2007, DoD identified an initial overall procurement objective of approximately 8,000 MRAP CAT I and Cat II vehicles. This procurement objective is expected to rise to approximately 16,000 vehicles.
- In July 2007, the MRAP program initiated a request for proposals for an MRAP II vehicle. The MRAP II is intended to provide increased ballistic protection against EFPs. Initial test and evaluation of MRAP II candidates is currently scheduled to begin in October to November 2007.

## Mission

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

## Activity

- The MRAP Joint Program Office led by the Marine Corps Systems Command was established in November 2006.
- DOT&E approved the MRAP TEMP in 2007.
- The essential elements of the MRAP T&E program are:
  - Developmental Test (DT) phase one (DT-C1) was designed to conduct initial threshold testing of candidate vehicles. Marine Corps Operational Test and Evaluation Agency (MCOTEA) and Army Test and Evaluation Command

(ATEC) conducted DT-C1 in June 2007. It consisted of automotive and ballistic survivability testing and a limited user evaluation. The intent of DT-C1 was to provide an assessment of the capability of vendor candidate vehicles to meet MRAP system threshold requirements.

- DT phase 2 (DT-C2) will consist of safety testing, testing to assess key performance parameters and attributes, and

selected live fire testing. DT-C2 for the selected MRAP vehicles is ongoing.

- DT phase 3 (DT-C3) will consist of Full-up System Live Fire T&E as well as developmental test and evaluation to address any system requirements remaining from DT-C2.
- Each MRAP vehicle type by vendor will undergo an IOT&E. MCOTEA and ATEC will conduct a series of five IOT&E's. Each IOT&E will be vendor specific and will consist of CAT I and CAT II vehicles operated by both Marine Corps and Army units. The first IOT&E, consisting of vehicles from Force Protection Industries, is scheduled for early November 2007. The remaining vehicle variants will undergo IOT&E from January to April 2008. All IOT&E events will be conducted at Yuma Proving Ground, Arizona.

## Assessment

- As a result of DT-C1, the MRAP program selected candidate vehicles from five vendors – Force Protection Industries, General Dynamics Land Systems-Canada, International Military and Government, Armor Holdings, and BAE – to move on to DT-C2. Based upon the evaluation of results from DT-C1, candidate vehicles from Oshkosh Truck, Textron, and Protected Vehicles were not selected to move on to further testing due to identified shortfalls in ballistic survivability against threshold threats, automotive performance, and mission utility.

- Key DOT&E focus areas for the evaluation of MRAP effectiveness, suitability, and survivability include: overall capability of MRAP equipped forces to accomplish designated missions, automotive performance, vehicle reliability, human factors, effective integration of mission equipment, and ballistic survivability.
- The addition of EFP armor protection on existing MRAP vehicles will add significant weight to these vehicles and potentially compromise other aspects of vehicle performance.

## Recommendations

- Status of Previous Recommendations. No previous report was submitted for the MRAP program.
- FY07 Recommendations.
  1. DoD should continue to ensure that an effective T&E program remains in place that balances the need for rapid fielding and deployment of MRAPs with the need to identify and fix significant vehicle performance shortfalls prior to deployment.
  2. The program should ensure that adequate T&E plans are developed and executed to support the development of MRAP II, EFP armor, and any additional vehicle upgrades which may be implemented.

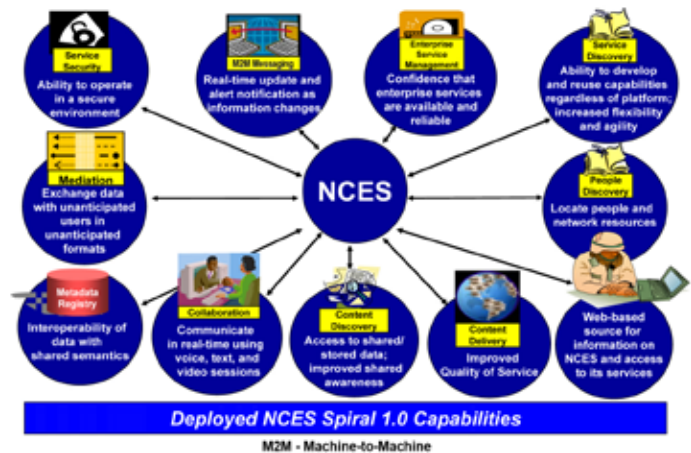
# Network Centric Enterprise Services (NCES)

## Executive Summary

- The Network Centric Enterprise Services (NCES) program completed Early User Tests on the International Business Machine's (IBM) Sametime collaboration service on both the Unclassified but Sensitive Internet Protocol Router Network (NIPRNet) and the Secret Internet Protocol Router Network (SIPRNet). Limited Authority to operate with up to a maximum of 100,000 registered users was granted by the Defense Information Systems Agency's Component Acquisition Executive (DISA CAE).
- Developmental testing was sufficient to provide a Limited Authority to Operate for the Defense Knowledge On-Line Portal and the Enterprise Service Management capability.
- A risk assessment was conducted to determine the level of testing for Increment 1, Spiral 2, which consists of Service Oriented Architecture and Content Discovery and Delivery capabilities. The risk assessment recommended that an operational assessment be conducted. The Joint Interoperability Test Command is developing the test plan for an operational assessment currently scheduled for December 2007.
- Developing a methodology to test and evaluate rapidly evolving, commercially managed enterprise services continues to prove more difficult than anticipated. Challenges include:
  - The slow adoption rate of NCES by existing programs of record
  - Continual evolution of core enterprise capabilities
  - Concerns about security that inhibit content providers from sharing information
  - Lack of established governance standards for exposing information on the Global Information Grid

## System

- NCES is a suite of capabilities that support automated information exchange across DoD on both classified and unclassified networks. These capabilities include collaboration, discovery, and subscriber tools.
- NCES is a suite of software products that are commercial off-the-shelf and government off-the-shelf products.
- The warfighting, intelligence, and business communities access NCES capabilities either directly or through a portal that controls access by the use of public key infrastructure profiles. NCES will extend selected services through the Internet to state, local, and authorized coalition users by the end of Increment 1.



- NCES collaboration tools provide all registered users the ability to hold meetings and exchange information by text, audio, and video.
- The discovery capabilities (content, people, services, metadata, publish/subscribe) allow producers of data to post information, alert others to the presence of new information, and evaluate the relevance of the data to their current roles and activities.
- NCES includes security and management capabilities that integrate with, and rely upon:
  - Network operations management capabilities supporting enterprise service/network management
  - Information Assurance/computer network defense
  - Content staging/information dissemination management
- Increment 1 services are available to all operational and tactical users who connect to a Defense Information System Network (DISN) point-of-presence. Future increments will expand and refine services to operational and tactical users in bandwidth-restricted, intermittent, and disconnected environments.
- NCES capabilities are intended to be commercially available products managed under a series of Service Level Agreements.

## Mission

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

## Activity

- The Joint Interoperability Test Command (JITC) documented the functional capabilities and performance of the NCES IBM Sametime 7.0 collaboration tool on the NIPRNet in February 2007 and IBM Sametime 7.5 tool on SIPRNet in June 2007. Observations were collected in separate DoD exercise and training events. IBM Sametime achieved incremental Limited Operational Availability status on NIPRNet in March 2007 and on SIPRNet in June 2007 for a maximum of 100,000 registered users and 1,000 concurrent users.
- The Defense Knowledge On-line Portal capability achieved Limited Operational Availability status in March 2007.
- The Enterprise Service Management capability completed developmental testing in August 2007. Testing assessed the ability of the Joint Task Force - Global Network Operations Center to adequately monitor the functioning and use of NCES Web services across the network. A Limited Operational Availability decision was made by the DISA CAE in September 2007.
- The JITC, with the supporting Service Operational Test Agencies, conducted a risk assessment and determined that Increment 1, Spiral 2, which consists of Service Oriented Architecture and Content Discovery and Delivery capabilities, will require an operational assessment. The JITC is developing the test plan for the December 2007 operational assessment in conjunction with the Service Operational Test Agencies.

## Assessment

- The development of a streamlined means of testing rapidly evolving, commercially managed, enterprise services continues to prove more difficult than anticipated. Challenges include:
  - The slow adoption rate of NCES by existing programs of record
  - Continual evolution of core enterprise capabilities
  - Network latencies for users without direct access to the DISN
  - The level of effort needed for programs to expose their capabilities using NCES
  - Security policies that inhibit content providers from sharing information

- The lack of established governance standards for exposing information on the Global Information Grid.
- The IBM Sametime collaboration capability is available to 100,000 registrants, but typically sustains an average of 50 concurrent users. Adoption has been slow due to issues with security, latency, and audio performance.
- The Defense Knowledge On-line Portal does not provide the same level of storage as the current NCES Defense On-line Portal. As a result, customers must find alternate storage options when the NCES Defense On-line Portal is removed from operations in December 2007. The differences in capability are causing Services and Agencies to reassess transition plans.

## Recommendations

- Status of Previous Recommendations. The NCES Program Office took constructive action on the FY06 DOT&E recommendations and identified U.S. Strategic Command as the NCES sponsor. The Services, Agencies, and Combatant Commands developed limited operational success criteria for NCES.
- FY07 Recommendations.
  1. DISA and the JITC should align the NCES evaluation strategy with the planned NCES implementations developed by programs of record and communities of interest. The strategy should be generic, repeatable, and assess the contribution NCES makes towards mission success.
  2. Update the NCES Test and Evaluation Master Plan to reflect the slow adoption of NCES and the consequent limited availability of effectiveness and suitability data at the enterprise level. Specifically, modify the decision supported by the IOT&E from “full-fielding” to continued expansion of Limited Operational Availability decisions.
  3. U.S. Strategic Command and U.S. Joint Forces Command, in conjunction with the Services, Agencies, and other Combatant Commands, should continue to refine the operational success criteria for NCES so that they clearly relate NCES services to mission or task accomplishment.

## Net-Enabled Command Capability (NECC)

### Executive Summary

- Consistent with Defense Acquisition Executive guidance to explore new approaches to acquiring information technology, the Net-Enabled Command Capability (NECC) Technology Development phase developed innovative and interdependent requirement, acquisition, and test strategies intended to improve the efficiency and agility of information technology acquisition.
- DOT&E supported developing these strategies by actively participating in integrated product teams, Test and Evaluation Master Plan development, and approving a waiver to apply software intensive test guidelines before completion of the IOT&E.
- End-to-end demonstration of test processes using the initial NECC Capability Modules is required to confirm adequacy and viability of the test strategy and to identify lessons learned for the NECC Milestone C.

### System

- NECC is the DoD's principal Command and Control Capability (C2C) that will provide access to a net-centric environment.
- NECC is a family of net-centric services comprised of software applications and databases implemented using service-oriented architecture technology.
- Users access NECC functionality via a software architecture composed of Capability Modules that are collections of net-centric services or data providing an operationally useful capability.
- Operators access NECC via a standard Global Information Grid computing node on a physical architecture consisting of operator clients and sites/nodes that access Capability Modules (classified and non-classified networks).
- The objective "mission space" for NECC is the area supporting command capability and command and control (C2) activities from the National Military Command System (NMCS) through the Joint Task Force and Service/functional components to unit level commanders.



- The DoD will develop NECC in three increments:
  - Increment 1 mission space extends from the NMCS through the Service/functional Component with focus on the Joint Force Commander Situational Awareness and Joint operations planning.
  - Increment 2 and 3 mission space extends from the NMCS to the tactical edge with focus at the unit level.

### Mission

- Joint Commanders will use the NECC to accomplish joint global command and control.
- Commanders intend to use the NECC to:
  - Link the National Command Authority to the Joint Task Force and Service/functional components down to the unit level
  - Access, display, and understand information necessary for the warfighter to make efficient, timely, and effective decisions
  - Achieve decision superiority and to execute joint operations planning

### Activity

- Technology Development phase activities of the Test and Evaluation Working Integrated Product Team included the development of a test and evaluation strategy, a management structure, and supporting processes for testing the NECC. A fundamental premise of the proposed strategy is using risk assessments of Capability Modules (consider the effect on mission and implications of product maturity) to determine an appropriate level (amount and type) of testing to support

fielding of the capability to operational forces. The strategy integrates the testing and systems engineering processes in a manner intended to attain informed decisions, fulfill statutory requirements, and include warfighter input from U.S. Joint Forces Command.

- The Test and Evaluation Working Integrated Product Team recommended supporting the NECC acquisition strategy with a Capstone Test and Evaluation Master Plan and detailed

annexes. The capstone document describes the test and evaluation process and its relation to other program processes. The annexes will provide the schedule, execution, and resource information for testing NECC Capability Modules.

- The Assistant Secretary of Defense (Networks and Information Integration) assigned Lead Operational Test Agency responsibilities to the Army Test and Evaluation Command (ATEC) in December 2006.
- DOT&E approved a waiver for the NECC Program Management Office and ATEC to apply the Guidelines for Conducting Operational Test and Evaluation of Software Intensive Systems prior to completion of an IOT&E in June 2007.
- Assistant Secretary of Defense (Networks and Information Integration) delayed the NECC Milestone B decision allowing the program time to examine options that would more rapidly replace legacy systems and to address full funding requirements.

## Assessment

- An end-to-end demonstration of the proposed test strategy was not completed during the Technology Development Phase. The ability to complete test events and evaluation reports within the time needed to meet the program development schedule is a significant concern.
- NECC intends to employ new tools to improve the efficiency and effectiveness of testing. The Defense Information Systems Agency (DISA) is developing the Federated Development and Certification Environment (FDCE) that will provide a comprehensive set of distributed tools to support the

NECC user, development, and test community activities in a collaborative manner. The Designated Approving Authority issued the FDCE an Interim Authority to Operate (IATO) for non-classified networks. The FDCE continues to mature; however, the Operational Test Agencies still need to validate its use for operational testing.

- DISA is developing the Capstone Test and Evaluation Master Plan; however, the detailed annexes are in the development process. A key challenge for developing the annexes is the timely receipt of essential information from the requirements and systems engineering processes.
- NECC Milestone B delays could impact the scheduled follow-on Milestone C, capability development, and operational testing.

## Recommendations

- Status of Previous Recommendation. There were no FY06 recommendations for the NECC program.
- FY07 Recommendations. The NECC Program Management Office should:
  1. Demonstrate execution of the test strategy, including the use of the FDCE, by exercising processes from end-to-end for an initial set of NECC Capability Modules.
  2. Update the Capstone Test and Evaluation Master Plan at Milestone C to address any Acquisition Strategy and other programmatic changes that impact NECC capability development and operational testing.
  3. Develop Test and Evaluation Plan Annexes for the initial NECC Capability Modules that define an adequate and executable test strategy.

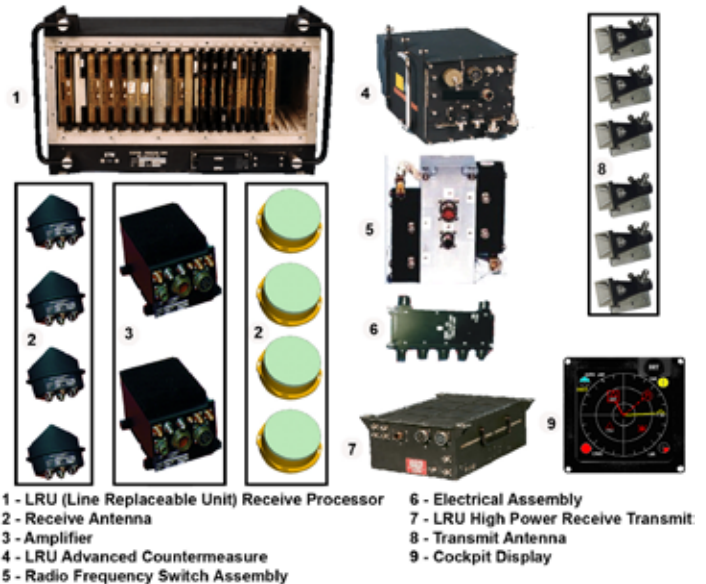
# Suite of Integrated Radio Frequency Countermeasures (SIRFC) (AN/ALQ-211)

## Executive Summary

- Emerging results from the FY07 Suite of Integrated Radio Frequency Countermeasures (SIRFC) IOT&E indicate that the SIRFC:
  - Radar Warning Receiver (RWR) provides significant improvement to effectiveness and situational awareness for special operations helicopter pilots in operationally representative mission environments
  - Electronic Countermeasures Suite has effectiveness and reliability limitations, but provides effective radar jamming against some threats, while enhancing helicopter survivability against most threats when combined with tactics and expendables
  - Electronic Countermeasures suite continues to demonstrate reliability problems that limits the availability of self-protection jamming during IOT&E
- The U.S. Army's Special Operations Command (USASOC) completed IOT&E of SIRFC for the MH-47G in late FY07 supporting a 1QFY08 SIRFC full-rate production decision.
- The Navy and Air Force Special Operations Command (AFSOC) will operationally test integration of SIRFC on the CV-22 aircraft during the FY08 CV-22 IOT&E.

## System

- SIRFC is an advanced radio frequency self-protection system designed for installation on aircraft.
- Major SIRFC subsystems are:
  - Advanced threat RWRs (Numbers 1, 2, 3, 6 and 9 in picture)
  - Advanced threat radar jammer/Electronic Countermeasures (Numbers 4, 5, 7 and 8 in picture)
- SIRFC is being developed for use on Army Special Operations MH-47 and MH-60 helicopters and Air Force Special Operations CV-22 tilt rotor aircraft.



## Mission

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

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

## Activity

### U.S. Army Special Operations Command

- USASOC completed the IOT&E of SIRFC on MH-47G and MH-60K+ helicopters in 4QFY07. This supports USASOC's 1QFY08 full-rate production decision for SIRFC.
- The SIRFC IOT&E included more than 20 two-ship missions, accumulating over 40 hours of dedicated mission representative flight data in a six week time period. Missions were conducted at the Naval Air Warfare Center, China Lake, California, and the Air Force's Nevada Test and Training Range.

- The U.S. Army Communications-Electronic Research, Development, and Engineering Center (CERDEC), USASOC's designated operational test agency for SIRFC, will also use applicable data products from extensive SIRFC development ground and flight testing in FY07, in addition to IOT&E data products to report on SIRFC.
- DOT&E approved USASOC's SIRFC IOT&E test plan in FY07.

- FY07 testing was conducted in accordance with the DOT&E-approved SIRFC Test and Evaluation Master Plan (TEMP).

### **Air Force and Navy**

- The Navy, in coordination with AFSOC and the Air Force Operational Test and Evaluation Command (AFOTEC), the Air Force's Operational Test Agency, led extensive CV-22 SIRFC development testing in FY07. The Air Force conducted this testing in preparation for the IOT&E commencing in 1QFY08.
- The FY07 testing included reliability testing of a re-designed SIRFC jamming technique generator component.
- The Air Force conducted CV-22 SIRFC testing in FY07 at the Naval Air Warfare Center, China Lake, California, and the Air Force's Nevada Test and Training Range.
- The Navy submitted a revised V-22 TEMP in FY07, which includes a focus on CV-22 defensive system testing.
- FY07 Navy and Air Force testing was conducted in accordance with the DOT&E-approved V-22 TEMP.

### **Assessment**

Although SIRFC development and testing is being conducted under two separate TEMPS, inter-program communication is good allowing the CV-22 program to benefit from the USASOC SIRFC lessons-learned.

### **U.S. Army Special Operations Command**

- DOT&E's assessment of emerging results from the FY07 SIRFC IOT&E, augmented with applicable development test data, is that:
  - The RWR provides a significant improvement to effectiveness and situational awareness to special operations helicopter pilots in operationally representative mission environments.
  - The Electronic Countermeasures Suite provides effective radar jamming against some of the threats, while enhancing

helicopter survivability against most threats when combined with tactics and expendables. However, stand-alone jamming effectiveness is significantly limited when employed against a small number of specific operational threats.

- The Electronic Countermeasures suite continues to demonstrate reliability problems that limited the availability of self-protection jamming during IOT&E.

### **Air Force and Navy**

- The Navy and Air Force's extensive testing of CV-22 defensive systems in FY07 demonstrated that the SIRFC RWR and Electronic Countermeasures Suite when integrated on the CV-22 are ready for the platform's upcoming IOT&E.
- MV-22 icing flight testing conducted in FY05 revealed that the design and integration of the forward SIRFC antennas significantly contribute to icing build-up. The Navy and AFSOC are considering configuration changes to mitigate these, but must ensure any new configurations are tested prior to operational use.

### **Recommendations**

- Status of Previous Recommendations. One of the five previous DOT&E recommendations is not being adequately addressed and remains unresolved. The Services should employ more realistic short-range radar-guided missile threats, which will support adequate testing of self-protection systems against radio frequency guided threats (FY06).
- FY07 Recommendations.
  1. USASOC: None.
  2. The Navy and AFSOC should ensure that applicable SIRFC component design changes or integration changes on the CV-22 are adequately characterized prior to fielding those configuration changes on CV-22.

## Teleport

### Executive Summary

- The DoD Teleport Generation One, Initial Operational Capability 3 (IOC3) system is operationally effective and suitable. Testing revealed critical maintenance failures that exceeded the 2-hour mean time to repair. The program took action to correct these and other issues.
- In order to maximize the full potential of IOC3 capability, the Teleport program should exercise additional efforts to improve maintainability, training, documentation, Defense Information Systems Network (DISN) circuit activation, and assist U.S. Strategic Command in publishing approved operational procedures.

### System

- DoD Teleport sites are globally distributed satellite communications (SATCOM) facilities. Teleport sites consist of four segments:
  - Teleport SATCOM earth terminals operate in X, C, Ku, Ultra High Frequency (UHF), and Extremely High Frequency (EHF) frequency bands. The terminals provide the radio frequency links between the Teleport site and the deployed warfighter SATCOM terminal via commercial or military satellites.
  - The base-band segment includes encryption, switching, multiplexing, and routing functions for connecting data streams or packeted data to the DISN.
  - Network services provide connectivity to the DISN long-haul networks and other interworking functions necessary to meet the warfighter's requirements.
  - Management control provides integrated and automated control and monitoring of Teleport base-band hardware, earth terminal hardware, electronic matrix switch, transmission security, and test equipment.
- The system is globally distributed across six Teleport facilities located at:
  - Chesapeake, Virginia
  - Ramstein/Landstuhl, Germany
  - Lago Patria, Italy
  - Fort Buckner, Japan
  - Wahiawa, Hawaii
  - Camp Roberts, California



- Teleport IOC3 implementation added EHF capabilities at the above-listed Teleport facilities and Bahrain.

### Mission

- Combatant Commands, Services, and deployed operational forces use the Teleport system in all phases of military operations to gain worldwide access to voice, video, and data services via military and commercial SATCOM.
- Commanders use Teleport to provide deployed forces with access to standardized fixed gateways from anywhere in the world for use of the six DISN services:
  - Secret Internet Protocol Router Network
  - Unclassified-but-Sensitive Internet Protocol Router Network
  - Defense Red Switch Network
  - Defense Switched Network
  - Video Teleconferences
  - Joint Worldwide Intelligence Communications System
- Units use Teleport to provide worldwide, interoperable communications between users by enabling multiple relays within a SATCOM band and cross-banding between different SATCOM bands.

### Activity

- In FY07, Joint Interoperability Test Command (JITC), Air Force Operational Test and Evaluation Center, and Commander Operational Test and Evaluation Force conducted two-week, concurrent operational tests at the Wahiawa, Hawaii, and Fort Buckner, Japan, Teleport sites. This completed operational testing started during OT&E at the Northwest Virginia Teleport site in July 2006.
- The test effort achieved broad Service participation, including nine Air Force units, two Navy ships, one Marine Corps unit, and three joint units.

- In August 2007, JITC conducted an Operational Assessment of commercial open standard Internet Protocol (IP) modem capabilities planned for Teleport fielding.

## Assessment

- JITC conducted testing in accordance with the DOT&E-approved Test and Evaluation Master Plan.
- Operational testing was adequate to demonstrate that the DoD Teleport IOC 3 system is operationally effective.
- Testing was adequate to demonstrate that the IOC3 system is operationally suitable, but revealed some maintenance issues. The Wahiawa and Fort Buckner Teleport sites experienced three critical failures that exceeded the 2-hour Mean Time to Repair standard. The Teleport program addressed identified maintenance issues (associated with the critical failures) with an EHF system software upgrade.
- The IOC3 system provides enhanced capability to the warfighter and is ready to support operations.
- The Operational Assessment of commercial open standard IP modems concluded that procurement of subject modems

is a low risk endeavor due to their widespread successful use within the commercial sector.

## Recommendations

- Status of Previous Recommendations. The Teleport program continues to mature the Teleport Concepts of Operation for each new capability and is creating a library of operational procedure documents (FY06).
- FY07 Recommendation.
  1. In order to maximize the full potential of the IOC3 capability, the Defense Information Systems Agency and the Teleport program should continue efforts to improve maintainability, establish baseline standards for training across the Teleport system, correct documentation deficiencies, ensure all DISN circuits are activated, and assist U.S. Strategic Command in publishing approved operational procedures.



# Army Programs



## **Army Programs**

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

### Executive Summary

#### Common Missile Warning System (CMWS)

- FY07 Army operational reports indicate that the Service should reevaluate the Operation Iraqi Freedom (OIF)/ Operation Enduring Freedom (OEF) threat environments and the impact on CMWS testing or effectiveness limitations.
- The fielded version of CMWS offers significant advantages in the OIF/OEF environments over the legacy MWS it is replacing, but substantial CMWS effectiveness limitations outside the current OIF/OEF environments remain.
- The Army should further improve the CMWS and conduct T&E for combat operations outside the OIF/OEF environments.

#### Advanced Threat Infrared Countermeasures (ATIRCM)

- The ATIRCM incorporates an active infrared laser jammer that provides Army helicopters with improved defensive countermeasures. The CMWS cues the ATIRCM.
- The Army stopped testing of the ATIRCM laser jammer in FY05 due to significant reliability problems identified while testing.
- The Army incorporated a redesigned ATIRCM system and began limited ATIRCM government testing in FY07 to provide an assessment through a methodical test process. This test process includes an FY10 ATIRCM IOT&E, to support a planned full-rate production decision in FY10.
- DOT&E is unable to assess the ATIRCM performance until the Army conducts adequate government testing.

### System

- CMWS is the newest Army aircraft missile warning system designed to detect incoming surface-to-air infrared missiles, warn pilots of the threat, and to command automatic employment of Infrared Countermeasures (IRCM). The fielded CMWS is not integrated with an infrared laser jammer and only cues expendable flares.
- The Army will use CMWS as the first missile warning sensor (MWS) on some aircraft, while augmenting the legacy ALQ-144 passive infrared jammer and replacing the legacy AN/AAR-47 or AN/ALQ-156 missile warning sensors.
- Production CMWS are currently fielded on approximately 760 Army CH-47, UH-60, AH-64, C-12 series, and UC-35 aircraft. The Army is purchasing 1,710 CMWS systems.



- The Army plans to install ATIRCM/CMWS on most H-47 Chinook, H-60 Blackhawk, and H-64 Apache helicopters. CMWS-only is the planned configuration for Army fixed-wing C-12 and UC-35 series aircraft.
- The Navy is installing CMWS-only on a limited number of Marine Corps UC-35 Executive Transports.
- ATIRCM incorporates an active infrared laser jammer to provide Army helicopters with improved infrared defensive countermeasures. The Army plans to conduct the ATIRCM IOT&E as integrated with the full CMWS capability in FY10.

### Mission

- Combatant Commanders intend to use the integrated ATIRCM/CMWS suite to enhance threat warning and improve defensive countermeasures for helicopters and some fixed-wing aircraft. The system is also used to protect aircraft and crews during normal take-off and landing, assault, attack, re-supply, rescue, forward arming, and refueling missions against shoulder-fired, vehicle-launched, and other infrared-guided missile threats.
- Combatant Commanders currently use the fielded version of CMWS-only to warn pilots and support limited infrared-countermeasures.

# ARMY PROGRAMS

## Activity

### CMWS

- The Army authorized full-rate production of CMWS in FY06, following submission of the classified DOT&E report to Congress on CMWS.
- The Army continued to field an interim CMWS designed to support immediate warfighter needs, while deferring development of a full threat capable CMWS. The Army plans to conduct operational tests on the full threat CMWS capability that supports worldwide operations in FY10.
- The CMWS Program Office sponsored CMWS live fire missile testing at Eglin AFB, Florida, to provide the prime contractor more data to develop the full threat capable CMWS.
- The Army conducted follow-on testing at Fort Rucker, Alabama, of the CMWS installation on the Army UC-35 jets, integration on the UH-60M, CH-47F, and the addition of sensors on select fielded aircraft to improve the CMWS field of view.
- The U.S. Navy is planning to test CMWS integration on U.S. Marine Corps UC-35 aircraft late in FY07.
- The Army's CMWS testing in FY07 was not conducted in accordance with the DOT&E-approved Test and Evaluation Master Plan (TEMP).

### ATIRCM

- The Army stopped testing of the ATIRCM laser jammer due to significant reliability problems identified during testing in FY05.
- In FY07, the Army initiated a fundamental redesign of the ATIRCM laser jammer to address reliability issues and to provide a multi-band laser jamming capability reducing the number of system components.
- The Army began limited ATIRCM government testing in FY07 to provide an assessment of ATIRCM capabilities through a methodical test process. This test process includes a FY10 ATIRCM IOT&E designed to support a planned full-rate production decision in FY10.
- The ATIRCM contractor continued a five-phase reliability growth test to assess the reliability of the ATIRCM redesign.

## Assessment

### CMWS

- Army operational reports in FY07 indicate that the Service should reevaluate the OIF/OEF threat environments and quickly determine if there are any related CMWS testing or effectiveness limitations.
- In FY06, DOT&E determined that CMWS was operationally effective and suitable for the OIF/OEF combat operations when installed on the CH-47, UH-60, AH-64, and C-12 aircraft.
- The fielded version of CMWS offers significant improvements over the legacy MWS it is replacing in the OIF/OEF environment. However, testing has shown substantial system effectiveness limitations for CMWS outside the FY06

OIF/OEF threat environments, as well as limitations caused by specific platform integrations.

- The Army has incorporated incremental improvements to CMWS that mitigate some of the limitations reported by DOT&E, but the test results have not been fully analyzed.
- The Army has not accredited their end-to-end CMWS simulation model, which has the potential to reduce the flight test requirements of follow-on testing.
- The Army has not coordinated test planning with DOT&E for CMWS integration on new platforms as stated in the approved TEMP. The consequences of this is that DOT&E:
  - Is unable to influence the adequacy of test during planning
  - May not be aware that the testing has been conducted, and subsequently is unable to help other Services apply applicable Army testing results to similar CMWS platform integration efforts

### ATIRCM

- DOT&E assesses the Army's schedule for a planned full system (CMWS and ATIRCM) IOT&E in FY10 as being optimistic because there are no government test data products available to support the assessment of ATIRCM performance improvements since development of the redesigned ATIRCM began over two years ago.

### ATIRCM/CMWS

- The combined ATIRCM/CMWS TEMP does not adequately detail current plans to integrate a laser-based jamming capability with CMWS.
- The approved Army Acquisition Strategy for ATIRCM/CMWS does not detail an incremental CMWS capability (i.e. Interim Threat) or provide an accurate timeline for planned ATIRCM and CMWS integration.

## Recommendations

- Status of Previous Recommendations. The three DOT&E recommendations from FY06 remain valid. The Army needs to be more aggressive addressing the following three FY06 recommendations:
  - Test and report on CMWS improvements that support current OIF/OEF environments and worldwide mission environments
  - Provide a revised TEMP that clearly describes the development and test efforts required to support assessment of the full-threat capable CMWS and redesigned ATIRCM
  - Continue to develop the end-to-end simulation model for ATIRCM and CMWS to support the FY10 ATIRCM/CMWS full-rate production decision
- FY07 Recommendation.
  1. The Army must test and report on CMWS capabilities and limitations related to a changing OIF/OEF threat environment.

## Armed Reconnaissance Helicopter (ARH)

### Executive Summary

- The Army reported Acquisition Baseline Program schedule breaches to IOT&E, Milestone C Decision Review, and First Unit Equipped on May 16, 2007.
- On February 21, 2007, the fourth System Development and Demonstration (SDD) aircraft made a forced landing near the Bell test facility due to fuel starvation of the engine. The aircraft sustained major structural and component damage. This mishap forced a halt to Armed Reconnaissance Helicopter (ARH) flight testing until investigators found foreign debris in the fuel tank to be the cause of the mishap.
- The Army issued a stop-work order for the ARH on March 21, 2007, due to system development and integration, cost and schedule concerns. The Army lifted the stop work order on March 28, 2007, and continued the program to preclude high start-up costs.
- The Army held a special Systems Acquisition Review Council (ASARC) in May 2007 to consider options in the procurement of the ARH to replace OH-58D Kiowa Warrior helicopters. The ASARC decided to continue with Bell Helicopter/Textron as the prime contractor for the ARH.
- The complexity of ARH system integration has added 6 to 8 months to the schedule.
  - Milestone C: From September 2007 to April 2008
  - IOT&E: From February 2009 to September 2009
  - Full-rate production: From May 2010 to July 2010
  - First Unit Equipped: From July 2010 to December 2010
- The Army's ARH Replan Strategy adds additional aircraft (from 368 to 512) to replace selected Army National Guard Apache helicopters with ARH. The Replan strategy includes additional test vehicles, as well as a pre-planned product improvement to the rotor system.
- The ARH program completed live fire testing of several components under static conditions during FY07 and plans for additional testing for component and subsystems during FY08.

### System

- The ARH is a replacement for the OH-58D helicopter. The ARH is largely based on the commercial Bell Helicopter 407 design and incorporates new designs for several major components.
- The ARH integrates the Common Avionics Architecture System cockpit with target acquisition sensor systems for day, night, and marginal weather operations.



- The ARH will have a 50 caliber machine gun, and be able to fire 2.75-inch aerial rockets and Hellfire missiles. The ARH will have armored crew stations and will employ Aircraft Survivability Equipment, to include radar, laser, and missile warning systems and chaff/flare dispensers.
- The new acquisition objective is 512 aircraft (up from the original objective of 368) with a full-rate production decision in 3QFY10. The increase will equip Army National Guard Apache Helicopter units with ARHs. The Army plans to have 10 ARH per troop and 30 per squadron.

### Mission

- A Regimental Aviation Squadron, as part of the Multi-Functional Aviation Brigades, employs ARH to conduct aerial armed reconnaissance for collection of combat information and intelligence about enemy and terrain.
- ARH squadrons also provide security and early warning against enemy observation or attack for ground maneuver forces.
- Other ARH troop missions include:
  - Command and control
  - Communications relay
  - Convoy security
  - Nuclear/chemical surveys

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## Activity

- SDD test activities continue to evaluate flight performance and integration of mission equipment (navigation, communications, weapons, and survivability equipment) onto a modified, off-the-shelf Bell 407 aircraft.
  - The test and evaluation of the Honeywell HTS-900-2 engine and the Brite Star II, Target Acquisition Sensor Suite integration has continued since November 2006.
  - On February 21, 2007, the fourth SDD aircraft made a forced landing near the Bell test facility causing major structural and component damage to the aircraft. This mishap forced a halt to ARH flight testing until investigators found foreign debris in the fuel tank to be the cause of the mishap.
  - The Army issued a stop-work order for the ARH on March 21, 2007, due to cost and schedule concerns. The Army lifted the stop work order on March 28, 2007, to continue the program and preclude high start-up costs.
  - The Army reported Acquisition Baseline Program schedule breaches to IOT&E, Milestone C Decision Review, and First Unit Equipped on May 16, 2007.
  - The Army held a special ASARC in May 2007 to consider options in the procurement of the ARH to replace OH-58D Kiowa Warrior helicopters. The ASARC decided to continue with Bell Helicopter/Textron as the prime contractor for the ARH.
  - The Army's ARH Replan Strategy adds additional aircraft (from 368 to 512) to replace selected Army National Guard Apache helicopters with ARH.
  - The ARH Test and Evaluation Master Plan (TEMP) and acquisition strategy will be updated for a Milestone C decision scheduled for June 2008.
  - Component live fire testing began in 2006 with several subsystems including main and tail rotor components, the main transmission, and the proposed cockpit armor system. Other ballistic testing with applicability to ARH completed under the DOT&E Joint Live Fire program (OH-58D fuel and cockpit subsystems, and seat armor). These tests were conducted on components under static conditions and the results will be used in planning the more realistic dynamic system-level tests later in the program.
  - HTS-900-2 engine
  - Ballistic Armor
  - Transmission modified for rotor brake and torque sensor
  - Aircraft Survivability Equipment
  - Rotor Hub modified for blade folding
  - Landing Gear narrowed to accommodate weapons stores
  - Ballistically tolerant Fuel Cell
  - Integrated communications with Improved Data Modem
  - Targeting and Acquisition Sensors
  - Software Blocking
  - Armament Systems and Weapons pylon design
- The ARH continues as an event driven program focused on the Replan execution, two Limited User Tests (LUT), and flight testing.
  - The critical path to the 1QFY08 LUT #1 is the associated risk in developmental and integration testing of the Target Acquisition Sensor System (TASS).
  - The complexity of ARH system integration has added 6 to 8 months to the schedule.
    - Milestone C: From September 2007 to April 2008
    - IOT&E: From February 2009 to September 2009
    - Full rate production: From May 2010 to July 2010
    - First Unit Equipped: From July 2010 to December 2010
  - Developmental and integration testing delays have caused a two-year lapse for the Army to update the ARH TEMP. The TEMP update is ongoing.
  - The LFT&E strategy includes full-up system-level testing and will be updated with platform-specific details. Component/subsystem live fire testing is providing an adequate understanding of ballistic impact and damage results. Subsequent dynamic testing during the full-up system-level test series in FY08 should provide adequate live fire data.

## Assessment

- The Milestone B decision authority approved an accelerated ARH program schedule based on the Army acquisition strategy that capitalized on commercial off-the-shelf and non-developmental items. Since Milestone B in July 2005, the Army learned that the selected ARH design requires a more significant development and integration effort than originally envisioned. Systems/subsystems that required development and/or integration include:

## Recommendations

- Status of Previous Recommendations. The Army is addressing FY06 recommendations to monitor aircraft performance and integration, and to allow sufficient time to correct problems before IOT&E.
- FY07 Recommendations. The Army should:
  1. Continue to monitor the performance and integration of ARH components to allow development and delivery of a production representative aircraft for the execution of two LUTs.
  2. Expand the scope of the LUTs to include completion of the armed reconnaissance mission with an armed aircraft and aircraft survivability equipment.

## Black Hawk Upgrades (UH-60M) Utility Helicopter

### Executive Summary

- DOT&E published a combined OT&E/LFT&E report in May 2007 and found that the UH-60M Block I is operationally effective, suitable, and survivable.
- The Army completed the IOT&E in December 2006, flying 262 hours with five UH-60M Black Hawks. The IOT&E included 45 operationally realistic missions with 117 aircraft sorties and a 10-day field exercise.
- The UH-60M successfully accomplished 41 of 45 (91 percent) of assigned combat missions. The aircraft exceeds performance requirements for internal lift, external lift, and self deployment.
- The UH-60M is more reliable than the current UH-60L. Mission aborts and other reliability failures occurred infrequently. Aircraft were available for mission execution over 95 percent of the time.
- Operational and live fire testing demonstrated that the UH-60M is survivable in expected threat environments and that overall susceptibility to surface-to-air threats is lower when compared to the legacy UH-60A/L aircraft.
- The Army is extending the LFT&E program during FY08 to address pre-planned product improvement changes that may affect vulnerability of the aircraft, including the new composite tailcone and tail rotor drive shaft, fly-by-wire flight control system, and the main and tail rotor servo actuators.

### System

- The UH-60M is a modernized UH-60 A or L model Black Hawk medium-lift helicopter.
- The Assault Helicopter Battalion is organized as three companies of 10 aircraft each.
- The acquisition objective is for 1,806 UH-60M Black Hawks, with 1,227 projected to be UH-60M variant and the remaining to be UH-60Ls. The program projects that 123 aircraft will be UH-60M Block I aircraft, and the remaining 1,104 will be UH-60M Block I Upgrade aircraft.
- The UH-60M Block I aircraft include:
  - A digital cockpit with Blue Force Tracker
  - Power and airframe improvements with the 701D engine, wide chord blades for enhanced performance, and



- monolithic machined parts that show improvement over the A/L model Black Hawk
- Improved survivability with enhanced laser warning and infrared suppression for anti-missile defense
- The Army plans future improvements, beginning in 2010, for a UH-60M Block I Upgrade. This design adds:
  - Fly-by-wire advanced flight controls
  - A Common Avionics Architecture System and networked digital connectivity for enhanced commonality with other Army aircraft
  - Improved handling qualities optimized for minimum pilot workload and increased safety in degraded environments
  - Composite tailcone and main rotor and tail rotor drive shafts and main and tail rotor actuators

### Mission

Assault Aviation and General Support Aviation Battalions will use this aircraft to conduct the following missions:

- Air Assault lift for 11 combat soldiers or equipment less than 9,000 pounds for mobile strike and counter mobility operations
- Sustainment Operations to resupply the force through internal and external cargo lift capability
- Casualty and medical evacuation
- Command and control

### Activity

- DOT&E approved the UH-60M Upgrade Test and Evaluation Master Plan (TEMP) on December 13, 2005, and the UH-60M test plan on October 11, 2006, in preparation for the IOT&E.
- The UH-60M program completed Infrared (IR) signature measurements and testing in November 2006 to compare current UH-60L fleet IR signatures with the UH-60M.
- The Army completed the IOT&E in December 2006, flying 262 hours with five UH-60M Black Hawks. The IOT&E included 45 operationally realistic missions with 117 aircraft sorties and a 10-day field exercise.
- The Army completed developmental testing of a satellite-based communications system. This system is

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compatible with Army digital architecture and allowed Blue Force Tracker installation on the IOT&E aircraft.

- Additional operational testing included:
  - Live fire testing of the M-240 Machine Gun mounted on the UH-60M during January 7-8, 2007, at Fort Rucker, Alabama. This test confirmed adequate integration of the M-240 Machine Gun, laser sight, and the laser warning receiver.
  - HH-60 Medical Evacuation (MEDEVAC) operational test during January 23-26, 2007, at Fort Rucker, Alabama. MEDEVAC crews conducted five missions with live patients during day and night conditions to confirm MEDEVAC configuration and integration.
  - Integration of the Volcano Mine Dispensing System on February 12, 2007, at Redstone Arsenal, Alabama. During multiple minefield emplacement missions, crews were able to successfully dispense 96 mines with the UH-60M.
  - Operational testing of the Common Missile Warning System (CMWS) and the ARC 231 Radio, March 21-23, 2007, at Fort Rucker, Alabama.
- The LFT&E strategy approved by DOT&E in May 2000 includes a waiver from full-up system-level testing. The Army is extending the LFT&E program to address pre-planned product improvement changes that may affect vulnerability of the aircraft, including the composite tailcone and tail rotor drive shaft, fly-by-wire flight control system, and the main and tail rotor servo actuators. This testing and System Integration Laboratory qualification is planned to begin during FY08.

## Assessment

- The UH-60M Block I IOT&E and live fire testing were executed in accordance with the DOT&E-approved test plans. UH-60M Block I test plans and execution were adequate to assess operational effectiveness, suitability, and survivability.
- DOT&E published its combined OT&E/LFT&E report in May 2007 and found that the UH-60M is operationally effective, suitable, and survivable.
- The UH-60M is operationally effective. The UH-60M successfully accomplished 41 of 45 (91 percent) of assigned combat missions. The aircraft exceeds performance requirements for internal lift, external lift, and self deployment. During IOT&E missions, the UH-60M experienced some subsystem degradation, but degradation did not prevent mission accomplishment. Subsystem issues included integration of digital messaging, communications systems, and flight management systems.
- The UH-60M is operationally suitable. The UH-60M is more reliable than the current UH-60L. Mission aborts and other reliability failures occurred infrequently. Aircraft were

available for mission execution over 95 percent of the time. Some subsystems warrant redesign or improved training to make them more usable by operational crews. An ergonomic redesign of the crew chief seat and restraint harness for easier ingress and egress of the crew chief station, and continued refinement of subsystem training for aircrews is warranted.

- Operational and live fire testing demonstrated that the UH-60M is survivable in expected threat environments and that overall susceptibility to surface-to-air threats is lower when compared to the legacy UH-60A/L aircraft. Susceptibility improvements are largely the result of the integration of the CMWS on the UH-60M. The APR 39A radar warning receiver demonstrated poor performance and was no better in operational testing on the UH-60M than legacy aircraft.

## Recommendations

- Status of Previous Recommendations. The Army has effectively resolved issues from FY05 recommendations. There were no recommendations for FY06.
- FY07 Recommendations. The May 2007 DOT&E combined OT&E and LFT&E Report included a set of 14 recommendations to the Army to improve operational effectiveness, operational suitability, and survivability. These included:
  1. Improve network connectivity and develop tactics, techniques, and procedures for secure communications and digital messaging in an aviation environment.
  2. Ergonomically redesign the crew chief seat and restraint harness for easier ingress and egress of the crew chief station.
  3. Continue development of, and improve training on, subsystems for:
    - Communications suite (loading frequencies and digital messaging systems)
    - A communication subsystem reset capability after system startup
    - Flight Management System and Aviation Mission Planning System
    - Aircraft survivability equipment to include improving the reporting accuracy of the radar warning receiver
  4. Reduce the potential for transmission gearbox chip detector screen blockage resulting from ballistic hits to the main transmission assembly and address issues with cascading damage to the tail rotor drive system.
  5. Install an additional fire detector and fire suppression agent dispenser nozzle to the engine nacelle compartment and add fire detection and extinguishment to the fuel plumbing enclosure.

## CH-47F – Chinook Cargo Helicopter

### Executive Summary

- DOT&E published a combined OT&E/LFT&E report in June 2007 and found that the CH-47F is operationally effective, suitable, and survivable.
- The CH-47F successfully accomplished 10 of 10 assigned assault and lift missions during the IOT&E Phase II. The aircraft exceeds performance requirements for internal lift, external lift, and self deployment.
- During the operational test, the CH-47 did not have a mission abort and reliability failures were infrequent. CH-47F aircraft exceeded reliability and maintainability requirements and were available for mission assignment 90 percent of the time.
- Operational and live fire testing demonstrated that the CH-47F is survivable in expected threat environments.
- The Army conducted realistic operational testing of two production Block II CH-47F aircraft during the IOT&E Phase II from March 6 - 27, 2007, at Fort Campbell, Kentucky. IOT&E Phase II included a five-day battalion-level field deployment and executed 20 aircraft sorties.

### System

- The CH-47F is a remanufactured and modernized CH-47D Chinook Helicopter.
- The CH-47F is designed to transport artillery and light equipment up to 16,000 pounds, or 31 combat troops.
- The CH-47F program fulfills the Army Aviation Transformation Chinook requirement for upgraded aircraft with both remanufactured and new aircraft. The acquisition objective is 452 CH-47Fs (333 rebuilt aircraft and 119 new aircraft).
- The CH-47F incorporates:
  - A Common Avionics Architecture System cockpit to increase crew situational awareness and increase cockpit commonality with other Army aircraft
  - A Digital Automatic Flight Control System to improve handling qualities and decrease pilot workload



- Engine upgrades for increased power
- Fuselage stiffening, corrosion protection, and a new monolithic airframe structure to reduce cockpit vibration and increase airframe durability

### Mission

- The CH-47F provides lift capability to the ground tactical commander by rapidly projecting tactical airlift support and supply sustainment to accomplish critical tasks.
- General Support Battalions of the Multi-Functional Aviation Brigades equipped with the CH-47F will:
  - Conduct air assault missions to transport ground forces
  - Conduct resupply operations to move fuel, ammunition, and other battle-critical cargo
  - Conduct mass casualty evacuation
  - Support peacetime missions of logistics resupply, medical evacuation, disaster relief, and fire-fighting
- CH-47F equipped units employ the aircraft in single or multi-ship formations to execute air assault and resupply operations as an integrated element of a combined arms team.

### Activity

- DOT&E approved the CH-47F Test and Evaluation Master Plan (TEMP) on January 5, 2007, and test plan on February 20, 2007.
- During October and November of 2006, CH-47F production aircraft flew a 100-hour flight test program. Testing included establishing aircraft flight characteristics, Information Assurance, electromagnetic environmental effects, joint interoperability, and Common Missile Warning System integration.
- Developmental testing in FY07 resulted in an airworthiness certification and demonstration of acceptable aircraft handling qualities for entry into IOT&E Phase II.
- Digital communications capabilities of the CH-47F during the Software Block 1 testing demonstrated that the CH-47F can successfully exchange digital messages via Blue Force Tracker with various Army aircraft and beyond line-of-sight operations centers.

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- The Army conducted realistic operational testing of two production Block II CH-47F aircraft during the 62.7 hour IOT&E Phase II from March 6-27, 2007, at Fort Campbell, Kentucky. IOT&E Phase II included a five-day battalion level-field deployment and executed 20 aircraft sorties.
- During FY07, the Live Fire Integrated Product Team analyzed three deficiencies found during previous CH-47F testing. The three issues include insufficient concentration of Halon fire extinguishing agent for the engine fire detection and suppression system, incomplete dynamic main rotor blade testing, and the vulnerability of the synchronization and main rotor drive shafts.
- The Army investigations during FY07 included an analysis of CH-47F vulnerability to man-portable air defense system (MANPADS) and an analysis of damage tolerance of the new high-speed machined monolithic airframe components.

## Assessment

- CH-47F IOT&E Phase II and live fire testing were executed in accordance with the DOT&E-approved test plans. CH-47F test plans and execution were adequate to assess operational effectiveness, suitability, and survivability.
- DOT&E published a combined OT&E/LFT&E report in June 2007 and found that the CH-47F was operationally effective, suitable, and survivable.
- The CH-47F is operationally effective. The CH-47F Block II successfully accomplished 10 of 10 assigned assault and lift missions during the IOT&E. The aircraft exceeds performance requirements for internal lift, external lift, and self deployment. The digital map and other cockpit enhancements reduce pilot workload, although some improvements in subsystem integration to the Aviation Mission Planning System and Flight Management System to include digital messaging are necessary. More cargo handling systems would assist in mission accomplishment.
- The CH-47F is operationally suitable. During the operational test, the CH-47 did not have a mission abort and reliability failures were infrequent. CH-47F aircraft exceeded reliability and maintainability requirements and were available for mission assignment 90 percent of the time. While mission accomplishment was demonstrated, an expanded program is needed for crew training for digital communications, operation of the Flight Management System, and Aircraft Survivability Equipment.
- Operational and live fire testing demonstrated that the CH-47F is survivable in expected threat environments. The APR-39A radar warning receiver performance was poor.

- Live fire assessments include:
  - The engine fire detection and suppression system testing showed the current system does not meet the specified Halon concentration level requirements.
  - Static test results and analysis conducted were sufficient to accurately estimate ballistic threats to the main rotor blades.
  - The vulnerability of the synchronization and main rotor drive shafts is no more vulnerable than the CH-47D.
  - The man-portable air defense system vulnerability analysis remains to be validated.
  - The results of the structural analysis of the monolithic frames indicate the structure is no more vulnerable than the original built-up frames.

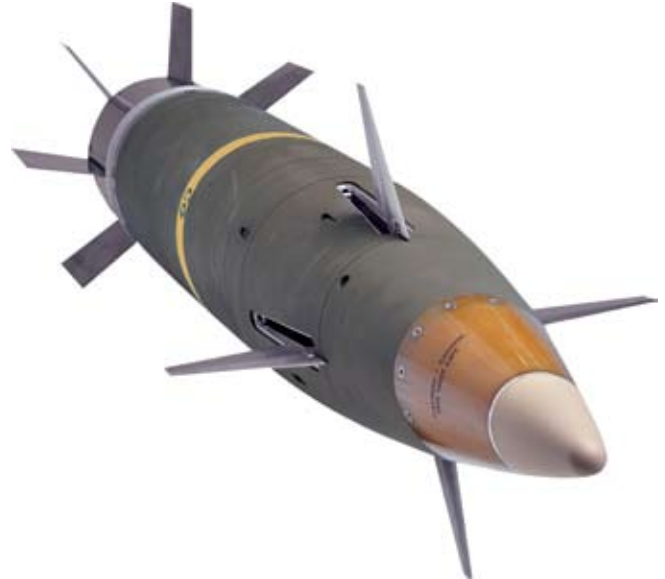
## Recommendations

- Status of Previous Recommendations. The Army satisfactorily resolved all previous recommendations.
- FY07 Recommendations. The June 2007 DOT&E combined OT&E and LFT&E Report included a set of 10 recommendations to the Army to improve operational effectiveness, operational suitability, and survivability. These included:
  1. Expand integration and continue development of CH-47F subsystems to include:
    - The transfer of Aviation Mission Planning System data to the Flight Management System
    - Tactics, techniques, and procedures for digital messaging in an aviation environment
    - The Common Avionics Architecture System and the Digital Automatic Flight Control System
    - The installation of an effective radar warning receiver or the improvement of the APR-39 radar warning receiver performance to increase threat reporting accuracy for the aircrew
  2. Develop an integrated cargo handling system for each aircraft or increase the number of the current cargo handling systems from two per company to one per aircraft.
  3. Continue to develop maintenance manuals to better address maintenance procedures for new CH-47F helicopters.
  4. Improve the engine compartment fire extinguishing system and add design features to reduce the fuel leaks and fire hazard to the passengers from the fuel plumbing.
  5. Increase crashworthiness with improved crew seats and improved landing gear to accommodate the increased gross weight of the aircraft.

## Excalibur XM982 Precision Engagement Projectiles

### Executive Summary

- On May 23, 2007, OSD approved the Excalibur Milestone C Test and Evaluation Master Plan (TEMP).
- The Increment Ia-1 projectile completed developmental testing, a Limited User Test with an Army firing battery platoon equipped with Paladin Howitzers, and a Customer Test with a Marine Corps unit using Lightweight 155 mm Towed Howitzers.
- The Army approved an Urgent Material Release for Increment Ia-1 to Iraq in April 2007. DOT&E delivered an Early Fielding Report to Congress, in accordance with Section 231 of the 2007 National Defense Authorization Act, summarizing Excalibur's demonstrated performance.
- Increment Ia-2 projectile development continues. In April 2007, the Increment Ia-2 achieved a range of 40 kilometers (km) during a live fire event.
- In July 2007, the Army approved entry of the Increment Ia-2 projectile into low-rate initial production.



### System

- Excalibur is a family of precision-guided, 155 mm artillery projectiles.
- The Army is developing three Excalibur variants:
  - ~ High Explosive, Unitary (Increment I)
  - ~ Smart (Increment II)
  - ~ Discriminating (Increment III)
- The Army will develop the High Explosive, Unitary Projectile (Increment I) in three spirals of increasing capability (Ia-1, Ia-2, and Ib).
- All variants use Global Positioning System (GPS) and an Inertial Measurement Unit to attack point targets with an accuracy of less than 20 meters from the desired aim point.
- The projectiles are fin-stabilized and glide to extended ranges beyond 30 kilometers by using base bleed technology and aerodynamic lift generated by canards in the nose of the projectile.

### Mission

Artillery units will use Excalibur to provide fire support to combat maneuver units in all weather and terrain, including urban areas. Artillery units will use:

- The High Explosive, Unitary Projectile (Increment I) to attack stationary targets in complex and urban terrain and minimize collateral damage
- The Smart Projectile (Increment II) to engage moving and time sensitive targets
- The Discriminating Projectile (Increment III) to search, detect, and selectively engage individual vehicles by distinguishing specific target characteristics

### Activity

#### Increment Ia-1

- The Increment Ia-1 projectile completed safety and developmental testing in 1QFY07. This included Production Verification Tests, which verified the contractors could furnish the projectile in accordance with the established technical criteria and contract specifications; and First Article Tests, which verified the capability of the manufacturing process, equipment and procedures, and certified the projectile free from critical safety incidents. Live fire flight testing, conducted against realistic ground targets, used live warheads.
- In February 2007, the Increment Ia-1 projectile completed a Limited User Test (LUT) in which a Paladin Howitzer-equipped artillery platoon fired the projectile. This test cleared the projectile for material release and use by Paladins, which are equipped with the Portable Excalibur Fire Control System.
- In April 2007, the Army approved an Urgent Material Release of the Increment Ia-1 projectile to Operation Iraqi Freedom (OIF). DOT&E delivered an Early Fielding Report

to Congress, in accordance with Section 231 of the 2007 National Defense Authorization Act, summarizing Excalibur's demonstrated performance.

- In June 2007, during a Customer Test with the Marine Corps, Joint Lightweight 155 mm Towed Howitzers fired the Increment Ia-1 projectile. This test cleared the projectile for material release with the M777A2 Howitzers, which are equipped with the Enhanced Portable Inductive Fuze Setter.

## **Increment Ia-2**

- In April 2007, developmental testing of the Increment Ia-2 projectile continued with a "Shooter-to-Effects on Target" live fire demonstration. In this demonstration, the projectile achieved a range of 40 km and demonstrated its initial capability in a limited GPS jammed environment.
- In May 2007, OSD approved the Excalibur Milestone C TEMP for Increment Ia-2.
- In July 2007, the Army Acquisition Executive approved the Milestone C decision for the Increment Ia-2 projectile to enter into low-rate initial production.
- Beginning in August 2007, the Increment Ia-2 projectile will undergo a series of Sequential Environmental Tests for Safety and Performance. These tests are used to evaluate the Increment Ia-2 projectile against all the requirements identified in the Capability Production Document. Live Fire flight tests, conducted against realistic ground and structure targets, will use live warheads.

## **Assessment**

- The Excalibur Increment Ia-1 projectile achieved the desired lethal effects against personnel and structure targets during the February 2007 LUT. The projectile met reliability, safety, and suitability goals for early release to combat forces. Its April 2007 fielding to artillery units in OIF enhanced their ability to precisely strike targets requiring minimal collateral damage.
- The Excalibur Increment Ia-2 projectile demonstrated effectiveness against personnel and structure targets in an unjammed environment. The projectile is expected to meet reliability, survivability, and safety requirements before the full-rate production decision point.
- Excalibur projectiles rely on GPS technology to enhance accuracy, which may make them vulnerable in a GPS

jamming environment. To overcome this, the contractor and program manager have developed a plan to address projectile susceptibility, which will be validated in future operational testing.

- The Smart (Increment II) and Discriminating (Increment III) projectiles Milestone C decisions are expected to be made beginning FY13. These projectiles will incorporate target discrimination capabilities. The previous efforts to field projectiles with target discrimination capabilities were successful against fully exposed benign targets but consistently unsuccessful against targets that employed active and passive countermeasures. It will challenge the program to successfully demonstrate target discrimination capabilities in the next seven years.

## **Recommendations**

- Status of Previous Recommendations. The Army is making progress on DOT&E's previous recommendations. The Army postponed Milestone C so that the program could complete a LUT and focus on event-driven testing instead of schedule-driven testing (FY05). The program used Soldiers in several developmental testing events as permitted by safety releases (FY05). The Army is reviewing Guided Multiple Launch Rocket System fire mission reports from Iraq to assist in the development of Excalibur tactics, techniques, and procedures. The U.S. Army Fires Center of Excellence reviews all new reports concerning Increment Ia-1 employment in Iraq for potential implications to the future variants (FY06).
- FY07 Recommendations. The Army should:
  1. Improve and accelerate the fielding of more precise targeting systems to dismounted forces in order to achieve Excalibur accuracy requirements.
  2. Address the self-jamming problem identified during cold conditions environmental testing in order to reduce incidents of stray rounds.
  3. Implement updated anti-jamming solutions in time for FY08 testing.

## Future Combat Systems (FCS) Overview

### Executive Summary

- The Army has structured the Future Combat Systems (FCS) program to include three different Spin Outs. FCS Spin Outs are a subset of the FCS program focused on providing FCS capabilities to the current force. The Army intends to field a Spin Out 1 capability to current force Modular Brigade Combat Teams (BCTs) starting in 2010. Spin Out 1 includes two types of unattended ground sensors, the Non-Line-of-Sight Launch System, and a corresponding information network linking these elements to the BCT. A detailed report on Spin Out 1 is provided following this overview.
- In 2007, the Army identified the content of two additional Spin Outs. Spin Out 2, currently planned to begin fielding in FY13, will consist of integrating the Short-range FCS Active Protection System (APS) into the Army's Stryker vehicle. Spin Out 2 will also integrate the mast mounted sensor from the FCS Reconnaissance and Surveillance Vehicle into selected Stryker vehicles. Spin Out 3, currently scheduled to begin fielding in FY15, will field the FCS Battle Command Network to current force BCTs to replace current command and control networks as well as the Armed Robotic Vehicle-Assault (Light), the Small Unmanned Ground Vehicle, and the Class I and IV Unmanned Aerial Vehicles (UAVs).
- The Army deferred development of the Class II and III UAVs as part of the FCS program. Class II and III UAVs remain an FCS objective requirement. Additionally, the Army deferred development of the larger Armed Robotic Vehicles (ARV).
- The Army removed the Intelligent Munitions System (IMS) from the FCS program; it is now a separate program of record.

### System

FCS is a networked system-of-systems consisting of 14 individual manned or unmanned systems linked together by an information network. The information network connects FCS via an advanced network architecture that provides joint connectivity and enhances situational awareness, understanding, and synchronized operations. The FCS operates as a system-of-systems and encompasses the FCS program systems as well as other complementary Army and joint systems in order to meet the missions of the Army's FCS BCTs.

The FCS program consists of manned and unmanned platforms that include:

#### Manned Ground Vehicles (Eight variants)

- Combat vehicles (Six variants):
  - Command and Control Vehicle
  - Infantry Carrier Vehicle
  - Non-Line-of-Sight Cannon
  - Non-Line-of-Sight Mortar



- Mounted Combat System
- Reconnaissance and Surveillance Vehicle
- Maneuver sustainment vehicles (Two variants):
  - Medical Vehicle (Treatment and Evacuation variants)
  - Recovery and Maintenance Vehicle

The Non-Line-of-Sight Cannon (NLOS-C) is the lead vehicle in the development of Manned Ground Vehicles. A detailed report on this system is provided following this overview.

#### Unmanned Aerial Vehicles (Four variants)

Class	FCS Unit Size	Time on Station	Operational Radius
I	Platoon	50 minutes	8 km
*II	Company	2 hours	16 km
*III	Battalion	6 hours	40 km
IV	Brigade	24 hours	75 km

\* Since last year's report, the Army has deferred development of the Class II and III UAVs as part of the FCS program. Class II and III UAVs remain an FCS objective requirement.

The Army intends the FCS UAVs to be multi-functional and mission tailorable; operable in varying terrain, including urban environments; and teamed with manned aircraft and ground maneuver forces.

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## Unmanned Ground Vehicles (Three types)

Type	Functions
Small Unmanned Ground Vehicle (SUGV)	<ul style="list-style-type: none"> <li>Reconnaissance of urban and subterranean battlespace</li> </ul>
<i>*Armed Robotic Vehicle (ARV) (two variants):</i> <ul style="list-style-type: none"> <li>ARV-Reconnaissance, Surveillance, and Target Acquisition</li> <li>ARV-Assault</li> </ul>	<ul style="list-style-type: none"> <li>Reconnaissance, surveillance, and target acquisition</li> <li>Line-of-sight and beyond line-of-sight fires</li> </ul>
Multi-functional Utility/Logistics Equipment (MULE) (three variants): <ul style="list-style-type: none"> <li>MULE - Transport</li> <li>MULE - Counter-mine</li> <li>MULE-ARV - Assault (light)</li> </ul>	<ul style="list-style-type: none"> <li>Transport of equipment and supplies</li> <li>Direct fire in support of dismounted infantry</li> <li>Detection of mines and improvised explosive devices</li> </ul>

*\* Since last year's report, the FCS program has deferred development of the larger ARV from its current program. The ARVs require more technological maturity before entering into system development. ARVs remain an FCS objective requirement.*

The Army plans to equip the MULE variants with the Autonomous Navigation System to provide the capability to operate all UGVs either in a man-in-the loop mode or in a semi-autonomous mode.

### Unattended Munitions\*

The Army intends the Non-Line-of-Sight Launch System (NLOS-LS) to provide networked, extended-range targeting, and precision attack of stationary and moving targets. It consists of a Container Launch Unit (CLU), with self-contained tactical fire control electronics and software for remote and unmanned operations, and the Precision Attack Munition missile. NLOS-LS is intended to be able to fire missiles with the CLU on the ground or mounted on a transport vehicle.

*\* Since last year's report, the Intelligent Munitions System (IMS) has been removed from the FCS program and is now a separate program of record.*

## Unattended Ground Sensors

FCS Unattended Ground Sensors (UGS) are an array of networked sensors capable of target detection, location, and classification. UGS consist of multiple types of sensors to include acoustic, seismic, magnetic, electro-optical/infrared sensors, and radiological/nuclear sensors. UGS is intended to be employed to provide enhanced threat warning and situational awareness.

The FCS UGS program is developing two major sensor subgroups:

- Tactical-UGS (two variants):
  - Intelligence, surveillance, and reconnaissance sensors
  - Radiological and nuclear sensors
- Urban-UGS is an array of small, lightweight imagery and intrusion detection sensors emplaced in urban structures.

### Battle Command Network

The Battle Command Network is the information network that links together the FCS BCT system-of-systems. The Battle Command Network consists of hardware and software that is intended to deliver video, still images, voice, data, and network control services throughout the FCS BCTs. It is intended to provide an interconnected set of information capabilities for collecting, processing, displaying, disseminating, storing, and managing information on demand with secure and reliable access by soldiers throughout the FCS BCT. This network is intended to include communications payloads on all FCS ground and air platforms and network management software distributed on all platform computers and communications payloads.

### Mission

The FCS BCT will perform all tactical operations – offensive, defensive, stability, and support – currently conducted by light infantry, Stryker, and heavy mechanized forces. The Army intends for the FCS BCT to provide a measurable improvement over current brigade combat teams in terms of deployability, maneuverability, survivability, lethality, battle command, sustainability, and joint interoperability.

## Activity

- In 2007, the Army defined two additional Spin Outs of FCS systems to current force BCTs. The T&E program to support Spin Outs 2 and 3 will be addressed in the FY08 FCS Test and Evaluation Master Plan (TEMP) Update.
- The FCS program deferred development of two UAV variants (Class II and III) and the ARVs. These systems remain objective requirements for FCS. It is not clear at this time when and under what circumstances these systems might be reintroduced into the FCS program.
- The Army Evaluation Task Force (AETF) (formerly the Evaluation Brigade Combat Team) was established at Fort Bliss, Texas. The AETF is intended to provide the test unit to support FCS system development and will be sized and equipped to meet FCS operational test requirements as well as supporting developmental testing as required.
- Design efforts for all FCS systems are ongoing. All preliminary design reviews (PDR) for FCS systems are

# ARMY PROGRAMS

planned to be completed by the end of 2008 leading to an FCS system-of-systems PDR in early 2009.

- The program initiated two additional incremental armor upgrades for the Manned Ground Vehicles (MGV) aimed at achieving a satisfactory level of vehicle ballistic protection within vehicle weight constraints.
- The Class I UAV is being redesigned to incorporate a laser range finder and laser designator.
- The Mid-Range Munition (MRM) was funded for system development and production. The MRM is a beyond line-of-sight 120 mm guided munition intended to be fired from the FCS Mounted Combat System. It is an FCS complementary system, which, although not managed by the FCS program, is intended to be a key element in overall FCS BCT battlefield lethality. MRM is a DOT&E oversight program and it will have a TEMP and LFT&E strategy approved by the Director.

## Assessment

- The AETF is key to the FCS test program by providing a stable, dedicated brigade-size unit to support FCS throughout the course of its developmental and operational testing.
- The FCS program continues to address the challenges imposed on the MGVs by the requirement to transport three MGVs on a C-17. The resulting constraint on MGV size and weight will continue to pose challenges to MGV designers to balance tactical survivability and lethality and MGV payload capacity with the requirements for air transportability.
- The Army is working MGV armor upgrades to achieve the desired level of weight and performance while still adhering to the current MGV program schedule.
- Overall platform survivability will be dependent upon an effective Hit Avoidance System that includes an Active Protection System. While Active Protection System technologies are showing some promise, it is not yet clear whether their performance will make up for lesser levels of MGV armor protection than those found in current force combat vehicles such as the Abrams tank and Bradley fighting vehicle.
- The FCS program continues its efforts to synchronize Joint Tactical Radio System (JTRS) and Warfighting Information Network -Tactical (WIN-T) systems development schedules with those of FCS. While progress is being made in this area, these non-FCS complementary programs remain a significant risk area for the FCS program. The effectiveness of the FCS battle command network will depend upon JTRS and WIN-T performance.
- The Class I UAV will require significant design and development in order to meet system requirements.

Integration of a heavy fuel engine and sensor package, system weight and size, and operational endurance are risk areas the program is working.

- Adequate operational testing of the FCS BCT will require a high fidelity Real Time Casualty Assessment (RTCA) system. In particular, the ability to adequately evaluate the force-level lethality and survivability of the FBCT will be highly dependent upon such RTCA. In 2007, the Army Test and Evaluation Command (ATEC) reverted to using the Multiple Integrated Laser Engagement System (MILES) as an engagement system for operational testing due to developmental challenges associated with the prospective high fidelity test RTCA. MILES is not satisfactory for use as test instrumentation. It is as yet not clear that the Army and ATEC are committed to the development of an adequate RTCA system necessary to support FCS operational testing.

## Recommendations

- Status of Previous Recommendations. DOT&E continues to be concerned about the impact of the MGV design trades necessary to balance tactical survivability, lethality, and payload capacity with the requirements for air transportability. The Army believes that these trades will not compromise the operational effectiveness and survivability of the FBCT and that the existing air deployability requirements are essential to the overall effectiveness of the FBCT.
- FY07 Recommendations.
  1. In the FY08 TEMP update, the FCS program must:
    - Retain the existing planned series of operational test events culminating in an IOT&E with a fully equipped FCS BCT operating in a sophisticated and robust enemy threat environment; this live brigade-size IOT&E will be essential to assessing the operational effectiveness and suitability of the FCS system-of-systems
    - Maintain its commitment to provide the number and configuration of MGV prototypes for Limited User Test 3 and ballistic testing that were laid out in the FY06 TEMP
    - Outline the program's approach to adequate testing of the MGV's Hit Avoidance System, including the Active Protection Systems for both the FCS MGVs and Stryker
    - Clarify the path for developing and integrating the evolving MGV armor upgrades
  2. The Army should review its test instrumentation development and procurement strategy to ensure that an adequate high fidelity RTCA system is available to support FCS operational testing.

# ARMY PROGRAMS

## Future Combat Systems (FCS) Spin Out 1

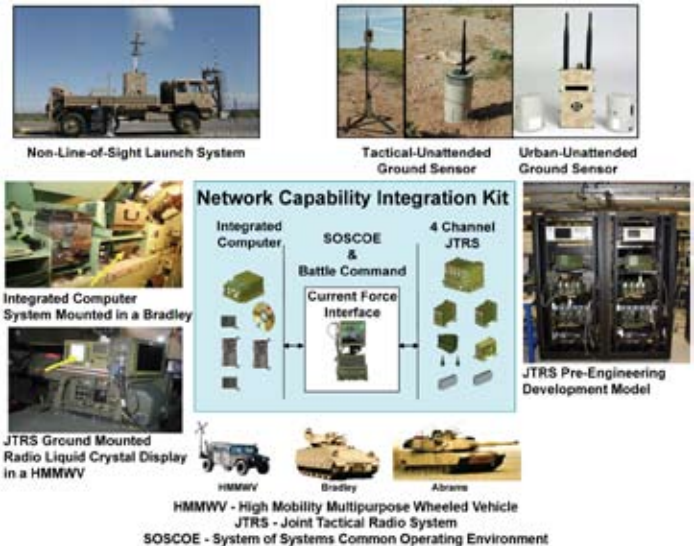
### Executive Summary

There are several technological and programmatic challenges with Future Combat Systems (FCS) Spin Out 1 systems. These are:

- Development of sensors that are able to detect, classify, and track multiple vehicular and personnel targets
- Communicating over the air to individual communication modes
- Meeting reliability requirements
- Allowing sufficient time between Non-Line-of-Sight Launch System (NLOS-LS) flight tests to discover and fix problems that may occur

### System

- Spin Out 1 is a subset of the FCS program.
- The Army plans to field Spin Out 1 systems to Current Force Heavy Brigade Combat Teams (BCT) in FY10 prior to FCS BCT fielding.
- Planned Spin Out 1 capabilities include:
  - Network Capability Integration Kit
    - Integrated Computer System
    - System-of-Systems Common Operating Environment (SOSCOE) Standard Edition 1.8 and Battle Command Software Build 1
    - Pre-Engineer Development Model (EDM) Four Channel Joint Tactical Radio System (JTRS) Ground Mobile Radio
    - Other surrogate radios (Zigbee and Munitions Sensor Receiver Transmitter) for Unattended Ground Sensors (UGS) are for pre-Milestone C testing only and are not intended for either the IOT&E or fielding
  - Unattended Ground Sensors (UGS)
    - Tactical UGS (T-UGS) include a Gateway, the Intelligence, Surveillance, and Reconnaissance (ISR) sensors, Radiological and Nuclear (RN) sensors, and Electro-Optical/Infrared (EO/IR) sensors.
    - Urban UGS (U-UGS) are small, leave-behind imaging and intrusion detection sensors emplaced in structures such as buildings, caves, and tunnels.
  - Non-Line-of-Sight Launch System (NLOS-LS)
    - The system includes a Container Launch Unit, which holds 15 missiles (maximum range out to 40 kilometers), and a Computer and Communications System.



- In Spin Out 1, the Battle Command for the Non-Line-of-Sight Launch System is the Advanced Field Artillery Tactical Data System.

### Mission

- Current Force BCTs will use Spin Out 1 enhancements in all military operations – offensive, defensive, and stability and support.
- The Army intends Spin Out 1 capabilities to enhance BCT situational awareness, force protection, and lethality by using the following systems:
  - Unattended Ground Sensors (T-UGS and U-UGS)
    - Units will employ UGS to provide perimeter defense, surveillance, target acquisition, and situational awareness, including RN, and high-yield explosive RN early warning.
  - Non-Line-of-Sight Launch System
    - BCT commanders will use precision attack missiles to attack moving, stationary, and point targets, such as tanks, armored troop carriers, and artillery, air defense, and communications sites.

### Activity

#### Network Capability Integration Kit

- A limited capability FCS Network passed simulated UGS sensor data for target generation during exercise JFEX.

- The FCS Network, using surrogate and pre-EDM JTRS radios, supported assessing sensors and Class I UAV during an experimental exercise (Experiment 1.1) at Fort Bliss, Texas.

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- During 2007, the Army is integrating FCS Network systems into Current Force Vehicles (Abrams, Bradley, and HMMWVs), followed by testing of each platform.

## **Unattended Ground Sensors**

- Soldiers used both T-UGS and U-UGS in Experiment 1.1 to assess target detection, data fusion from multiple sensors, and network loading.
- Soldiers learned how to operate the U-UGS and established tactics, techniques, and procedures for U-UGS employment in an Air Assault Expeditionary Force Experiment.

## **Non-Line-of-Sight Launch System**

- The Army conducted several pre-qualification tests on the NLOS-LS warhead.
- The Army conducted flight tests of early prototype missiles in 2007.
- To reduce the technical risk, the Army decided the NLOS-LS Precision Attack Missile will use a boost sustain motor in lieu of the current pintle motor due to technical challenges.

## **Assessment**

### **Network Capability Integration Kit**

- The FCS Network is dependent upon functionality to be provided by software and JTRS variants. Most software is under test and only a partial capability will be provided for near term FCS Spin Out 1 testing. The Spin Out 1 Limited User Test (LUT) will utilize pre-EDM JTRS radios and surrogates, which may limit the Spin Out 1 FCS Network.

### **Unattended Ground Sensors**

- Technological challenges include: developing sensors that are able to detect, classify, and track multiple vehicular and personnel targets; communicating over the air to individual communications nodes; meeting reliability requirements, and integrating the command and control suite and individual sensors in order to achieve effectiveness requirements.
- The operational concept for employing both T-UGS and U-UGS is not yet developed.
- During Experiment 1.1, Soldiers found hand-emplaced T-UGS awkward to handle, which limited the system's operational use.
- The system under test in Spin Out 1 will not be the same configuration as the system under test in the FCS IOT&E. Many of the same technological challenges identified for the LUT have been identified as risk areas for follow-on tests.

### **Non-Line-of-Sight Launch System**

- The Army is involving Soldiers early in the design process with the NLOS-LS soldier interface. Developing interface systems that Soldiers can easily use in a combat environment should enhance operational performance.

- The program has been proactive with subcomponent testing and early flight tests. Flight tests with early prototype missiles demonstrated that NLOS-LS missiles could fly a ballistic trajectory. In follow-on tests, the missile exhibited launch and flight problems. The Army developed interim solutions to fix the faults and is working to resolve the remaining launch and flight issues.
- NLOS-LS warhead pre-qualification tests revealed that the simulator used by the contractor and the Army to test the missile's infrared and semi-active laser seeker did not have the necessary fidelity to evaluate warhead performance.
- DOT&E and the Army Evaluation Center recommended the program evaluate the effects of realistic Improvised Explosive Device threats against the warheads and motors inside the Container Launch Units because they are primarily transported in ground convoys. This test matrix was identified in the Test and Evaluation Master Plan (TEMP). The program has allocated the resources, but has not yet conducted these tests.

## **Recommendations**

### **Network Capability Integration Kit**

- Status of Previous Recommendations. There were no FY06 recommendations.
- FY07 Recommendations. The Army should ensure subsequent testing of the FCS Network as SOSCOE and Battle Command software mature and surrogate radios are replaced with JTRS production models and waveforms.

### **Unattended Ground Sensors**

- Status of Previous Recommendations. The one FY06 recommendation remains in that the Army should assess UGS suitability during Spin Out 1 operational testing as there are no plans to upgrade UGS between the Spin Out 1 and Spin Out 3 assessments.
- FY07 Recommendation. The Army should conduct a follow-on operational test following the Spin Out 1 LUT in order to assess the configuration that will be evaluated in the FCS IOT&E.

### **Non-Line-of-Sight Launch System**

- Status of Previous Recommendations. The one FY06 recommendation remains in that the Army should conduct adequate countermeasure testing early in the NLOS-LS flight test program. Previous efforts to field projectiles with discriminating or smart warheads have been successful against benign targets, but have been less successful against targets that employ passive countermeasures (FY06).
- FY07 Recommendation. The Army should begin testing the effects of IEDs against the Container Launch Unit as agreed upon in the TEMP.

## Future Combat Systems (FCS): Non-Line-of-Sight Cannon (NLOS-C)

### Executive Summary

- The Non-Line-of-Sight-Cannon (NLOS-C) Firing Platform began testing in October 2006 at Yuma Proving Ground, Arizona. The Army is using the Firing Platform for risk reduction in cannon and mount development, safety certification, and the improvement of NLOS-C reliability.
- The contractor started fabricating the first five Early Prototype NLOS-C vehicles for delivery beginning in May 2008.
- NLOS-C performance may be compromised in order to meet C-17 aircraft weight and size restrictions for the standard deployment of three howitzers on one aircraft.

### System

- NLOS-C, XM1203, is a tracked, self-propelled, hybrid-electric drive 155 mm Howitzer with a two-man crew.
- NLOS-C is the lead Future Combat Systems (FCS) Manned Ground Vehicle (MGV) system. Three MGV systems are designed to be deployable on one C-17 aircraft (before installing extra protective armor) to support early deploying forces with cannon fires.
- The Army will:
  - Procure eight prototypes in FY08 and FY09 for testing
  - Procure 18 Initial Production (formerly Block 0) systems in FY10-FY12 for fielding to the Army Evaluation Task Force for experimentation
- The cannon will fire six standard artillery rounds per minute to ranges of 30+ kilometers leveraging its automated ammunition handling system, laser ignition, and firing Excalibur munitions.
- NLOS-C units are expected to achieve improved accuracy with unguided projectiles.



- NLOS-C equipped units are expected to respond to fire mission requests within 20 seconds when stationary and within 30 seconds when moving.

### Mission

- NLOS-C units are designed to provide area and precision cannon fires in support of FCS Brigade Combat Teams and other mechanized brigade combat teams.
- NLOS-C will fire the entire suite of Army 155 mm munitions, including Excalibur precision munitions, to attack point targets.

### Activity

- The NLOS-C Firing Platform began testing in October 2006 at Yuma Proving Ground, Arizona. The Firing Platform is a surrogate chassis with a mounted Mission Module containing the gun mount, cannon, aiming, and ammunition handling systems. The design of the Mission Module closely resembles what will be used in the Early Prototype vehicles. The Army is using the Firing Platform for risk reduction in cannon and mount development, safety certification, and improving reliability of the Mission Module.
- The Army continues to test NLOS-C subsystems on the Firing Platform at Yuma Proving Ground, Arizona, and the Mission Equipment Integration Test Stands in Minneapolis, Minnesota, in order to gather data for development of the Early Prototype vehicles.

- The contractor started fabricating the first five Early Prototype NLOS-C vehicles for delivery beginning in May 2008.
- In August 2007, the Army initiated contract negotiations to direct the Lead Systems Integrator to deliver six NLOS-C initial production vehicles per year from FY10 to FY12.
- The Army continues using the NLOS-C Demonstrator for tube wear testing and cannon charge development.

### Assessment

- NLOS-C performance may be compromised in order to meet C-17 aircraft weight and size restrictions for the standard deployment of three howitzers on one aircraft.

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- Using the currently designed breech chamber and 38-caliber cannon tube, compared to the current 155 mm Paladin breech chamber and 39-caliber cannon tube, reduces the NLOS-C range for most munitions by 3-5 km.
  - Conducting continuous 24-hour operations while performing fire missions, maintenance, resupply, and security associated with combat operations will test the two-man crew's endurance and mission focus.
  - The eight-fold increased reliability requirement to 512 hours between system aborts during operational missions compared to the Paladin's 62-hour requirement may be difficult to achieve given NLOS-C's automated ammunition handling system, sophisticated automation, and communications equipment.
  - Assessing the effectiveness of NLOS-C, within the Future Combat System-of-Systems, will require a high fidelity, real-time casualty assessment system that can accurately capture the impact indirect fires have on combat operations.
- continue efforts in developing a separate test and evaluation strategy to support the fielding of 18 NLOS-C Initial Production howitzers to the Army Evaluation Task Force (AETF). Currently, there is no requirement for a separate testing strategy to support equipment fielded only to the AETF. Other Previous Recommendations remain valid:
- Ensure that FCS operational tests include adequate NLOS-C Live Fire exercises. Supported maneuver units will need opportunities that they can plan and coordinate fires, and the NLOS-C units will need to demonstrate they can sustain operations while delivering accurate and timely fires (FY05).
  - Develop a real-time casualty assessment system for indirect fires that can accurately assess the effectiveness of NLOS-C fires in system-of-systems exercises (FY05).
- FY07 Recommendations. None.

## Recommendations

- Status of Previous Recommendations. The Army has begun to address DOT&E's FY05 recommendations and should

## Guided Multiple Launch Rocket System (GMLRS) – Unitary

### Executive Summary

- U.S. forces have fired over 390 Guided Multiple Launch Rocket System - Unitary (GMLRS-Unitary) in support of current combat operations. The rockets are reportedly achieving desired lethal effects and reliability while minimizing collateral damage.
- In May 2007, GMLRS-Unitary completed Milestone C and entered into low-rate initial production (LRIP).
- DOT&E is working with the Army to develop a Test Plan for the upcoming Initial Operational Test and Evaluation (IOT&E) in 2QFY08.

### System

- The GMLRS-Unitary warhead rocket has a single 196-pound high explosive warhead and a range of 70 kilometers (km). The rocket uses Inertial Measurement Unit guidance and the Global Positioning System (GPS) to enhance accuracy.
- The procurement objective for GMLRS-Unitary is expected to be 34,848 rockets.
- The M270A1 Multiple-Launch Rocket System and the High Mobility Artillery Rocket System (HIMARS) are capable of firing GMLRS-Unitary rockets.
- GMLRS-Unitary will have three fuze settings enabled to attack different target types at extended ranges:
  - Proximity fuze for use against personnel in the open
  - Delay fuze for lightly fortified bunkers and structures
  - Point detonating fuze for single, lightly armored targets



- GMLRS-Unitary rockets provide a day and night engagement capability in all terrain or weather conditions.

### Mission

Artillery units will use GMLRS-Unitary rockets to attack point targets in complex and urban terrain to minimize collateral damage.

### Activity

- U.S. forces have fired over 390 Guided Multiple Launch Rocket System-Unitary (GMLRS-Unitary) in support of current combat operations. The rockets are reportedly achieving desired lethal effects and reliability while minimizing collateral damage.
- In FY07, the Army completed GMLRS-Unitary Insensitive Munition (IM) testing and decided not to pursue an IM rocket motor for GMLRS-Unitary. Testing revealed the new IM motor was only slightly better than the currently fielded rocket motors. The Army will continue leveraging IM risk mitigation technology as it becomes available. The GMLRS-Unitary warhead is IM compliant, making it less susceptible than other types of Army MLRS warheads.
- The project manager completed flight Production Qualification Tests in December 2006. The testing team fired GMLRS-Unitary rockets against threat representative

- targets and then conducted post-test damage assessments to determine the warhead lethality.
- In May 2007, GMLRS-Unitary completed Milestone C and entered into the LRIP phase.
- DOT&E is working with the Army to develop a Test Plan for the upcoming IOT&E in 2QFY08.

### Assessment

- Throughout the developmental testing program, the GMLRS-Unitary rocket demonstrated appropriate accuracy and reliability rates. The Army estimates a 98 percent reliability rate for the rockets supporting combat operations.
- Developmental testing also confirmed that with accurate target location, the rocket is lethal against its intended target set. The Army has confirmed deployed soldiers in combat can locate stationary targets with the needed accuracy.

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- During IM rocket motor development, the ignition system experienced problems in flight tests and demonstrated the new motor was only slightly better than the currently fielded rocket motors.
- The GMLRS-Unitary rocket is dependent on two key requirements in order to achieve accuracy: accurate long-range sensors and targeting systems and a responsive command and control system to clear airspace in a complex operational environment. Current operations demonstrated the ability to acquire static targets and coordinate airspace using niche tactics, techniques, and procedures. Joint Force commanders must continue to resolve the many cross-Service targeting and clearance issues with deep fires.

## Recommendations

- Status of Previous Recommendations. The Army should continue capitalizing on Lessons Learned from current combat operations for optimizing targeting and command control to effectively exploit the weapon's range and accuracy (FY06).
- FY07 Recommendations. The Army should:
  1. Continue pursuing methods to improve the IM ratings.
  2. Conduct additional tests and analysis of GPS jamming to determine the conditions under which the system may be vulnerable and, if required, explore potential mitigation efforts.

## Land Warrior

### Executive Summary

- The Army deployed the Land Warrior system with the 4th Battalion, 9th Infantry to Operation Iraqi Freedom in FY07 prior to completion of IOT&E and the full-rate production decision.
- DOT&E submitted an Early Fielding Report in April 2007.
- Land Warrior enhanced unit operational effectiveness especially at night.

### System

- Land Warrior is an integrated combat fighting system used by dismounted combat Soldiers on the modern networked battlefield. It includes a laser rangefinder, visual displays, integrated load carrying equipment with ballistic protection, protective clothing, a helmet, a speaker, a microphone, a computer, navigation tools, a radio, mission data support products, and a Stryker vehicle installation kit.
- The system is modular to permit tailoring for mission requirements and will interface with the M4 Carbine, M203 40 mm Grenade Launcher, and M249 Squad Automatic Weapon.
- The Army plans to field Land Warrior from Stryker Infantry Company to fire team level.

### Mission

- Dismounted infantry units will use Land Warrior to provide increased situational awareness and enhanced

### Activity

- The Army deployed the Land Warrior system with the 4th Battalion, 9th Infantry to Operation Iraqi Freedom in FY07 prior to completion of the IOT&E and the full-rate production decision.
- In April 2007, DOT&E submitted an Early Fielding Report to Congress.
- In December 2006, the Army withdrew future Land Warrior funding.

### Assessment

- Land Warrior enhanced unit operational effectiveness. In theater, the Land Warrior system assisted the unit in accomplishing its assigned tactical missions in the following areas:
  - Enhanced unit mission performance especially at night
  - Enhanced speed and accuracy of dismounted night tactical movement
  - Enhanced the situational awareness of squad, platoons, companies, and the battalion



communications to increase the effectiveness of dismounted units in 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.

- Infantry units will use Land Warrior to:
  - Enhance small unit leaders' situational awareness through Blue Force Tracking
  - Provide voice communications between companies, platoons, and squads
  - Enhance collaborative mission planning

- Although the system does not meet some Army user-specified requirements, the Land Warrior's performance in theater indicates:
  - The Land Warrior ensemble has been effectively maintained in theater
  - Contractors working out of a Forward Operating Base can maintain and support the Land Warrior system in accordance with the Army's support concept
- Although the system enhanced unit mission accomplishment, performance issues from theater indicate that:
  - Land Warrior provided enhanced situational awareness for the platoon leader and above, but squad leaders and below found limited improvements.
  - Land Warrior voice communications continue to be problematic and less effective than desired. Within squads and platoons, the Land Warrior Enhanced Position Location Reporting System radio is not used as the primary means of voice communications because of range limitations and the transmission quality is not consistent.

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- Land Warrior-generated enemy situational awareness is not automatically sent to the Army Battle Command System network.
  - Land Warrior radios are not interoperable with FM radios (Single-Channel Ground and Airborne Radio System) and have limited interoperability with Force XXI Battle Command Brigade-and-Below (FBCB2). This degrades Land Warrior mission planning capabilities.
  - Soldiers do not rely on the Land Warrior system during close-in combat operations (Military Operations in Urban Terrain, actions on the objective), while riding on Stryker vehicles, or once enemy contact is made.
  - Soldiers reported that system reliability was poor due to a high number of system failures, lock-ups, and freezes that require system reboots.
  - Soldiers consistently reported that the Land Warrior ensemble was too heavy and too bulky which hindered task performance.
  - The average single life of battery power varies from 8 to 16 hours. Soldiers reported that the battery operates too hot and is too heavy.
  - The Global Positioning System loses signal when entering buildings.
  - Increased preparation time for Pre-Combat Checks and Pre-Combat Inspections is required in order to maintain system readiness.
- Unit leaders are concerned that the high level of contractor logistics support may not be available in the future.

## Recommendations

- Status of Previous Recommendations. The three recommendations from FY06 remain valid.
- FY07 Recommendations. If funding is restored, the Army should consider the following to improve Land Warrior effectiveness and suitability:
  1. Enable the fully automated exchange of all Land Warrior-generated friendly and enemy situational awareness messages.
  2. Expand interoperability between Land Warrior and FBCB2.
  3. Increase battery performance.
  4. Reconfigure the Daylight Video Sight as a handheld device so that Land Warrior-equipped leaders are able to see and shoot around corners or over walls.
  5. Configure the Helmet Mounted Display so that it provides a combination of near real-time video, pictures of persons of interest, targeting aiming points, graphics, and digital mapping in order to provide leaders and soldiers' movement routes that could be safer.
  6. Integrate Land Warrior requirements into Ground Soldier System requirements currently under development.

## Light Utility Helicopter (LUH)

### Executive Summary

- DOT&E found that the UH-72A Lakota LUH is effective in the performance of light utility missions, but is not effective for use in hot environments or for medical evacuation of two litter patients requiring critical medical care. The LUH is effective for air movement and aerial sustainment missions, but does not meet its criteria to lift required external and internal loads. The LUH demonstrated performance and mission effectiveness over the Kiowa (OH-58A/C) and Huey (UH-1H) aircraft it will replace.
- The LUH aircraft is not operationally suitable due to excessive heat in the aircraft cockpit and cabin from the sun, heat generated by aircraft avionics and inadequate ventilation.
- The LUH meets required design standards for crashworthiness in accordance with the Federal Aviation Regulations to protect crew and passengers.
- The reliability, maintainability, and availability of the UH-72 Lakota exceeded requirements.
- All LUHs are being modified with solar shades over the pilot seats and an improved ventilation system to direct ambient air into the cabin and cockpit on all 322 aircraft.
- All LUHs medical evacuation (MEDEVAC) aircraft are being modified with Federal Aviation Administration (FAA) approved ceiling rails, additional lighting, and a wall mounted MEDEVAC equipment rack. The improved configuration will enhance the flight medic's ability to care for patients during transport for all 81 designated MEDEVAC aircraft.
- The LUH is not a covered system for Live Fire test and evaluation because the Army intends for the aircraft to operate in non-hostile environments.

### System

- The UH-72A Lakota LUH is a commercial aircraft derived from the Eurocopter 145 aircraft, certified by the FAA for use in civil airspace. The Army intends to employ the LUH worldwide, in non-hostile operational environments.
- The Army is procuring 322 systems that began in May 2007 to replace UH-1H and OH-58 A and C aircraft in the Active Army and National Guard inventory.

### Activity

- After a Source Selection Performance Demonstration during 2006, the Army selected the EADS North America UH-145 helicopter and designated the aircraft as the UH-72A Lakota in October 2007.
- Six LUH aircraft have been delivered to the Army's First Unit Equipped, with 13 more LUH aircraft in various stages of production. The Columbus, Mississippi, plant has undergone



- The LUH is certified for instrument flight with a Global Positioning System to operate in day, night, and adverse weather conditions.
- The LUH is compatible with night vision goggles; nuclear, biological, and chemical gear; and the Air Warrior ensemble. The LUH mission equipment packages include a 600-pound hoist, fire bucket, slings for external loads, and patient litters.

### Mission

- LUH-equipped units will provide general aviation support, respond to terrorist events, conduct civil search and rescue, support damage assessment, support test and training centers, perform medical evacuation, and provide support to counter-drug operations.
- LUH units will conduct general administrative aviation and aerial sustainment missions, and execute tasks as part of an integrated effort with joint forces, government agencies, and nongovernmental organizations.
- LUH units will perform Homeland Security and medical evacuation missions in permissive environments.

major expansion to accommodate the LUH program and achieved full-up assembly capability in August 2007.

- DOT&E approved the Test and Evaluation Master Plan (TEMP) on March 5, 2007, to support the IOT&E followed by the LUH full-rate production decision in August 2007.
- The Army conducted the IOT&E with an Air Ambulance Detachment, equipped with three production-representative

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- LUH aircraft at the National Training Center at Fort Irwin, California, and Barstow, California, March 7-26, 2007.
- Additional developmental and operational testing and evaluation included:
    - Inclusion of data from a 10-month, 252 flight-hour Reliability Validation Effort ending in FY07
    - A 36 flight-hour Safety Release Test conducted by the Army at Fort Rucker, Alabama, with production-representative LUH aircraft in December 2006 and January 2007
    - Demonstration of the LUH to conduct fire-fighting missions with a water bucket by successfully completing nine water delivery sorties without incident during December 2006 at Fort Rucker, Alabama
  - Based on IOT&E findings, the Army conducted an Aircraft Temperature Data Collection Effort at Barstow-Daggett Airfield during June 20-21, 2007. This effort confirmed findings from the IOT&E in March 2007 that the interior of the LUH in mission configuration is hotter than the UH-60, UH-1, and OH-58A/C (cockpit heated as much as 15-24 °F above outside air temperature, while the cabin area heated as much as 8-16 °F above outside air temperature).
  - Based on IOT&E findings the Army conducted a review of commercially available medical evacuation storage systems and equipment mounting provisions on July 3, 2007, and intends for EADS North America to improve medical and casualty evacuation capability of the aircraft.

## Assessment

- The Army executed the LUH IOT&E in accordance with the DOT&E-approved test plan. The IOT&E was adequate to assess operational effectiveness, suitability, and survivability.
- DOT&E published its OT&E report in July 2007 and found that the LUH is effective in the performance of light utility missions, but not effective for use in hot environments or for medical evacuation of two litter patients requiring critical medical care. The LUH is effective for air movement and aerial sustainment missions, but does not meet its criteria to lift external and internal loads. The LUH demonstrated performance and mission effectiveness over the Kiowa and Huey aircraft it will replace.
- The LUH aircraft is not operationally suitable due to excessive heat in the aircraft cockpit and cabin from the sun, heat generated by aircraft avionics, and inadequate ventilation. The aircraft's Rotorcraft Flight Manual describes an avionics overheat condition where various avionics components have a 30-minute operating time if temperatures exceed safe operating ranges. This did not occur during the IOT&E.
- The reliability, maintainability, and availability of the LUH exceeded requirements.
- The LUH costs less to operate and support than the UH-60 helicopter.
- After modification of the LUH aircraft at the National Training Center with solar shades and an improved ventilation system, the Army will assess the internal temperatures in mission configuration during 1QFY08.
- After modification of the LUH MEDEVAC aircraft, ceiling rails, additional lighting, and wall mounted MEDEVAC equipment rack, the Army plans to assess the flight medic's ability to care for patients during transport.
- The LUH meets required design standards for crashworthiness in accordance with the Federal Aviation Regulations to protect crew and passengers.
- The LUH is not a covered system for Live Fire test and evaluation because the Army intends for the aircraft to operate in non-hostile environments. The FAA has certified the UH-72A meets standards for crashworthiness. LUH aircrews, wearing the Army's Air Warrior ensemble and when operating with chemical masks, and night vision goggles, are afforded adequate protection in the event of an emergency.

## Recommendations

- Status of Previous Recommendations. The Army effectively resolved both previous FY06 recommendations.
- FY07 Recommendations. The July 2007 DOT&E OT&E Report included a set of 10 recommendations to the Army to improve operational effectiveness and operational suitability. These include:
  1. Reconfigure or modify the cabin to provide additional space for the medic and MEDEVAC equipment when in a two-litter configuration.
  2. Update LUH performance data to incorporate into a standardized flight manual and to facilitate more accurate mission planning.
  3. Install and test potential material fixes to include the Environmental Control System, engine inlet barrier filters, landing gear skid shoes, and relocation of the first aid kit and fire extinguisher.
  4. Reconfigure the LUH communication package to allow simultaneous communication on Ultra High Frequency (UHF) and Frequency Modulation (FM) channels and secure communications.
  5. Assess the New Equipment Training package and the hybrid maintenance concept planned for Army National Guard units once implemented.

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

### Executive Summary

- The Army conducted five major developmental Patriot flight tests from October 2006 to July 2007 (three operational flight tests and two Evolutionary Development Program flight tests) and achieved four successes.
- The Army conducted a major Patriot operational test, the Post-Deployment Build-6 (PDB-6) Limited User Test (LUT), from 4QFY06 through 2QFY07.

### System

- The Patriot/Medium Extended Air Defense System (MEADS) Combined Aggregate Program (CAP) is based on incrementally inserting MEADS major end items into the current Patriot system. The approach allows for earlier modernization and fielding of enhanced capabilities prior to fielding of the full MEADS system capability.
- The Patriot system includes:
  - C-band phased-array radars for detecting, tracking, classifying, identifying, and discriminating targets
  - Battalion Information and Coordination Centrals, Battery Command Posts, and Engagement Control Stations for battle management
  - Communications Relay Groups and Antenna Mast Groups for communicating with battery and battalion assets
  - A mix of Patriot Advanced Capability-3 (PAC-3) hit-to-kill missiles and PAC-2 blast-fragmentation warhead missiles for negating air and missile 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 Missile Segment Enhancement (MSE) missile with increased range and altitude capabilities.
    - PAC-2 interceptors include the Guidance Enhanced Missile (GEM), the newest version of which is the GEM-T. The GEM-T is designed primarily to counter



aircraft, including low radar cross-section cruise missiles, but also has improved capability against short-range ballistic missiles.

- Planned MEADS developments include:
  - Battle management, command, control, communications, computers, and intelligence elements; Ultra High Frequency-band 360-degree surveillance radars; X-band 360-degree multifunction 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.

### Activity

- The Army fired a salvo of two Patriot GEM missiles at a short-range ballistic missile target during the PDB-6 LUT flight test P6L-2 in October 2006. The first GEM intercepted and killed the target at the expected ground range and altitude.
- The Army fired a salvo of two Patriot PAC-3 CRI missiles at a short-range aerodynamic ballistic missile target during the PDB-6 LUT flight test P6L-3 in October 2006. The first CRI intercepted and killed the target at the expected ground range and altitude. The second CRI missile self-destructed as planned.
- During PDB-6 LUT flight test P6L-1 in November 2006, Patriot intercepted a low radar cross section cruise missile target with a GEM-T.
- The Army conducted sustained operations testing during the PDB-6 LUT in November 2006.
- In January and February 2007, the Army conducted PDB-6 LUT mobile flight mission simulator hardware-in-the-loop regression testing.

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- In May 2007, during the first flight test of the MSE missile (Flight Test 7-1), Patriot fired an MSE control test missile at a simulated target.
- Patriot fired a PAC-3 CRI missile at a subscale aircraft target equipped with electronic countermeasures during Flight Test 14-1 in July 2007. The CRI intercepted and killed the target.
- The Army conducted penetration characterization testing for the MSE missile lethality enhancer titanium fragments in July 2007.
- The Army Research Laboratory conducted information assurance insider penetration testing during the PDB-6 LUT.

## Assessment

- The four FY07 major developmental Patriot flight tests conducted against targets were successful.
- During Flight Test 7-1, a loss of actuator battery voltage at MSE control test missile launch led to lateral accelerations exceeding design limits. This caused missile structural failure approximately three seconds after launch.
- Only one mobile flight mission simulator hardware-in-the-loop system was available for the PDB-6 LUT, preventing the Army from testing more than one Patriot battery at a time. Patriot met the PAC-3 Operational Requirements Document system effectiveness and defended area Key Performance Parameter requirements for some tactical ballistic missiles, but failed to meet these requirements for other tactical ballistic missile threats. Patriot demonstrated mixed performance against cruise missiles and aircraft. Performance against anti-radiation missiles, air-to-surface missiles, and unmanned aerial vehicles is uncertain due to insufficient data on Patriot interceptor lethality against these three classes of threats.
- The Army has acquired a second hardware-in-the-loop system that will support the PDB-6.5 LUT (scheduled for 2009) enabling a robust battalion-level evaluation of Patriot performance. This will allow the Army to use two flight mission simulators simultaneously to load two Patriot batteries with tactically-representative types and numbers of simulated targets and live friendly and threat aircraft with electronic countermeasures. The Army will also use these simulators for training, verifying fixes, and minimizing the possibility of encountering unexpected problems.
- The sustained operations phase of the PDB-6 LUT demonstrated that the Patriot test unit had good reliability and operational availability but did not meet mean time to repair, emplacement time, or march order time requirements. PDB-6 increased the workload of some Patriot operators and required a level of expertise that exceeded the current Army training standard for some Patriot operations.

- Limited information assurance insider penetration testing during the PDB-6 LUT revealed shortcomings that could contribute to Patriot system vulnerability to information operation attacks. The test was limited because it was conducted at a time when the system was unmanned. Although the test provided data to address information assurance protection metrics, it was not adequate to address DOT&E metrics on information assurance detection, reaction, recovery, or restoration or to fully assess Patriot survivability from information operations attacks.
- The PDB-6 LUT included a Joint Interoperability Demonstration that addressed interoperability between Patriot and other air and missile defense elements using both live and virtual participants. The results indicate a marked improvement in Patriot joint interoperability since the last demonstration conducted in 2002, although some issues remain unresolved.
- The penetration characterization lethality testing provided data that should lead to improved estimations of PAC-3 missile lethality.

## Recommendations

- Status of Previous Recommendations. The Army has resolved all but the following DOT&E recommendations, which require further attention: Air and missile defense testing should occur during joint and coalition exercises that include large numbers of different aircraft types; sensors; battle management, command, control, communications, computers, and intelligence; and weapon systems (FY05). The Army should upgrade the existing and new hardware-in-the-loop systems to model electronic countermeasures and identification friend or foe systems (FY06). The Army should update the Test and Evaluation Master Plan to address changes in the acquisition and supporting test strategies for the MSE missile and MEADS (FY06).
- FY07 Recommendations. The Army should:
  1. Conduct the Test and Evaluation Master Plan-required Patriot flight test against a threat-representative anti-radiation missile target. A test to address this recommendation is scheduled for December 2007.
  2. Conduct Red Team penetration testing during mobile flight mission simulator hardware-in-the-loop operational testing to evaluate the effects of information operations attacks on mission performance and to determine the ability of Patriot soldiers to detect, react, recover, and restore following information operations attacks.

## Spider XM7 Network Command Munition

### Executive Summary

- During FY07, the Spider program continued in the low-rate initial production phase of its acquisition program and completed a Force Development Test (FDT) and Initial Operational Test and Evaluation (IOT&E).
- DOT&E approved the IOT&E plan contingent on the Army's commitment to execute a Follow-On Test and Evaluation (FOT&E) prior to the full-rate production (FRP) decision.
- Previously identified hardware and software complexity problems continued to challenge the program in the IOT&E. Follow-on testing will validate fixes for problems revealed in the IOT&E and support the FRP decision in February 2009.
- FOT&E is required to fully assess Spider's operational effectiveness and suitability.
- The program timeline remains consistent with the landmine alternative timeline.

### System

- Spider is a landmine alternative that satisfies the anti-personnel munition requirements outlined in the 2004 National Landmine Policy. That policy directs the DoD to:
  - End use of all persistent landmines after 2010
  - Incorporate self-destructing and self-deactivating technologies to develop alternatives to current persistent landmines
- The Army intends to achieve an initial operational capability with Spider by 2010.
- A Spider munition field includes:
  - Up to 63 munition control units, each housing six miniature grenade launchers
  - A remote control station, allowing the Soldier to maintain "man-in-the-loop" control or allow the Soldier to direct the munitions to act autonomously (if authorized) in response to intruders



- A communications relay device or "repeater" for use in difficult terrain or at extended ranges
- Units can employ Spider in all environments and in all terrains.
- Spider incorporates self-destructing and self-deactivating technologies to reduce residual risks to non-combatants after hostilities cease.

### Mission

Maneuver or engineer units will employ Spider, by itself or in conjunction with other networked munition systems, to accomplish these missions:

- Force protection
- Battlefield shaping
- Early warning
- Delay enemy forces
- Attrite enemy forces

### Activity

- DOT&E approved the IOT&E test plan in December 2006. Approval was contingent on the Army's commitment to conduct an FOT&E prior to an FRP decision.
- The program completed a FDT at Fort Leonard Wood, Missouri, in February 2007 to validate Spider tactics, techniques, and procedures.
- The IOT&E occurred at Fort Hood, Texas, in March-April 2007.
- Both events included the live firing of Spider munitions. Additionally, the FDT included live firing of Claymore mines and non-lethal Modular Crowd Control Munitions (MCCMs) using the Spider Munition Adaptor Modules.

### Assessment

- The February 2006 Milestone C Test and Evaluation Master Plan provides an adequate strategy to address system issues and thoroughly test Spider prior to the FRP decision.
- The IOT&E revealed that battery power is a significant factor in system performance and that units will most likely use vehicles to assist in powering and controlling Spider munitions fields. The program should provide vehicle power options for the Spider Control Station and test those options in the FOT&E.
- The IOT&E also revealed that Spider software, hardware, and electronic manuals are too complex. The program should

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- reduce system complexity, make the technical manuals more user-friendly, and test the fixes in the FOT&E.
- Jamming affects the unit's ability to control the Spider munitions field. Spider interoperability with friendly counter-Improvised Explosive Device (IED) jammers must be demonstrated.
- Army policy on reuse and reloading of Munition Control Units (MCU) after one or more Miniature Grenade Launchers have been fired must be reviewed. Current procedures which require MCU disposal after firing one grenade have significant operational impacts. The program manager is working with the Army Fuze Safety Review Board on a plan that will support reuse of MCUs post detonation prior to Spider fielding.
- The Program Office is making system changes and moving to a new production facility in West Virginia. These changes mean that the Spider system tested in the IOT&E may not be production representative and dictated the need for a FOT&E before the FRP decision.
- A Beyond Low-Rate Initial Production Report summarizing the results from both the IOT&E and FOT&E is required to adequately support an FRP decision in February 2009.
- The program has sufficient time to test and confirm all system fixes and achieve Initial Operational Capability by 2010 in order to comply with the 2004 National Landmine Policy. A capability gap will exist until the Army has sufficient stocks to replace all of their persistent mines.

## Recommendations

- Status of Previous Recommendations. The program has addressed all previous DOT&E recommendations.
- FY07 Recommendations. The Army should:
  1. Review and clarify the policy on reuse and reloading of MCUs after one or more grenades have been fired.
  2. Validate Spider interoperability with friendly counter-IED jammers.
  3. Address power and system complexity issues and test them in an FOT&E.
  4. Execute an FOT&E before the end of FY08. The FOT&E should validate fixes for problems revealed in the IOT&E and confirm the effectiveness and suitability of the Spider system.

## Stryker – Mobile Gun System

### Executive Summary

- The Army deployed the Mobile Gun System (MGS) to Operation Iraqi Freedom prior to completion of the IOT&E and the full-rate production decision.
- DOT&E submitted an Early Fielding Report to Congress in June 2007.
- DOT&E concluded in its Early Fielding Report that MGS performance was not sufficiently mature for combat operations.
- The U.S. Army Operational Test Command will conduct the Initial Operational Test at Fort Hood, Texas, from October 20, 2007, to November 4, 2007.

### System

- The Stryker Family of Vehicles consists of two basic variants: the Infantry Carrier Vehicle and the MGS.
- The MGS is undergoing a separate acquisition program because the system needs additional development.
- The MGS mission equipment includes:
  - M68A1E7 105 mm cannon system with an ammunition handling system
  - Coaxial 7.62 mm machinegun and a secondary M2HB, .50-caliber machinegun
  - Full solution fire control system with two-axis stabilization
  - Low-profile turret designed to provide survivability against specified threat munitions
- The MGS has a three-man crew.
- 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 crew with levels of protection against small-arms, fragmenting artillery, mines, and rocket-propelled grenades. Rocket-propelled grenade protection is provided by add-on Slat armor (flat steel stock arranged in a spaced array) not shown in photo.

### Mission

- The Stryker Brigade Combat Team equipped with the MGS can create openings in walls, destroy bunkers and machinegun nests, and defeat sniper positions and light armor threats. The primary gunnery systems are intended 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.

### Activity

- The Army deployed the MGS to Operation Iraqi Freedom prior to completion of the initial test and evaluation and the full-rate production decision.
- On June 4, 2007, DOT&E provided Congress an Early Fielding Report.
- DOT&E monitored MGS combat performance.
- The Army Test and Evaluation Command completed additional coupon, ballistic hull and turret, and full-up system-level testing against the MGS in FY07. DOT&E expects that the Army will conduct additional Controlled Damage Experimentation and ballistic shock testing in early FY08.
- The U.S. Army Operational Test Command will conduct the Initial Operational Test at Fort Hood, Texas, from October 20, 2007, to November 4, 2007.

- An MGS platoon will execute tactical tasks and missions in a small-scale contingency environment against a representative threat.
- The test will consist of three events: force-on-force, combat live fire, and excursions.

### Assessment

- DOT&E concluded in its Early Fielding Report that MGS performance was not sufficiently mature for combat operations. The configuration being deployed into theater was not yet operationally effective. The MGS design was improving, but new failure modes were continuing to emerge, which indicated the MGS was not yet mature in both the

# ARMY PROGRAMS

- design and production processes. DOT&E included an interim, classified vulnerability assessment in the report.
- DOT&E recommended that the Army verify effectiveness of the seven planned corrective actions prior to deploying the system to combat.
  - MGS performance in theater indicates the following trends:
    - Gunner sights help maintain situation awareness in urban terrain and are being used to identify Improvised Explosive Devices prior to detonation.
    - The 105 mm main gun is accurate.
    - Heat is a major concern. Vehicle internal temperatures have reached 130 degrees in the day and 115 degrees at night.
    - Some vehicle commander's are shutting down the Commander's Panoramic Viewer during the hottest time of the day (1200-1800) to minimize heat induced failures to the system.
  - The 7.62 mm coaxial machine gun is functioning normally, but the gunner still has to exit the vehicle in order to reload or reduce stoppages.
  - Crews are concerned about their ability to evacuate the vehicle in case of an emergency.
  - Maintenance and specific parts flow are a unit concern. There is some concern that contractor logistic support is not sufficient because the contractors lacked MGS experience.

## Recommendations

- Status of Previous Recommendations. The Army has addressed all previous recommendations.
- FY07 Recommendations. None.

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

### Executive Summary

- The 2006-2007 Initial Operational Test (IOT) demonstrated that the Stryker Nuclear, Biological, and Chemical Reconnaissance Vehicle (NBCRV) platoon in a Stryker Brigade Combat Team (BCT) is operationally effective for chemical surveillance and chemical route reconnaissance missions. Operational effectiveness for chemical surveillance and chemical route reconnaissance missions resulted from redundancy among the three NBCRVs in the platoon. The NBCRV platoon was not operationally effective for chemical area reconnaissance missions. Single NBCRV teams were not operationally effective. The Stryker NBCRV is not operationally suitable because the base vehicle and its mission equipment package are not yet reliable. The Stryker NBCRV needs performance, safety, and reliability improvements, which will be evaluated in a Reliability Growth Test. The project managers for the NBCRV and its mission equipment package are actively working reliability corrective actions and verification.
- The Stryker NBCRV LFT&E program found the NBCRV has similar vulnerabilities as other Stryker variants but its mission equipment package is more vulnerable to ballistic damage than other Stryker variants.
- The Army expanded its plan to field Stryker NBCRVs increasing from 39 to support Stryker BCTs to 355 to include the support of Heavy BCTs and Chemical Companies.
- The Army will seek a low-rate initial production (LRIP) or full-rate production (FRP) decision in 2QFY08.

### System

- The NBCRV is one of 10 specialized variants of the Stryker family of vehicles. The NBCRV uses a modified Infantry Carrier Vehicle chassis.
- Chemical, biological, and radiological sensors and communications are integrated with the Stryker base vehicle to perform chemical, biological, radiological, and nuclear (CBRN) detection, identification, marking, sampling, and reporting of these hazards.
- The NBCRV's armor provides ballistic protection to the crew against small arms, mines, and artillery fragments. The armor has been enhanced with slat armor. The vehicle is also equipped with a filtering and over-pressure system that provides protection from CBR threats.
- The CBRN mission equipment package includes:
  - Joint Biological Point Detection System
  - Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD)



- Chemical and Biological Mass Spectrometer to detect liquid chemical warfare agents on the ground collected by a Surface Contamination Sampler
- Chemical Vapor Sampling and Storage System
- NATO standard markers and deployment system
- Automatic Chemical Agent Detector Alarm to provide point detection of chemical warfare agent vapors
- Radiological detectors
- A NBCRV team consists of an NBCRV and its four-person crew. Two or more teams are organized into CBRN reconnaissance platoons. These platoons are assigned to a:
  - Stryker Brigade Combat Team (BCT), with one platoon of three NBCRVs
  - Heavy BCT, with one platoon of two NBCRVs
  - Chemical Company – Combat Support, with one platoon of six NBCRVs; this company is assigned to a Division or Corps

### Mission

- CBRN reconnaissance platoons perform tactical route and area reconnaissance and tactical surveillance operations. A CBRN reconnaissance platoon, as part of an early entry combat force, is capable of limited independent operations.
- Each NBCRV team, a NBCRV and its four-person crew, reports information to the Reconnaissance Squadron in the Stryker BCT and other units within a BCT based on platoon employment for an assigned mission.

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## Activity

- DOT&E approved the revised NBCRV Test and Evaluation Master Plan (TEMP) in April 2006.
- The program manager conducted government production verification tests in 1QFY06-3QFY07.
- Army testers successfully completed a test event in July 2006 to demonstrate the vehicle's capability for deployment on a C-130 transport aircraft.
- The Army's NBCRV LFT&E program completed in FY07.
- The Army conducted the NBCRV IOT in August-October 2006 in accordance with the DOT&E-approved test plan with one exception. Biological simulant releases to test the biological point detector on the NBCRV were not in accordance with the approved threat test support package.
- The JSLSCAD program manager continued modeling and simulation of the JSLSCAD's performance against chemical warfare agents in different operational environments through July 2007.
- The Army conducted a Soldier Demonstration in May 2007 to assess base Stryker vehicle and CBRN mission equipment package modifications and procedures changes recommended from IOT findings.
- The Army expanded its plan to field Stryker NBCRVs to support Stryker BCTs from 39 to 355 to support also Heavy BCTs and Chemical Companies.
- The United States Army Chemical School is staffing doctrinal changes to use two or more NBCRVs in a mission set for all NBCRV-equipped units.

## Assessment

- DOT&E focused its evaluation on the ability of the Stryker BCT CBRN reconnaissance platoon's three NBCRVs to accomplish its mission. The platoon demonstrated in the IOT that it is operationally effective for chemical surveillance

and chemical route reconnaissance. Effectiveness resulted from redundant coverage by sensors. The platoon was not successful for chemical area reconnaissance missions. Single NBCRV team performance was not operationally effective. The Stryker NBCRV base vehicle and its mission equipment package are not yet reliable.

- The Joint Program Executive Office for Chemical and Biological Defense provides the mission equipment package for the NBCRV as government-furnished equipment. The Army operational test agency conducted operational testing with three NBCRVs operating as a platoon. Testers executed biological simulant releases not in accordance with the approved test plan.
- The Surface Contamination Sampler (SCS) used with the Chemical Biological Mass Spectrometer was easily misaligned or damaged during off-road operation causing 10 times greater unscheduled maintenance than the user requires. The project managers demonstrated improved user procedures to stow and protect the SCS in a Soldier Demonstration conducted by Army Test and Evaluation Command in May 2007.
- NBCRV employment is in squads of two in Heavy BCTs and Chemical Companies. The IOT did not adequately test employment of squads.

## Recommendations

- Status of Previous Recommendations. The Army accepted all previous recommendations.
- FY07 Recommendation.
  1. The Army should conduct additional operational testing to validate reliability, availability, and maintainability improvements and assess squad performance before fielding to Heavy BCTs or to Chemical Companies.

## Transportation Coordinators' Automated Information for Movements System II (TC-AIMS II)

### Executive Summary

- The Army Test and Evaluation Command (ATEC) conducted operational testing of the Transportation Coordinators' Automated Information for Movements System II (TC-AIMS II) Block 3 capability during April and May 2007 at U.S. Army Europe.
- Operational testing was adequate and was conducted in accordance with a DOT&E-approved Test and Evaluation Master Plan and operational test plan.
- TC-AIMS II Block 3 is operationally effective, suitable, and survivable.
- TC-AIMS II requires additional operational testing to verify Block 2 software fixes. The operational testing should validate the Army's mobility concept of operations and evaluate the end-to-end integration of Blocks 2 and 3 for operational effectiveness and suitability prior to a full-fielding decision for the system.



### System

- The TC-AIMS II is a joint Major Automated Information System that interfaces with joint and Service movement and command and control systems, providing commanders in-transit information during movement operations.
- The Army is fielding TC-AIMS II in three blocks:
  - Block 1: Basic Unit Movement provides the Army and Navy with an initial, limited unit level mobilization capability.
  - Block 2: Enhanced Unit Movement provides the Army and Navy with enhanced capability to support all phases of mobilization from the home station to the port of embarkation.
  - Block 3: Joint Reception, Staging, Onward Movement and Integration (JRSOI) provides capability needed to complete the movement from port of debarkation and staging areas onward to forward tactical assembly areas.

### Mission

Commanders utilize TC-AIMS II to execute movement operations. These operations include:

- Providing movement requirements to U.S. Transportation Command to order strategic movement assets in support of operations for combatant commanders.
- Providing in-transit data to the Global Transportation Network in support of U.S. Transportation Command
- Supporting day-to-day traffic management operations in support of the Installation/Traffic Management Office
- Supporting in-theater distribution and movement control of deploying personnel and equipment in support of battlefield commanders

### Activity

- ATEC conducted operational testing on TC-AIMS II Block 3 with U.S. Army Europe units at Kaiserslautern, Germany, in March and April 2007.
- The OT&E was conducted in accordance with DOT&E-approved test plans.
- ATEC used existing Block 2 data to stimulate Block 3 functionality to assess its operational effectiveness and suitability. The operational test did not assess TC-AIMS II Block 2 general purpose users, capabilities, or end-to-end integrated capabilities of Blocks 2 and 3.
- The Army users participating in the Block 3 operational test consisted of lower, middle, and senior grade enlisted soldiers; civilian mobility coordination specialists; and middle grade transportation and mobility warrant officers and civilian managers. The Navy users included senior grade enlisted sailors and civilian mobility coordination specialist supervisors.

# ARMY PROGRAMS

## Assessment

- Operational testing of TC-AIMS II Block 3 was adequate. The Army and Navy mobility coordination specialist and movement managers were able to successfully execute assigned missions in a JRSOI scenario.
- The ATEC evaluation determined that the TC-AIMS II Block 3 software is operational effective, suitable, and survivable. DOT&E agrees with the ATEC evaluation.
- The TCAIMS II Block 3 operational test event did not assess integrated capabilities of Block 2 and Block 3 as an end-to-end system.
- There was no verification of Block 2 software fixes or an assessment of general purpose users during the operational test event.

## Recommendations

- Status of Previous Recommendations. The Army needs to continue the effort to improve Block 2 utility for the general-purpose user (FY05). The TC-AIMS II Program Management Officer has not provided an adequate plan to address DOT&E's recommendation for additional testing of Block 2 to verify correction of deficiencies (FY05).
- FY07 Recommendation.
  1. The TC-AIMS II Program Management Officer and ATEC should coordinate a follow-on test and evaluation that will verify Block 2 fixes and the integrated capabilities of Blocks 2 and 3.

## Warfighter Information Network – Tactical

### Executive Summary

- The Army used supplemental funding to procure and is fielding the Joint Network Node (JNN, now part of Warfighter Information Network - Tactical (WIN-T) Increment 1) to all deploying Army units. This action occurred outside of normal DoD acquisition processes and congressional reporting requirements.
- On June 5, 2007, the Defense Acquisition Executive directed restructuring of the WIN-T program into four increments with Increment 1 absorbing the JNN effort. The program restructuring included consolidating management responsibilities, combining funding lines, and developing new acquisition documentation that reflect the phased capability approach of the four increments.
- The proposed WIN-T Increment 1 IOT&E in 1QFY09 is high risk due to the system delivery schedule and unit availability to support the test.

### System

- WIN-T is a high-speed and high-capacity backbone communications network designed to be the Army's tactical intranet.
- WIN-T should provide reliable, secure, and seamless voice, video, data, and imagery services and support communications from the fixed-station sustaining base to Future Combat Systems (FCS) Brigade Combat Teams and Modular Brigade Combat Teams.
- The WIN-T program consists of four Increments:
  - Increment 1 (former JNN), Networking at the Halt, enables the exchange of voice, video, and data throughout the tactical battlefield using a satellite-based network that includes Ku and Ka satellite trailers, Joint Network Nodes, Satellite Transport Terminals, and Unit Hub Nodes.
  - Increment 2, Initial Networking on the Move, provides command and control on the move for maneuver brigades.
  - Increment 3, Full Networking on the Move, provides command and control on the move for all echelons and full support for FCS.

### Activity

- The Defense Acquisition Executive restructured the WIN-T program into four increments (absorbing JNN as WIN-T Increment 1) and directed the development of Acquisition Strategy Reports and Test and Evaluation Master Plans (TEMPs) for Increments 1 and 2 by November 2, 2007.
- The Army is developing an overarching Acquisition Strategy with separate Acquisition Strategy Annexes for each increment. The program is developing a TEMP for each increment, starting with Increments 1 and 2.



1 - Increment 1 Unit Hub Node  
 2 - Increment 1 Satellite Transport Terminal  
 3 - Increment 1 Joint Network Nodes  
 4 - Increment 1 Ku Satellite Trailer  
 5 - Operations in Shelter

- Increment 4, Protected Satellite Communications on the Move, provides protected satellite communications on the move.

### Mission

Units at theater and below intend to use WIN-T to:

- Integrate terrestrial, Ku satellite, and Ka military satellite-based communications capabilities into an everything-over-Internet Protocol network to support commanders with voice, data, and video connectivity across an extended, non-linear battlefield and at remote locations (Increment 1)
- Provide maneuver brigade commanders with communications capabilities, resident in maneuver platforms, needed to support command and control on the move (Increment 2)
- Provide commanders at all echelons with communications capabilities needed to support command and control on the move (Increment 3)

- The Army is identifying resources required to conduct the WIN-T Increment 1 IOT&E in 1QFY09 with newly produced configuration items from the pending competitive Fixed Price Production contract.
- The Army is coordinating test activities across WIN-T Increment 1 IOT&E/Limited User Test (LUT) and the WIN-T Increment 2 LUT to gain improved test scope and resource efficiency.

# ARMY PROGRAMS

## Assessment

- Conducting the WIN-T Increment 1 IOT&E in 1QFY09 is high risk. The program does not yet have assigned test units, a production contract, mature requirements documents, and required test documentation, including the overarching Acquisition Strategy Report, Acquisition Strategy Increment Annexes, and approved TEMPs.
- The 1QFY09 IOT&E for this theater and below communications system will require elements of a corps, division, and brigade communications network. The proposed hardware delivery schedule associated with the pending competitive Fixed Price Production contract indicates that Increment 1 configuration items will be fielded to only one active duty Army brigade by the IOT&E in 1QFY09. The

Army is examining equipping other test unit echelons with functionally and technically similar WIN-T Increment 1 capabilities, procured from JNN Lots 1 through 9.

## Recommendations

- Status of Previous Recommendations. The Army is making progress in the development of an acquisition strategy, concept of operations, and test strategy to support the transition of JNN into the WIN-T program (FY06).
- FY07 Recommendation.
  1. The Army should identify appropriate test units and resources to support Increment 1 IOT&E to ensure an adequate operational test.

## XM1022 Long-Range Sniper Ammunition

### Executive Summary

- The Army completed LFT&E of the XM1022 Long-Range Sniper Ammunition in accordance with a DOT&E-approved test plan.
- The XM1022 demonstrated significant wounding potential and the ability to perforate personnel body armor at desired ranges, including ceramics.

### System

- The Army initiated the XM1022 program to develop .50 caliber sniper ammunition with increased accuracy over the currently fielded Mk 211 multi-purpose armor piercing round.
- Because the XM1022 is not a dud-producing round and is less expensive than currently fielded .50 caliber ammunition, it will also serve as training ammunition.
- The XM1022 cartridge consists of a 650-grain projectile loaded into a standard M33 .50 caliber cartridge case.

### Mission

- Snipers will employ XM1022 Long-Range Sniper Ammunition at extended ranges to destroy enemy personnel.



- In the event other ammunition types (i.e., armor-piercing) are not available, snipers will employ the XM1022 against lightly armored vehicles.

### Activity

- DOT&E approved the LFT&E Strategy in 4QFY05, and developmental testing supporting the LFT&E began thereafter. However, during testing, the projectile exhibited in-bore breakup. The materiel developer made changes to the projectile and completed contractor testing in 2006.
- Developmental testing in support of LFT&E began again in FY07. During FY07, the Army Research Laboratory completed ballistic gelatin testing to assess lethality, completed testing against rolled homogeneous armor to assess anti-materiel capability, and completed testing against threat personnel body armor recovered in Iraq.
- During FY07, the Aberdeen Test Center, Maryland, completed testing against personnel body armor, conducting shots against the armor at extended ranges.
- Although the Army completed LFT&E for the XM1022, developmental testing continues. The Army is expected to

make a procurement and fielding decision on the XM1022 in late FY08.

### Assessment

- Ballistic gelatin testing demonstrated that the XM1022 has significant wounding potential at the required range.
- XM1022 demonstrated the ability to perforate personnel body armor.
- XM1022 demonstrated anti-materiel capability beyond its requirement.

### Recommendations

- Status of Previous Recommendations. This is the first Annual Report for this program. There are no previous recommendations.
- FY07 Recommendations. None.

# ARMY PROGRAMS



## **Navy Programs**



## **Navy Programs**

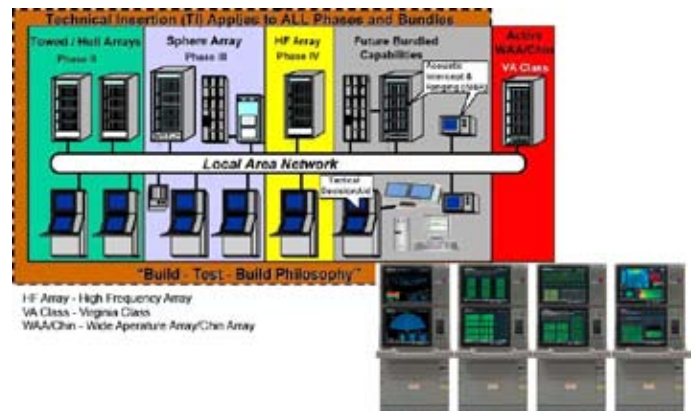
## Acoustic Rapid Commercial Off-the-Shelf (COTS) Insertion for Sonar AN/BQQ-10 (V) (A-RCI)

### Executive Summary

- The Navy conducted operational testing of the Acoustic Rapid Commercial off-the-shelf (COTS) Insertion (A-RCI) Sonar Advanced Processor Build-04 (APB-04) between November 2006 and June 2007.
- The Navy's operational testers evaluated A-RCI APB-04 under-ice navigation sonar as operationally effective, but not operationally suitable. Significant deficiencies include system reliability, maintainability, crew training, and documentation.
- Due to the rapid APB cycle, the Navy does not adequately operationally test and evaluate A-RCI APBs before the systems are fielded and deployed.

### System

- A-RCI is an open architecture sonar system designed to maintain the acoustic advantage over threat submarines.
- A-RCI utilizes legacy sensors and replaces central processors with COTS computer technology and software. It includes:
  - A sonar system for the *Virginia* class submarine
  - A replacement sonar system backfit into *Los Angeles*, *Ohio*, and *Seawolf* class submarines
  - Schedule-driven annual software upgrades (APBs) and biannual hardware upgrades called Technology Insertions (TI)
- Improvements are intended to provide expanded capabilities for anti-submarine warfare, high density contact management, and mine warfare, particularly in littoral waters and against diesel submarines.



### Mission

Submarine crews equipped with the A-RCI sonar should be able to complete the following submarine force missions:

- Search, detect, and track submarine and surface vessels in open-ocean or littoral sea environments without being counter-detected
- Search, detect, and avoid mines or other submerged objects
- Covertly collect acoustic Intelligence Surveillance/Reconnaissance information
- Covertly conduct Special Forces Operations missions
- Conduct under-ice operations

### Activity

- DOT&E conditionally approved the A-RCI TI-04/APB-04/APB-05 Test and Evaluation Master Plan (TEMP) in January 2007 based on a draft Capability Production Document (CPD). The Navy approved the TI-04/APB-04/APB-05 CPD in May 2007.
- The Navy continues to install and deploy A-RCI upgrades on operational submarines before completing operational testing. Currently 12 submarines have A-RCI APB-04 systems and six submarines have A-RCI APB-05 systems installed.
- The Navy is developing requirements documents and a TEMP for A-RCI TI-06/APB-06. However, the Navy is installing this version on four submarines and is planning for an operational test in 2QFY08.
- The Navy conducted four OT&E events for the TI-04 APB-04 system to evaluate performance in mission areas for SSGN and SSN submarines.

- The Navy tested the High Frequency (HF) under-ice sonar during an under-ice transit and deployment in November 2006.
- The Navy tested passive sonar search performance in conjunction with the SSGN class conversion operational evaluation in March 2007. This dedicated test evaluated an SSGN TI-04/APB-04 sonar against a SSN also equipped with the same system.
- The Navy tested HF mine avoidance on an SSGN class submarine in April 2007.
- The Navy tested TI-04/APB-04 in a high-density shipping area to assess the crew's situational awareness in a difficult littoral environment in June 2007.
- The Navy's Commander, Operational Test and Evaluation Force (COMOPTEVFOR) issued an A-RCI APB-04 HF under ice sonar report in June 2007. COMOPTEVFOR is evaluating

data for the remainder of the A-RCI tests and plans to issue a consolidated report in 1QFY08.

## Assessment

- Although the Program Executive Officer introduced more discipline over the last two years, the majority of the A-RCI requirements documents preparation and testing still occur in parallel with the A-RCI installations, completing after some ships have deployed. This schedule-driven process prevents determination of the system's operational effectiveness and suitability before the Navy deploys the system. It also prevents timely feedback into the next A-RCI APB development cycle. A-RCI upgrade installations need to be preceded by adequate operational testing and evaluation so that operational effectiveness and suitability of what is being fielded is understood up-front.
- A-RCI is an improvement over the legacy sonar systems; however, insufficient test data exists to conclude that A-RCI improves mission capability between APBs. The A-RCI APB-04 system contains features and capabilities to improve performance, but because of reliability failures or lack of crew training, these enhancements appear untapped. DOT&E believes the new functionality should enable a trained operator's performance to improve at sea; however, significant performance improvements have not been substantiated or measured in realistic operational environments.
- COMOPTEVFOR reported the APB-04 HF under-ice sonar as effective, but not suitable. The HF under-ice performance is an improvement over legacy systems; however, the low system reliability led COMOPTEVFOR to recommend the system not be used for operations in shallow water under pack-ice until system reliability was improved. COMOPTEVFOR reported significant shortfalls in reliability, maintainability, crew training, and documentation. DOT&E agrees with this assessment.
- Operational testing of the SSGN variant of HF mine detection and avoidance sonar showed improved reliability compared to

the *Los Angeles* class A-RCI HF. The reliability improvement appears related to the installation of a new integrated HF sonar on the SSGNs (active sonar is not installed on pre-conversion SSBNs) while the *Los Angeles* submarines must interface with legacy sonar projectors, hydrophones, and signal amplification equipment. Independent of the reliability deficiencies, the APB-04 HF mine detection sonar demonstrated improvement over legacy systems, and introduced computer-aided detection features that improved effectiveness.

- SSGN A-RCI APB-04 search performance against a nuclear submarine appears equivalent to APB-04 search performance on a *Los Angeles* class submarine.

## Recommendations

- Status of Previous Recommendations. The Navy has not implemented an event-based methodology for developing and testing A-RCI (FY05). However, the Navy is implementing a memorandum of agreement between all organizations involved in A-RCI development and testing, detailing the timeframes for completing actions and milestones in the A-RCI TI/APB development-to-fielding cycle. The Navy plans to slow the insertion of new functionality into A-RCI in FY08. The Navy conducted combined testing of A-RCI and other submarine combat control systems in 2007 and is planning for more combined testing in 2008 (FY05). The Navy has not developed platform level metrics with thresholds for the combat system; however, the Navy is conducting more end-to-end combat system testing (FY05). The Navy has not developed a dedicated minefield for testing and/or training. However, the temporary minefield installed for SSGN APB-04 testing was adequate for operational testing (FY06).
- FY07 Recommendation.
  1. The Navy should complete requirements development, TEMP development, and approval for APB-06 and for future APBs to support initiation of APB development.

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

### Executive Summary

- This is the first annual report submittal for the AGM-88E Advanced Anti-Radiation Guided Missile (AARGM).
- AARGM is in the developmental test (DT) phase and was successfully flown onboard an F/A-18C for its first flight in 2007.
- The follow-on DT phase and development work have been delayed by hardware and software technical challenges.
- There is risk in the Milestone C decision timeline, currently scheduled for June 2008, due to program delays and technical challenges.
- A surrogate target program has been instituted to apply operational realism to the test program.

### System

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



- The IBS-R allows reception of national broadcast data and transmittal of weapon impact assessment

### Mission

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

### Activity

- A contracted twin engine Beech aircraft with an AARGM seeker assembly attached to the nose of the aircraft flight tested in 2007. This provides characterization of the MMW radar and ARH performance to the DT team. This is the first combination of complex technologies in a single aircraft missile system coupled with the addition of the GPS and IBS-R.
- The DT team conducted lab and field testing of the ARH hardware and software.
- A DT flight test demonstrated a 50+ nautical mile GPS-guided point-to-point shot capability from a Navy F/A-18C aircraft, resulting in a direct hit.
- The second DT phase began in 2007, executing five scheduled Beech aircraft flight tests and five F/A-18C aircraft captive

- carry events to continue characterization of MMW and ARH seekers.
- Representative targets do not exist for this type of weapons system. The Resource Enhancement Project provided \$4.6 Million in FY07 and \$2.0 Million in FY08 for target development to support AARGM operational testing. Target development continues in parallel with AARGM DT.

### Assessment

- Hardware and software integration challenges impose a risk to the program schedule.
- The MMW radar sensor is not fully characterized.
- Surrogate target development, verification, and validation could adversely impact the schedule if target development is

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delayed. The target completion timeline possesses limited flexibility should technological challenges occur.

- Pressure to maintain the Milestone C decision in June 2008 imposes risk to the scheduled operational assessment in 3QFY08.

## Recommendations

- Status of Previous Recommendations. There are no FY06 recommendations as this is the first AARGM annual report.

- FY07 Recommendations. The Navy must:

1. Ensure the AARGM program is event driven and not schedule driven to ensure complete sensor characterization and missile integration.
2. Ensure surrogate target development, validation, and verification is accomplished for threat representative operational assessments and operational testing.

## AIM-9X Air-to-Air Missile Upgrade

### Executive Summary

- In October 2007, the AIM-9X program completed operational testing of a software update to the currently fielded missile with conflicting results.
- Analysis is not complete, but initial review indicates that the test results do not show measurable improvement of missile performance.
- The software upgrade included several new interim capabilities. The program office elected not to operationally test the rudimentary air-to-ground capability until they can complete further development.
- The Services should carefully consider the results of the operational test before committing to fielding the new software and capabilities. The AIM-9X program should add additional shots to future testing that fully evaluate missile performance and accurately determine increased (or decreased) capability.

### System

- AIM-9X is the latest generation short-range, heat-seeking, air-to-air missile that reduces the gap in short-range combat capability between U.S. aircraft and primary enemy threat aircraft. The currently fielded version of the missile software is 8.019.
- AIM-9X is highly maneuverable, day/night capable, and includes the warhead, fuse, and rocket motor from the previous AIM-9M missile.
- AIM-9X added a new imaging infrared seeker, vector-controlled thrust, digital processor, and autopilot. F-15C/D, F/A-18 C/D, and F/A-18 E/F aircraft can carry the AIM-9X and the missile includes a container for storage and maintenance.

### Activity

- The AIM-9X program completed an operational test evaluating a software upgrade (8.2XX) to the fielded missile. The upgrade addressed a previous deficiency in performance against aircraft employing countermeasures (flares) against heat-seeking missiles, and added new interim capabilities to the baseline missile in order to reduce future development risk.
- The program executed the operational test from May through October 2007, using the DOT&E-approved test plan. The program office did not certify the air-to-ground capability for operational test due to poor performance and a recommendation against further testing from development test agencies. Operational test did not evaluate this feature.
- The test program consisted of multiple captive carriage flights evaluating missile seeker performance in a variety of



- 8.2XX (the latest software version) includes a rudimentary air-to-ground attack mode; limited lock-on-after-launch; full envelope high off-boresight capability without a helmet-mounted cueing system; and increased flare rejection performance.

### Mission

Air combat units use the AIM-9X to:

- Conduct short-range offensive and defensive air-to-air combat
- Engage multiple enemy aircraft types using passive infrared guidance in the missile seeker, using external cues (other than the missile seeker itself) from multiple aircraft systems, including radar and the Joint Helmet Mounted Cueing System
- Seek and attack enemy aircraft at large angles away from the launch aircraft

- scenarios and conditions, and three live fire shots evaluating end-to-end system performance in three distinct scenarios.
- The program completed 105 captive carry sorties on F-15, F-16, and F/A-18 aircraft, and three end-to-end live fire shots against target drones.

### Assessment

- Analysis and evaluation is ongoing. Modeling and simulation analysis indicated the new software should have measurable increases in acquisition and track ranges, and greater capability against aircraft employing flares. Initial feedback from the captive flights is conflicting. Some crews noticed slightly better performance and slightly increased capabilities, while others felt the performance was less than the currently

fielded missile. There may be insufficient information in the limited test program (designed only to confirm the expected strong performance) to answer questions about marginal performance or confirm new capability.

- The three shots were only marginally successful. Of the three shots, only one successfully killed the target drone. One shot acquired and tracked the target but failed to achieve a kill since the pilot launched the missile just beyond the planned range for the test scenario. One shot acquired, tracked, and killed the target drone as planned. One shot acquired and tracked the planned target but lost track accuracy as the missile flew, missing the planned target. In all cases, the missile appeared to function correctly, but did not always achieve the expected performance increase over the current software.
- The AIM-9X operational testing demonstrated the primary problem with a limited test program when evaluating software changes. A limited test program with minimal shots (scoped under the belief that performance would meet modeled expectations) may not provide sufficient information to adequately evaluate missile performance when performance is less than expected or only marginally better than previous capability.
- The next phase of the program (Block II) upgrades a number of hardware components, in some cases due to obsolescence

and in some cases to increase performance and capabilities. The program intends to first test currently fielded software on the new hardware, then conduct more extensive testing after upgrading new software that adds greater capabilities. For the next software verification phase, the AIM-9X program is proposing a test program that plans a minimal number of missile shots, which may lead to the same inconclusive results that occurred during this year's operational test.

## Recommendations

- Status of Previous Recommendations. In FY05, DOT&E recommended that the program plan a robust, event-driven test strategy for the next increment in the program. Planning for this increment is not yet complete. Also, all three of the FY06 recommendations are still valid.
- FY07 Recommendations.
  1. The Services should carefully consider the results of the operational test before committing to fielding the new software and capabilities.
  2. The AIM-9X program should add additional shots to fully evaluate missile performance and accurately determine increased (or decreased) capability.

## AN/AAR-47 A(V)2 Upgrade Missile / Laser Warning Receiver

### Executive Summary

- The Navy's AAR-47 A(V)2 is the upgrade to the widely fielded AAR-47 V(2). It is designed to reduce vulnerability to bright light sources.
- DOT&E assessed the AAR-47 A(V)2 as operationally effective, including reduced sensitivity to bright light sources, when integrated on the KC-130J and KC-130T.
- The AAR-47 A(V)2's warning capability can be significantly degraded in certain environments, the details of which are classified. This limitation is a function of the older design and applies to all platforms that AAR-47 is integrated on.
- The Navy and Air Force need to ensure the pilots and crews relying on the AAR-47 for protection clearly understand this common limitation.

### System

- The AAR-47 is a defensive system that warns pilots of missile threats and commands dispensing of flares as an infrared countermeasure. This legacy missile warning sensor is installed on many aircraft, including C-130, C-5, C-17, AH-1, UH-1, H-46, H-60, P-3, H-47, H-53, and MV-22.
- The AAR-47 V(2) sensor upgrade program is designed to improve missile warning sensor performance and incorporates laser warning functionality.



- The new AAR-47 A(V)2 missile warning sensor incorporates an additional internal detector into the widely fielded AAR-47 V(2) sensor designed to reduce vulnerability to bright light sources.
- This is a Navy-led joint program with active Air Force and U.S. Special Operations Command participation.

### Mission

Combatant commanders utilize AAR-47 A(V)2 to enhance survivability of several types of fixed- and rotary-wing aircraft against shoulder-fired, vehicle-launched, and other portable infrared-guided missile threats.

### Activity

The AAR-47 A(V)2 is in full production as a Navy and Air Force upgrade designed to reduce vulnerability to bright light sources improving missile warning sensor effectiveness.

#### Navy

- Commander, Operational Test and Evaluation Force, the Navy's operational test agency, completed testing of the AAR-47 A(V)2 integrated on the KC-130T in FY07.
- The Navy began testing a potential upgrade to the AAR-47 A(V)2, commonly called the AAR-47 B(V)2. A data collection effort was completed in June 2007 and two live missile firing events are scheduled in FY08.
- The Navy testing of AAR-47 A(V)2 in FY07 was conducted in accordance with the Navy KC-130T Test and Evaluation Master Plan (TEMP) approved by DOT&E in FY07.

#### Air Force

- The Air Force's Air National Guard Air Force Reserve Command Test Center (AATC) conducted an operational utility evaluation of the AAR-47 A(V)2 as integrated on the A-10 aircraft in FY06 without DOT&E knowledge. The

Air National Guard subsequently fielded A10s with AAR-47 installed.

- In FY07, the Air Force coordinated with DOT&E to ensure appropriate involvement for all future testing of the AAR-47 on the A-10 aircraft.
- The Air Force acknowledged known AAR-47 system limitations to the systems capabilities in A-10 tactical publications.

### Assessment

#### Navy

- DOT&E assessed the AAR-47 A(V)2 as operationally effective, including reduced sensitivity to bright light sources, when integrated on the KC-130J and KC-130T.
- The AAR-47 A(V)2's warning capability can be significantly degraded in certain environments, the details of which are classified. This substantial limitation is a function of the AAR-47's older warning sensor design technology, which is independent of the specific platform integration.

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- The Navy's KC-130J/AAR-47 A(V)2 testing in FY07 was adequate, including the use of validated ground-based missile simulators and standardized operating procedures.
- Although the Navy executed adequate ground-based missile simulation procedures in FY07, standardized procedures still have not been institutionalized by the Navy, which increases the potential for future test adequacy issues.

## **Air Force**

- DOT&E did not concur with the FY06 AATC Report that stated that AAR-47 was effective on the A-10 aircraft because the Air Force did not test or report on one significant AAR-47 system limitation.

## **Air Force and Navy**

- There is not a current AAR-47 TEMP that aligns the Air Force and Navy's test efforts or addresses who will conduct follow-on testing for AAR-47 integration on new platforms.
- The Services do not consistently or uniformly test to or report on the one significant AAR-47 effectiveness limitation, which

needs to be clearly characterized for the warfighters counting on AAR-47 for self-protection.

## **Recommendations**

- **Status of Previous Recommendations.** Two DOT&E recommendations from the previous annual reports remain unresolved. Although the Services have established standardized ground-based missile simulation procedures as recommended by DOT&E, the Navy has not consistently planned applicable tests to employ these procedures. Additionally, the Services did not address the DOT&E recommendation to update the AAR-47 TEMP (FY06).
- **FY07 Recommendation.**
  1. The Navy and Air Force should ensure the pilots and crews relying on the AAR-47 for protection clearly understand common limitations.

## AN/APR-39 Radar Warning Receiver

### Executive Summary

- The AN/APR-39 is the most widely installed Radar Warning Receiver (RWR) in the DoD with over 4,000 systems integrated on Army, Navy, and Air Force rotary-wing and transport aircraft.
- The Army and Navy have been forced to consider strategies to upgrade their current APR-39 inventory due to the APR-39's limited situational awareness, marginal threat discrimination, parts obsolescence, supportability of the operational flight program (OFP) software, and very limited processor speed.
- In FY07, the Army established a three phase plan to upgrade their version of the APR-39 RWR. The Navy is currently planning to leverage the Phase 1 processor and OFP upgrade of the Army upgrade path for their version of the APR-39.
- A Test and Evaluation Master Plan (TEMP) revision is required in FY08 to ensure that the first major (Phase II advanced digital processor) system upgrade is properly characterized when tested in FY09.

### System

- The APR-39 is a RWR that detects, identifies, and provides relative location of threat electronic signals. The APR-39 also acts as the display for the missile and laser warning systems, and as the countermeasures dispenser on most aircraft in which it is installed.
- The Navy has the lead on this multi-Service Navy/Army program. The Air Force does not develop its own APR-39 variant, but purchases the Navy APR-39 systems, while incorporating Air Force unique threat libraries.
- The APR-39A initially fielded in FY96 on the Marine Corps UH-1N. The Navy's APR-39A/B variants are installed on over 1,000 Navy/Marine Corps helicopter, tilt-rotor, and transport aircraft and more than 200 Air Force Special Operations helicopters. The Army has installed a lighter-weight variant of the APR-39A on over 3,000 helicopters.
- The Army's variants can detect pulse and pulse doppler threat radars, while the heavier Navy variants add the capability to detect continuous wave threats and have improved identification via frequency discrimination.
- The Army and Navy are coordinating their spiral upgrade efforts to improve system effectiveness and maintainability.

### Activity

- The Services have made only minor modifications to the APR-39 since the Navy entered full-rate production in FY96.
- The Army and Navy are coordinating their spiral upgrade efforts to improve system effectiveness and maintainability.



1 - Central Processor/Receiver      4 - Display Unit  
 2 - Two Dual Channel Receivers      5 - Control Unit  
 3 - Blade Antenna      6 - Four Quadrant Antenna

- The Navy's near-term spiral upgrade (unfunded) leverages the Army's processor upgrade and antenna changes to address obsolescence issues, improve areas of APR-39 detection performance, and enhance direction of arrival accuracy.
- The Army's near-term spiral upgrade (funded) is designed to improve reaction time and to increase pulse density and complex wave form capabilities.
- The core APR-39 components include a cockpit control unit, a system processor, a cockpit display indicator, receivers, and antennae.

### Mission

- Combatant commanders use the APR-39 to enhance the survivability of Army, Navy, Marine Corps, and Air Force Special Operations rotary wing and transport aircraft on missions that penetrate hostile areas.
- Commanders use the APR-39 to provide aircraft self-protection by warning pilots of radar threats, supporting threat avoidance, or permitting timely use of defensive countermeasures.

- The Army's near-term spiral upgrade (funded) is designed to provide pilots better overall threat situational awareness and discrimination.

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- The Army has funded and is currently executing Phase 1 of a three phase upgrade plan. The three phase upgrade includes the following:
  - Phase 1: Processor Upgrade to sustain APR-39A(V) 1 and 4
  - Phase 2: Advanced digital RWR
  - Phase 3: Active Radio Frequency countermeasures
- The U.S. Army Intelligence and Information Warfare Division processor upgrade lab testing and U.S. Army Technical Test Center processor upgrade flight testing are both scheduled for 2QFY08.
- Although the Navy APR-39 Spiral upgrade is unfunded, the FY08 Navy plans include a Preliminary Design Review, Critical Design Review, and an update to the TEMP in FY08. A Navy flight test of the APR-39B(V)2 on a AH-1Z is currently planned for 4QFY08.
- The integration of APR-39 on new platforms was conducted in accordance with a DOT&E-approved platform TEMP. There was no stand alone testing of the APR-39 in FY07.
- A TEMP is not required to support the Phase I processor upgrade, but the Army needs an updated TEMP in FY08 to support the extensive development and testing of the Phase II advanced digital processor in FY09.
- A multi-service TEMP update by the Army and Navy should ensure the overarching test strategies are aligned between the Services.
- DOT&E coordination on APR-39 test plan development in FY08 is very important to ensuring the Services optimize resources and test efforts.
- In recent Navy testing, there were several significant APR-39 deficiencies as integrated on the MV-22, AH-1W, and the KC-130T. Further detailed evaluation of the APR-39 capability upgrades and performance assessments are required.

## Assessment

- The TEMP for APR-39 is seven years old and does not reflect current system upgrades, development or test plans.

## Recommendations

- Status of Previous Recommendations. There are no previous recommendations as there have been no DOT&E reports on APR-39 since 2002.
- FY07 Recommendation.
  1. The Army must coordinate with the Navy (lead Service) to provide an updated APR-39 TEMP for DOT&E approval in FY08.

## AN/WLD-1(V)1 Remote Mine-hunting System (RMS)

### Executive Summary

- Of the six DDG 51 Flight IIA class ships originally outfitted to host the Remote Mine-hunting System (RMS), only one ship retains this capability.
- The Navy attempted to complete IOT&E of the RMS in June 2007. As a result of reliability problems, the RMS program manager decertified the system after six days of testing.
- The DDG 51 host ship departed in August 2007 on a six-month deployment. The Navy elected to retain RMS aboard the host ship, but issued guidance prohibiting operational employment of the system. IOT&E has not yet been rescheduled.
- A modified version of the RMS is planned for use on Littoral Combat Ships (LCS) as part of the mine warfare mission package.

### System

- RMS is a naval mine detection system.
- RMS includes an unmanned, diesel-powered, semi-submersible vehicle called the Remote Mine-hunting Vehicle (RMV). The RMV tows an AN/AQS-20A variable depth sonar mine sensing subsystem.
- The Navy launches and remotely controls the RMV from a DDG 51 Flight IIA class ship outfitted with a launch and recovery subsystem. Although the Navy originally outfitted six ships to host the RMS, only one ship retains this capability. The Navy also plans to use the RMV on LCS as part of the mine warfare mission package.
- A data link subsystem provides continuous, real-time communications between the host ship and the RMV for command and control and transmission of sensor data.
- Missions are planned and controlled and data is processed, displayed, and recorded using a remote mine-hunting



functional segment integrated into the DDG 51 combat system.

### Mission

- The host platform Commanding Officer can employ RMS to detect, classify, and identify moored and bottom mines in shallow and deep water, allowing Naval forces to determine whether potential sea routes and operating areas contain mines.
- The Maritime Force Commander can use the organic or “in-stride” mine countermeasures capability of an RMS-equipped ship to make mine avoidance decisions without waiting for dedicated mine countermeasures ships or helicopters.

### Activity

- DOT&E approved a revised Test and Evaluation Master Plan (TEMP) and the IOT&E test plan in May 2007. Both documents supported planned IOT&E in June 2007.
- The Navy attempted to complete IOT&E of the RMS in June 2007 on the remaining DDG 51 host ship using the first low-rate initial production (LRIP) RMV. However, as a result of RMV reliability problems, the RMS program manager withdrew certification of the system for operational test after six days of testing.
- The DDG 51 host ship departed in August 2007 on a six-month deployment. The Navy elected to retain RMS aboard the host ship for training and further testing, but issued guidance prohibiting operational employment of the system.

- The Navy has not yet rescheduled the IOT&E because of the challenging schedule of the host ship in 2008. The ship is scheduled for a second deployment within seven months of returning from the current deployment; other activities in preparation for deployment will limit the opportunity for RMS testing.

### Assessment

- Although an operational assessment conducted in FY06 demonstrated improved reliability and operational availability for the RMV Engineering Development Model (EDM), the first LRIP RMV exhibited reliability problems during FY07 IOT&E, leading to early termination of the test. RMS

operational availability was not satisfactorily demonstrated under shipboard conditions.

- Overall, the available IOT&E test data is insufficient to fully characterize RMS detection performance. The FY06 operational assessment and the limited test data from IOT&E indicate that the RMS, when operated by a proficient crew, may effectively detect and classify moored mines in deep water. The data also indicates potentially acceptable detection performance in shallower minefields, containing both moored and bottom mines, when the bottom is smooth and the clutter density is low. Detection performance under other conditions has been lower than planning model predictions; it is not yet clear whether the system will meet performance objectives in challenging environments.
- The RMS false classification density (number of non-mine-like objects erroneously classified as mine-like per unit area searched) has generally been above the limits established for the sensor system (AN/AQS-20A). A large number of false targets may limit the system's usefulness to the operational commander.
- A number of capabilities remain high risk based on the limited test results to this point. These include operational suitability, shallow water performance, and the system's ability to reacquire a previously detected object and positively identify it as a mine or non-mine.
- Radiated noise measurements collected during developmental testing indicate that the LRIP RMV will be vulnerable to some

mines. RMV configuration changes will be required to reduce the RMV acoustic signature.

- Although the Operational Requirements Document states that RMS will be operated from select DDG 51 class ships as well as the LCS, the Navy intends to make the LCS the primary host for RMS. DOT&E is working with the Navy to ensure future testing on the LCS is adequate to fully evaluate effectiveness and suitability.

## Recommendations

- Status of Previous Recommendations. The Navy took action on two of the three FY06 DOT&E recommendations. The Navy only partially addressed the recommendation that they clarify the Operational Requirements Document to state the condition under which achieved search level and achieved search rate are to be measured. The Navy did add values for false classification density to the TEMP based on AN/AQS-20A performance requirements.
- FY07 Recommendations. The Navy should:
  1. Schedule and complete IOT&E of RMS prior to a full-rate production decision on RMS or on RMVs. Conduct sufficient developmental test events prior to the IOT&E to gain confidence in system performance.
  2. Ensure future operational testing of the revised system on the LCS is adequate to fully evaluate effectiveness and suitability.

## Common Submarine Radio Room (CSRR) (Includes Submarine Exterior Communications System (SubECS))

### Executive Summary

- The Navy completed IOT&E of the baseline Common Submarine Radio Room (CSRR) (Increment 1) from September 2006 to April 2007. The baseline CSRR is effective and suitable for current submarine communication requirements.
- The *Virginia* class SSN variant of the CSRR will be tested in 2008 as part of overall *Virginia* class platform IOT&E; this variant is considered an upgraded version of the baseline CSRR.
- The CSRR will achieve full capability in 2012 based on the current plan for incremental development.
- The Navy should re-evaluate the Extremely High Frequency (EHF) communications infrastructure and system architecture in light of the increased importance of EHF communications to submarine operations.

### System

CSRR/Submarine Exterior Communications System (SubECS) is an umbrella program that integrates modern antennas, radios, cryptographic equipment, and messaging systems into a submarine communications network.

- It is intended to provide a common communication system across all classes of submarines and is designed to support the steady infusion of new technology with incremental modernization and replacement of obsolete equipment.
- It establishes common hardware and software baselines.
- *Virginia* class CSRR (designated SubECS) is developed and integrated as part of new construction. Other submarine class radio rooms are replaced with CSRR variants to establish a common radio room baseline.
- The CSRR is an incremental acquisition program. Future increments are intended to address obsolescence issues and add new communications capabilities as they mature.



### Mission

The Submarine Commanding Officer utilizes the CSRR/SubECS for secure, reliable, and covert communications and information dissemination in order to accomplish assigned missions. The Navy intends to use CSRR capabilities to:

- Manage, control, and disseminate command, control, communications, computers, and intelligence information routed to and from submarines in an open architecture
- Enable Net-Ready communications and operations

### Activity

- DOT&E approved Revision 2 to the CSRR Test and Evaluation Master Plan (TEMP), fully incorporating the May 2006 Capability Production Document for CSRR and reflecting other program changes.
- The Navy completed IOT&E of the baseline CSRR (Increment 1) from September 2006 to April 2007. Commander, Operational Test and Evaluation Force (COMOPTEVFOR), the Navy's operational test agency (OTA), conducted separate, scenario-based IOT events on a

*Seawolf* class SSN, an SSBN, and two SSGNs. All testing was conducted in accordance with the DOT&E-approved TEMP and test plans.

- In separate IOT&E reports for each tested submarine class, the OTA evaluated the CSRR as effective and suitable.
- DOT&E published the CSRR Operational Beyond Low-Rate Initial Production Report required by Title 10 in June 2007. In the report, DOT&E concluded that IOT&E was adequate and that the CSRR baseline increment is effective and suitable.

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- The Assistant Secretary of the Navy (Research, Development, and Acquisition) authorized full-rate production of CSRR Increment 1 on August 9, 2007.
- The Navy is updating the CSRR TEMP to address Follow-on Operational Test and Evaluation for planned FY08 and FY09 upgrades to the baseline CSRR.

## Assessment

- The baseline CSRR is effective and suitable for current submarine communication requirements. The Navy has planned adequate operational testing for FY08 and FY09 CSRR upgrades.
- The CSRR will achieve full capability in 2012 based on the current plan for incremental development.
- Due to budget constraints, the Navy will not begin fielding the CSRR on older *Los Angeles* class submarines until 2015.
- The CSRR fielding plan is dependent upon successful IOT&E of the Digital Modular Radio (DMR) Version 6.4 by November 2008. This adds risk to the CSRR program schedule. DOT&E placed the DMR program on operational oversight in May 2006.
- The *Virginia* class SSN variant of the CSRR will be tested in 2008 as part of overall *Virginia* class platform IOT&E; this variant is considered an upgraded version of the baseline CSRR. DOT&E is working to ensure that the Navy fully tests the *Virginia* class variant of CSRR within the overall platform

test program. Although the CSRR is intended to be common across all submarine classes, the CSRR program manager is not currently responsible for the *Virginia* class variant (the CSRR program will assume this responsibility for future upgrades).

- EHF connectivity has become increasingly important to submarine operations. The baseline CSRR adequately implements EHF, but successful EHF communications are highly dependent upon satellite availability and adequate shore support. The testers observed, and the crews reported, frequent problems conducting EHF communications. Contributing to these problems, the Navy's EHF architecture does not appear to be optimized to support rapid restoration of communications following an inadvertent interruption.

## Recommendations

- Status of Previous Recommendations. The Navy has taken effective action on all previous DOT&E recommendations.
- FY07 Recommendations. The Navy should:
  1. Ensure that the *Virginia* class variant of the CSRR is subject to thorough operational testing.
  2. Re-evaluate the EHF communications infrastructure and system architecture in light of the increased importance of EHF communications to submarine operations.
  3. Complete DMR IOT&E as soon as practicable.

## CVN 21 – Next Generation Nuclear Aircraft Carrier

### Executive Summary

- The Navy conducted two test series and issued a Vulnerability Assessment Report in support of LFT&E.
- The Navy updated the Test and Evaluation Master Plan (TEMP), which adequately addresses testing the Sortie Generation Rate Key Performance Parameter (SGR KPP), the LFT&E, and the ship's entire combat system.
- The Navy issued an operational assessment of the risk levels associated with the CVN 21 design to date. The report detailed four high risk areas: Weapons Systems Performance, Command, Control, Communications, Computers and Intelligence (C4I), Information Assurance (IA), and Interoperability.

### System

- The CVN 21 Program is designing and building the new CVN 78 class of nuclear powered aircraft carrier. It has the same hull form as the *Nimitz* class, but many ship systems inside the hull and on the flight deck are new.
- The newly designed nuclear power plant will reduce reactor department manning by 50 percent and produce significantly more electricity when compared to a current CVN 68 class ship.
- CVN 78 will incorporate electromagnetic catapults (instead of steam powered) and have a smaller island with a Dual Band Phased Array Radar.
- Weapons stowage, handling spaces, and elevators have all been redesigned to reduce manning, increase safety, and increase throughput of weapons.
- The Integrated Warfare System will be adaptable to technology upgrades and varied missions throughout the ship's projected operating life.



- CVN 21 is designed to increase the sortie generation capability of embarked aircraft and have increased self-defense capabilities when compared to current aircraft carriers.

### Mission

Carrier Strike Group Commanders will use the CVN 21 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

### Activity

- The Commander, Operational Test and Evaluation Force (COMOPTEVFOR) issued an operational assessment (completed in FY06) which identified four areas of high risk: Weapons Systems Performance, C4I, IA, and Interoperability.
- The Navy completed a study which gave a recommendation for adequately testing the SGR KPP.
- DOT&E approved a revision of the CVN-21 TEMP (Rev B) and the LFT&E Master Plan in preparation for the FY08 Defense Acquisition Board Program Review (postponed from FY07). This Program Review supports the construction contract award.
- The Navy conducted two test series in support of the LFT&E program in FY07:
  - Caisson E, a survivability test of a full-scale section of the bottom of the CVN 21 tested against an underwater explosion threat at Aberdeen Proving Ground, Maryland.
  - Network Survivability testing examined the effects of fire on various components of the extensive computer network of the CVN 21; these tests were conducted at Dahlgren, Virginia, and on the ex-Shadwell fire safety research facility in Mobile, Alabama.
- The Navy completed the Vulnerability Assessment Report 3, which included extensive modeling and simulation and subject matter expert analysis of four threat impact scenarios.

## Assessment

- The updated TEMP (Rev B) now adequately addresses testing of the SGR KPP and testing of the entire ship warfare system.
  - The number of live flight days recommended in the Navy SGR study is acceptable only if the Navy continues to develop and properly validate the models it used as a design aid for the ship. The validated models, in conjunction with the live flight days, should be enough to adequately test the KPP.
  - The Navy decided to develop the Threat D target. This target will be required to adequately test the ship self-defense capabilities.
- Due to the level of maturity of CVN 21 lead ship design (IOT&E is not scheduled until FY16), the operational assessment conducted by COMOPTEVFOR consisted primarily of government and contractor briefings to subject matter experts. The design concept for the ship consisted of two phases. The high risk areas identified by COMOPTEVFOR (Weapons Systems Performance, C4I, IA, and Interoperability) are covered mainly in Phase Two where design has just started.
- The Electromagnetic Aircraft Launch System (EMALS) will be tested at the Naval Air Station in Lakehurst, New Jersey. If EMALS equipment design as installed at the System Development and Demonstration test site continues to diverge

from the ship design, EMALS installation and integration may require additional testing.

- The comprehensive CVN 21 LFT&E plan is now based on:
  - CVN survivability studies
  - Lessons learned from battle damage and flight deck accidents
  - Relevant weapon effects tests
  - Extensive surrogate testing
  - Probability of kill versus probability of hit studies
  - Damage scenario-based engineering analyses of specific hits
  - A total ship survivability trial
  - A full ship shock trial

## Recommendation

- Status of Previous Recommendations. All previous recommendations have been adequately addressed.
- FY07 Recommendations. The Navy should:
  1. Place an emphasis on the Phase Two systems during the FY08 operational assessment.
  2. Evaluate ways to test EMALS that more closely duplicates the ship installation or evaluate ways to perform extended pier side testing of the ship set before risking manned aircraft.

## DDG 1000 *Zumwalt* Class Destroyer

### Executive Summary

- The program continued detailed design, systems integration, and technology risk reduction in FY07 through developmental testing and Engineering Development Model demonstrations.
- The program is conducting an active LFT&E program to gain survivability insights.
- Ship IOT&E is expected to begin in 2013, but the OT&E of the combat system's self-defense capability against anti-ship cruise missiles is expected to conclude in 2012, two years before the Navy's projected availability of a Threat D anti-ship cruise missile target.

### System

DDG 1000 is a new combatant ship with a hull form designed to be difficult to detect on radar. It is equipped with:

- Two 155 mm Advanced Gun Systems that fire the Long-Range Land Attack Projectiles
- Dual Band (X-Band and S-Band) radar
- Eighty vertical launch cells that can hold a mix of Tomahawk missiles, Standard Missiles, Vertical Launch Anti-Submarine Rockets, or Evolved Sea Sparrow Missiles
- Integrated Undersea Warfare system with a dual frequency sonar to detect submarines and assist in avoiding mines
- An ability to embark and maintain MH-60R helicopters and vertical take-off unmanned aerial vehicles

### Mission

- The Joint Force Maritime Component Commander can employ DDG 1000 to accomplish:



- Land Attack Warfare - Joint Surface Strike and Joint Surface Fire Support
- Anti-Surface Warfare
- Anti-Air Warfare
- Integrated Undersea Warfare
- DDG 1000 can operate independently or in conjunction with an Expeditionary or Carrier Strike Group.

### Activity

- The program conducted no operational testing in FY07.
- The Navy conducted a supersonic rail test in September 2007 as part of the LFT&E program. The test was conducted at the China Lake Naval Air Warfare Station, California, with a live warhead against a light structure test article.
- The System Development and Demonstration phase of the LFT&E program is fully defined; the Navy is updating the Test and Evaluation Master Plan and LFT&E Management Plan to reflect these changes.
- The Navy conducted developmental test firings of the Long Range Land Attack Projectile in FY07.
- The Navy continued follow-on Multi-Function Radar (X-Band) testing on the Self-Defense Test Ship.
- The Navy transported the Volume Search Radar Array (S-Band) to Port Hueneme's Surface Warfare Engineering Facility, California, for far field testing to be conducted in FY08.

- Commander, Operational Test and Evaluation Force developed a draft test concept for executing an Operational Assessment in FY08.

### Assessment

- Commander, Operational Test and Evaluation Force maintains access to all developmental test events as appropriate to gain insight to DDG 1000 operational capabilities. The program has what appears to be an effective developmental test program.
- The Navy has not identified adequate facilities for measuring the ship's magnetic, acoustic, infrared, and radar signatures. These facilities are needed no later than the 2013 IOT&E.
- The Navy has not identified an appropriate range for conducting operational end-to-end testing of Land Attack

# NAVY PROGRAMS

Warfare using the Advanced Gun System with the Long Range Land Attack Projectile against realistic targets.

- DDG 1000 will have a crew of less than 150. This is small compared to a DDG 51 crew of more than 300. Current shore support infrastructure and Navy manpower management policies are not fully suited to DDG 1000's unique manning requirements. DDG 1000 will lack onboard administrative/maintenance personnel and facilities traditionally assigned to ships. The Navy has not specified how shore-side logistics, administrative, and maintenance support will be conducted. Additionally, the Navy has not demonstrated how training and assignment strategies will ensure all personnel arrive ready to operate systems and equipment. Several Navy initiatives and pilot programs are in progress that may address these challenges for DDG 1000.
- The Navy has committed funding to develop a Threat-D target. This target would act as a surrogate for a known threat anti-ship cruise missile. However, the Navy's projected delivery of the target is not until FY14, which is two years after anti-ship cruise missile threat testing on the Self-Defense Test Ship is scheduled to complete.

- The DDG 1000 has a robust LFT&E program providing a comprehensive survivability evaluation of the new technologies employed by this new generation of destroyer.

## Recommendations

- Status of Previous Recommendations. The Navy should continue its detailed analysis of manpower and human capital policies to ensure DDG 1000 can be properly manned and maintained upon introduction to the Fleet (FY05). The Navy has partially addressed the single FY06 recommendation for Threat-D development with the securing of funding. However, the Navy's projected delivery of the Threat-D target does not support scheduled Self-Defense Test Ship Operational Testing.
- FY07 Recommendations. The Navy should:
  1. Ensure that the Threat D target development contract includes incentives for earlier target delivery than currently projected.
  2. Develop a plan of action to mitigate the potential impact of late Threat-D target delivery date on the DDG 1000 OT&E schedule.

## Deployable Joint Command and Control (DJC2)

### Executive Summary

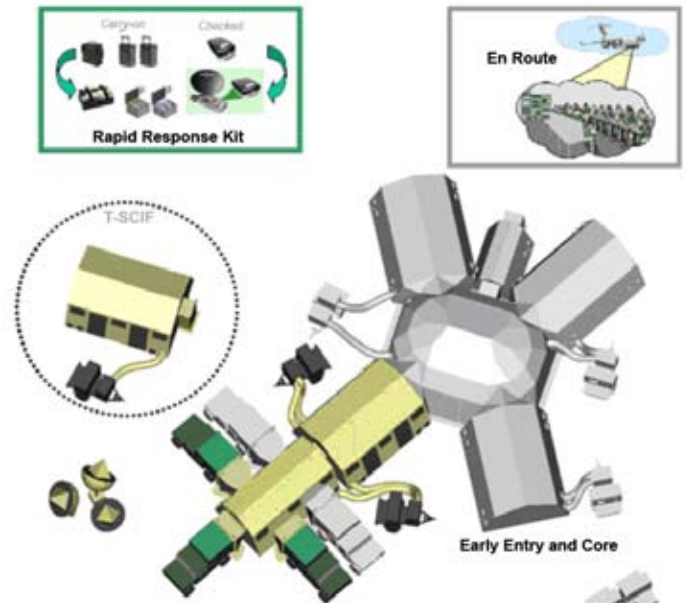
- The Deployable Joint Command and Control (DJC2) completed a series of test events that demonstrated resolution of shortfalls previously identified during the 2006 Multi-Service Operational Test and Evaluation (MOT&E) of Increment I, Spiral 1.0 Early Entry and Core configurations.
- As a result of this testing, Core systems have been fielded to the U.S. Southern and European Commands.
- The program completed risk assessments to determine the appropriate level of testing for the remaining Increment I products.
- The Rapid Response Kit and Spiral 1.1 successfully completed testing in September 2007.

### System

- DJC2 is a deployable integrated family of systems consisting of shelters, generators, environmental control, and communications systems integrated with an information technology system comprised of software applications, databases, and networks.
- DJC2 consists of four basic configurations:
  - A 2 to 15-position Rapid Response Kit reach-back capability which is transit-cased
  - A 6 to 12-position En Route configuration located on an aircraft
  - A 20 to 40-position Early Entry configuration with separate Top Secret Sensitive Compartmented Information Facility (T-SCIF)
  - A 60-position Core configuration with T-SCIF
- The Early Entry configuration is integrated with and becomes part of the larger Core configuration.
- For Increment I, selected Combatant Commands will receive two Core and one En Route configuration systems.
- In addition to the baseline configuration, DJC2 Increment I includes Spirals 1.1 and 1.2. Spiral 1.1 updates various information and communications technologies within the DJC2. Spiral 1.2 introduces a two-man deployable Rapid Response Kit for first responders and small control teams that can be carried on commercial aircraft.

### Mission

- The Joint Task Force commander and the Standing Joint Force Headquarters staff use DJC2 to plan, control, coordinate, execute, and assess operations across the spectrum of conflict.



- The Commander and staff use DJC2 tools and environments for collaborative planning, predictive battlespace situational awareness, dynamic asset synchronization and oversight, and executive battle management and control.
- Commanders use:
  - The Rapid Response Kit for communications and information exchange with small first responder teams
  - The En Route configuration to maintain situational awareness and perform limited command and control as they transit into the theater of operations
  - The Early Entry configuration to establish communications and command and control capabilities for a small 20-man forward element immediately upon getting into the theater of operations
  - The Core configuration for command and control using temporary communications to support continued planning and execution tasks; more robust communications capabilities are supplied by the Joint Communications Support Element, or other communications element, to sustain operations as the staff size increases

# NAVY PROGRAMS

## Activity

- In December 2006, the DJC2 Milestone Decision Authority approved fielding contingent on resolution of outstanding issues identified in the Commander, Operational Test and Evaluation Force (COMOPTEVFOR) report of the MOT&E to include:
  - Successful completion of electromagnetic testing
  - Successful completion of transportability certification
  - Successful completion of environmental testing
- The Joint Program Office completed electromagnetic environmental effects testing, environmental testing, and transportability certification of DJC2 Spiral 1.0 in April 2007. COMOPTEVFOR provided a Verification of Correction of Deficiencies message in March 2007, addressing the shortfalls identified in the MOT&E. In May 2007, DOT&E reported completion of contingent items to the Milestone Decision Authority as outlined in the Acquisition Decision Memorandum.
- In February 2007, the test and evaluation integrated product team completed risk assessments and level of test determinations for the DJC2 Spiral 1.1 design changes and technology upgrades (developmental test with operational test observation), and the Rapid Response Kit (operational test), and the En Route configuration (operational assessment).
- The DJC2 Spiral 1.1 completed developmental testing in September 2007.
- COMOPTEVFOR completed testing for the operational assessment of the Rapid Response Kit in September 2007.
- Internet Protocol Convergence developmental testing, with COMOPTEVFOR observing, was conducted in November 2007.

## Assessment

- The DJC2 program fulfilled the conditions of the Acquisition Decision Memorandum to support fielding of Spiral 1.0 Early Entry/Core configurations to U.S. Southern and European Commands.
- The test and evaluation integrated product team successfully applied the DOT&E policy on testing software intensive systems consistent with the strategy outlined in the DJC2 Test and Evaluation Master Plan.
- Developmental testing of DJC2 Spiral 1.1 showed there were no significant problems with the design changes and technology upgrades.
- Analysis of the data from the Rapid Response Kit operational testing in September 2007 continues. No significant problems were identified during the conduct of the test.

## Recommendations

- Status of Previous Recommendations. The Joint Program Office took effective action on the FY06 DOT&E recommendations.
- FY07 Recommendation.
  1. The Joint Program Office should complete testing of the remaining Increment I products to include the En-Route configuration.

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

### Executive Summary

- In support of the 4QFY07 Milestone C / low-rate initial production (LRIP) decision, DOT&E reported that the demonstrated maturity of the Growler's mission capabilities exceeds planned expectations for this stage of system development.
- The Navy conducted 11 flight test missions that successfully demonstrated the EA-18G's end-to-end capability, including the crew interaction, to detect, identify, and jam simple threats in-flight.
- Based on a successful first operational assessment (OA), the Milestone Decision Authority (MDA) and USD (AT&L) approved entry into the EA-18G LRIP for the first phase (eight kits) of the 26 total planned LRIP EA-18G Airborne Electronic Attack (AEA) kits.
- The Navy's application of integrated testing of EA-18G mission capabilities allowed early identification of higher risk areas. This allowed the Navy more time to aggressively pursue resolution of the identified risks.
- In accordance with the approved plans, the Navy tested only partial EA-18G functionality in support of the LRIP I decision, but has begun testing full EA-18G system functionality in support of the second LRIP.

### System

- The EA-18G Growler is a carrier-based radar and communication jammer.
- 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 AEA capability into the F/A-18F includes:
  - Modified EA-6B Improved Capability (ICAP) III ALQ-218 receiver system
  - Advanced crew station
  - Legacy ALQ-99 jamming pods
  - New Communications Countermeasures Receiver Set (CCS)
  - Expanded digital Link 16 communications network
  - Electronic Attack Unit
  - Interference Cancellation System (INCANS) which supports communications while jamming



- Satellite receive capability via the Multi-mission Advanced Tactical Terminal (MATT)
- Additional systems include:
  - Active Electronically Scanned Array (AESA) radar
  - Joint Helmet Mounted Cueing System
  - High Speed Anti-radiation Missile (HARM)
  - AIM-120 Advanced Medium-Range Air-to-Air Missile (AMRAAM)

### Mission

- Combatant commanders use the EA-18G to support friendly air, ground, and sea operations by suppressing enemy radar and communications.
- Commanders use the EA-18G capabilities to:
  - Jam integrated air defenses
  - 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 more accurate HARM targeting
  - Provide the EA-18G crew air-to-air self-protection with AMRAAM

### Activity

- The Navy completed the first OA of the EA-18G to assess the progress of the Growler's Weapons System development

and integration, in support of a 4QFY07 Milestone C/LRIP decision.

# NAVY PROGRAMS

- The OA included 11 mission representative flight test events at the Atlantic Test Range, Naval Air Warfare Center Patuxent River, Maryland; the Electronic Combat Range at the Naval Air Weapons Center China Lake, California; and the Nevada Test and Training Range Nellis AFB, Nevada.
- In support of the FY07 LRIP decision, the Navy conducted over 100 hour hours of mission systems flight tests on the EA-18G, and over 1,100 hours in the Air Combat Environment Test and Evaluation Facility (ACETEF) chamber.
- OSD approved a second revised Test and Evaluation Master Plan (TEMP) (Revision B) to support the EA-18G program's entry into LRIP, and commencement of an Integrated Test and Evaluation (IT&E) strategy.
- The Navy's IT&E planning in FY07 incorporated EA-18G effectiveness data products that simultaneously support DOT&E's Live Fire Analysis of EA-18G susceptibility to radar-guided threats.
- DOT&E approved the EA-18G Operational Test Framework in FY07, which provides detailed test objectives for the integrated testing, and allows early preparation of detailed test plans for a second OA and the FY09 IOT&E.
- Since the first OA was completed in 2QFY07, the Navy has continued testing the EA-18G AEA system's Core Block I functionality, which includes both hardware (CCS, INCANS, and MATT) and software (Build 2.0).
- The Navy completed over 50 hours of flight test and 800 hours of ground test in the ACETEF with Build 2.0 software.
- The Navy commenced the IT-C1 test period in early FY08, which includes the second EA-18G OA, following DOT&E approval of the test plan. This second OA is designed to support a Program Review prior to the Navy entering the second phase of LRIP in 3QFY08.
- FY07 testing was conducted in accordance with the USD (AT&L)- and DOT&E-approved TEMPs.
- The Navy conducted 11 flight test missions that successfully demonstrated the EA-18G's end-to-end capability, including the crew interaction, to detect, identify, and jam a simple threats in-flight.
- The Navy's application of integrated testing of EA-18G mission capabilities allowed early identification of higher risk areas, allowing the Navy more time to aggressively pursue the three following areas of risk to the EA-18G program:
  - ALQ-218 Receiver software stability
  - ALQ-218 Receiver and Aircraft Antenna threat locating capabilities
  - Mission Planning functionality
- In accordance with the approved plans, the Navy tested only partial EA-18G functionality in support of the LRIP I decision.
  - The Navy and DOT&E were able to evaluate the EA-18G's basic threat signal identification and simple jamming in-flight, an initial version of the mission planning system, and the utility of a two-person crew on some missions.
  - The Navy only assessed the new communications countermeasures set functionality, low band transmitter integration, precision threat locating, complex threat identification, and jamming development maturity. Although the Navy began flight testing these new subsystems and capabilities on the EA-18G in late FY07, they will not be assessed on the EA-18G in a mission environment until the second OA in FY08 is complete.
- To better understand the risks related to maturity of the EA-18G's full system functionality prior to completing the decision to approve 18 additional EA-18G AEA kits in 3QFY08, the MDA added entry criteria for the LRIP II Program Review and IOT&E, including completion of a second OA to support the formal LRIP II Program Review.
- The Navy initiated a third revised TEMP (Revision C) that is aligned with the Capability Production Document that added new requirements, and to incorporate the entry criteria specified in the Milestone C Acquisition Memorandum.

## Assessment

- Based on a successful first OA, the MDA and USD (AT&L), approved entry into EA-18G LRIP for the first phase (eight kits) of 26 total LRIP EA-18G Airborne Electronic Attack kits. Total EA-18G production is planned for 84 aircraft/kits.
- DOT&E provided a LRIP letter in support of the Milestone C decision, stating that testing was adequate, and the demonstrated maturity of the Growler's mission capabilities exceeds planned expectations for this stage of system development.

## Recommendations

- Status of Previous Recommendations. The Navy has taken effective action on the FY06 DOT&E recommendations.
- FY07 Recommendation.
  1. The Navy should submit a revised TEMP (Revision C) that is aligned with new requirements and incorporates applicable LRIP II and IOT&E entry criteria.

## EA-6B Upgrades / Improved Capability (ICAP) III and Low Band Transmitter (LBT)

### Executive Summary

#### ICAP III Block 2

- The Navy demonstrated significant improvement to the EA-6B aircrew's battle-space awareness in the Improved Capability (ICAP) III Block 2 Follow-on Operational Test and Evaluation (FOT&E). This included assessment of the ICAP III's digital link/Multi-function Information Display System (MIDS).

#### Low Band Transmitter (LBT)

- Emerging results of the IOT&E for Low Band Transmitter (LBT) indicate that this new jamming pod will provide improved flexibility and reliability, while providing comparable operational effectiveness to the multiple legacy low band pods it replaces.
- The Navy fielded an early operational capability of the LBT on older versions of EA-6B aircraft in FY07 to support specific operational missions. A Quick Reaction Assessment of LBT in FY06 supported this capability.
- The lack of open air threat resources to support testing the full mission capabilities of LBT limited the Navy's objective evaluation of LBT upon completion of the IOT&E. The Navy relied heavily on subjective side-by-side comparisons of LBT to legacy jamming pods.

### System

#### EA-6B

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

#### ICAP III Block I improvements are designed to provide:

- Enhanced reliability
- A new receiver, processor, and antenna system (ALQ-218)
- New tactical displays/interfaces
- Baseline new joint mission planner
- Better external communications

#### ICAP III Block 2 adds the following to Block 1:

- Improved battle space management capabilities with the MIDS/digital link
- Improved joint mission planner

#### ICAP III Block 3 adds the following to Block 2:

- Upgraded messaging capability for MIDS/digital link
- Capability to employ LBT
- Upgraded end-to-end automatic reactive jamming capability
- Improved joint mission planner



- Improved software to introduce corrections and enhancements previously integrated in older EA-6B systems

#### Low Band Transmitter (LBT)

- LBT improvements over legacy low band pods are designed to:
  - Expand frequency coverage
  - Provide better reliability as the simplified design replaces three low-reliability transmitters

#### USQ-113

- To meet emerging threats, the USQ-113 (V)4 is designed to be more capable and to improve operator utility compared to the fielded USQ-113 system.

### Mission

#### EA-6B

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

#### ICAP III

- Units equipped with EA-6B ICAP III use its improvements to provide:
  - Counters to emerging threats
  - More flexible and effective protection of strike aircraft
  - More accurate HARM targeting

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- Improved battle management and enhanced connectivity to national, theater, and tactical strike assets
- Selective reactive jamming capability to allow automatic detection and jamming of threats as they become active
- Streamlined mission planning and post flight analysis

## LBT

- Commanders use LBT and other EA-6B assets to jam radars and communications.

## Activity

### EA-6B

- EA-6B ICAP III testing in FY07 was conducted in accordance with the DOT&E-approved Test Evaluation and Master Plan (TEMP) (FY06 Revision B) and test plans.

### ICAP III Block 1

- In FY06, the Navy entered EA-6B ICAP III full-rate production following a successful development program and delivery of a DOT&E report to Congress that assessed the system as operationally effective and suitable.

### ICAP III Block 2

- In FY07, the Navy completed FOT&E of the ICAP III Block 2, which included testing of the new battle space management capabilities of the MIDS system, as well as upgraded versions of the new Joint Mission Planning System (JMPS).

### ICAP III Block 3

- The Navy initiated operational test planning in FY07 for the ICAP III Block 3, which incorporates LBT functionality.
- The Navy initiated a third revised TEMP to support planned FY08 ICAP III Block 3 testing.

### LBT

- The LBT is in the System Development and Demonstration phase in preparation for a full-rate production decision early in FY08.
- The Navy fielded an early operational capability of LBT on older versions of the EA-6B in FY07 to support specific operational missions. A Quick Reaction Assessment of LBT in FY06 supported this capability.
- The Navy completed an IOT&E of LBT in FY07 to support a 2QFY08 full-rate production decision. The Navy conducted this test at the Naval Air Warfare Center, China Lake, California, and at the Air Force's Nevada Test and Training Range.
- DOT&E approved the Navy's updated LBT TEMP (Revision A) in FY07.
- LBT testing in FY07 was conducted in accordance with DOT&E-approved TEMP and test plans.

### USQ-113

- To support a Rapid Deployment Capability, the Navy began a Quick Reaction Assessment of the USQ-113 (V)4 communications jammer in FY07.
- The Navy began operational test planning for the EA-6B's upgrades to the USQ-113 (V)4 communications jammer in FY07.

## Assessment

### ICAP III Block 1

- The ICAP III weapons system combines better crew situational awareness with improved speed and accuracy of electronic threat detection, identification, and locating to enhance the suppression of enemy radar-guided threats compared to older EA-6B systems.

### ICAP III Block 2

- The Navy demonstrated significant improvement to the EA-6B aircrew's battle-space awareness in the ICAP III Block 2 FOT&E. This included assessment of the ICAP III's MIDS/digital link.
- The end-to-end automatic functioning of the ICAP III selective reactive jamming capability is not being operationally utilized.
- The current planning techniques for using the ALQ-218 receiver system mission information for post-flight development of regional specific mission intelligence files, do not provide EA-6B operators high confidence in characterizing unanticipated radars for follow-on missions.
- Although the Navy's dedicated testing of JMPS in FY07 indicates JMPS functionality on the ICAP III is adequate, this new mission planner continues to show more deficiencies related to the complex ICAP III mission planning environment when compared to the simpler mission planning environment for older EA-6B systems.

### ICAP III Block 3

- Navy test planners applied ICAP III Block 2/MIDs operational experience to improve testing of new battle space management capabilities for ICAP III Block 3. ICAP III Block 3 testing is planned to be a total system evaluation in mission oriented scenarios, as opposed to a test of discrete components for the first two increments of ICAP III.

### LBT

- Emerging results of the IOT&E for LBT indicate that this new jamming pod will provide improved flexibility and reliability, while providing comparable operational effectiveness to the multiple legacy low band pods it replaces.
- The lack of open air threat resources to support testing the full end-to-end mission capabilities of LBT and AEA platforms and subsystems, limited the Navy's objective evaluation of LBT upon completion of the IOT&E. The Navy relied heavily on subjective side-by-side comparisons of LBT to legacy jamming pods.

# NAVY PROGRAMS

- The open air low band jamming test resource limitations are driven by very narrow frequency jamming restrictions and non-availability of specific threat radars.
- The Navy provided extensive reliability data from the early operational use of LBT, which is critical to evaluating the LBT's suitability prior to the full-rate production decision.

## **Recommendations**

- **Status of Previous Recommendations.** Two of the six issues from previous DOT&E recommendations remain unresolved. The Navy should address the deficiencies found in the process used to develop EA-6B ICAP III mission intelligence files and

continue to develop tactics to operationally employ the ICAP III selective reactive jamming capability (FY05).

- FY07 Recommendations.

## **ICAP III**

1. The Navy should conduct ICAP III Block 3 testing in FY08 as a total system evaluation in a mission environment.

## **Low Band Transmitter (LBT)**

1. The Services should provide adequate test resources to evaluate the full end-to-end mission capabilities of new AEA platforms and subsystems.

# NAVY PROGRAMS

## Expeditionary Fighting Vehicle (EFV)

### Executive Summary

- The Marine Corps is restructuring the Expeditionary Fighting Vehicle (EFV) program to include:
  - Extending System Development and Demonstration (SDD) by four years
  - Redesigning the vehicle for reliability
  - Building second-generation SDD prototype vehicles
- Prior to entering production, the program will conduct another Operational Assessment using the second-generation vehicles.

### System

- The EFV is an amphibious combat vehicle for the Marine Corps.
- The Marines intend the EFV to be capable of high-speed water transit at over 20 knots and have land mobility capabilities comparable to the M1A1/2 tank after transitioning out of the water.
- The EFVC (command variant) is operated by a crew of three and transports a commander and his staff (nine Marines).
- The EFVP (personnel variant) is operated by a crew of three and carries a reinforced rifle squad of 17 Marines. The EFVP carries a stabilized 30 mm chain gun and coaxial machine gun in the turret.

### Mission

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



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

### Activity

- Subsequent to the Operational Assessment conducted in 2006, the Assistant Secretary of the Navy for Research, Development, and Acquisition convened an Independent Expert Panel to review the EFV program. The panel's review was a critical assessment of numerous aspects of the EFV program, including system engineering, contracting, program management, and oversight.
- In June 2007, the EFV program was restructured as a result of a Nunn-McCurdy cost breach, and because of effectiveness and suitability problems identified during the 2006 Operational Assessment.
  - Inadequate performance during the Operational Assessment provided evidence that the program was not ready to proceed into low-rate initial production and that a significant vehicle redesign was required.
  - The restructured plan delays the program's Milestone C low-rate initial production decision approximately 4-1/2 years (from January 2007 to August 2011) to allow

time to design and construct a second generation of SDD phase prototypes. The program will conduct a second operational assessment that would use these redesigned vehicles.

- The restructured program will provide production-representative vehicles for IOT&E and full-up system-level LFT&E.

### Assessment

- The 2006 Operational Assessment was adequate to identify significant vehicle design shortfalls. Unexpectedly, poor vehicle reliability and availability prevented gaining expected operational insights into tactics, techniques, and procedures for the EFV-equipped units.
- The EFV did not demonstrate successful mission performance during the Operational Assessment. Low reliability and the resultant poor system availability were major contributing factors to the unsuccessful mission performance. Reliability,

availability, and maintainability were well below user requirements and program office predictions. The maintenance burden was very high, despite significant and unplanned levels of contractor maintenance personnel augmentation at the test site.

- Water performance and armor protection were compromised. Despite the removal of approximately 1,800 pounds of armor before the start of the Operational Assessment, EFVs often could not get on-plane when combat loaded unless drivers employed a hands-free technique, in which they did not steer while getting on-plane, which typically led to large, unpredictable turns in the water. This would be an unsafe condition for combat with multiple vehicles. The inability to demonstrate this critical performance characteristic without significant and impractical physical modifications to the vehicles and potentially unsafe and tactically unsound operating procedures highlighted a major performance concern.
- There was some encouraging performance in the Operational Assessment. The SDD-phase vehicles demonstrated the ability to keep pace with M1A1 tanks moving cross-country over challenging desert terrain. If poor reliability is fixed, the EFV's 30 mm cannon and thermal sight would provide a significant improvement in combat capability compared to the current amphibious assault vehicle.
- The EFVC's demonstrated reliability was comparable to the EFVP's during the execution of the operational mission attempted during the Operational Assessment. Because of reliability failures, the vehicle did not demonstrate that it could conduct its required over-the-horizon mission. The participating infantry battalion staff praised the installed collaborative software, the staff workstation configuration, and the potential capability to enhance the staff's ability to command and control, but considered that the current

number of installed radios was insufficient and that the vehicle's reliability had to be substantially improved. Poor auxiliary power unit reliability, inability to establish satellite communications or high-frequency communications while in the water, and low server reliability were discovered during the Operational Assessment and can be corrected by the program.

## Recommendations

- Status of Previous Recommendations. With one exception, the Marine Corps took effective action on DOT&E's five FY06 recommendations. Although there are no plans to conduct a second Operational Assessment on the current SDD-phase vehicles (modified with planned reliability-related upgrades as DOT&E recommended) it is possible that these vehicles can be used to support developmental test/operational test events to assess design changes intended to address two major deficiencies found in the 2006 Operational Assessment: (1) inability to maintain directional stability while attempting to achieve high water speed and (2) poor weapon system reliability.
- FY07 Recommendation.
  1. The Marine Corps should conduct two developmental test/operational test events before the critical design review for the second generation SDD-phase vehicles and the following Defense Acquisition Board review; these two reviews are planned for late FY08/early FY09. The focus of one event should be to assess the effectiveness of design improvements planned to prevent EFVs from veering off course while attempting to achieve high water speed. The other event should be designed to assess the effectiveness of turret design modifications that are intended to improve the reliability of the EFVP weapon system.

## F/A-18 E/F Hornet Naval Strike Fighter (All Upgrades)

### Executive Summary

- The fourth period of Follow-on Test and Evaluation (FOT&E) for the F/A-18E/F Super Hornet took place from June through December 2006 concurrent with the APG-79 Active Electronically Scanned Array (AESA) IOT&E. Testing was adequate to assess operational effectiveness and suitability.
- The DOT&E Operational Test and Evaluation Report assessed the APG-79 radar system as not operationally effective and not operationally suitable for combat.
- Commander, Operational Test Force (COTF) also found the APG-79 radar not operationally effective and not operationally suitable for combat, but recommended the system be used for training. Despite the adverse operational test results, the Navy approved full-rate production of the APG-79 in July 2007. The first deployment of AESA-equipped F/A-18Fs is planned for 2008.
- An FOT&E period is planned for 1QFY08 to assess deficiency corrections from the IOT&E, and also to characterize performance in an electronic warfare environment prior to the first deployment of AESA-equipped F/A-18E/F. Performance issues may delay this testing and could result in deployment prior to the completion of operational test and evaluation.
- F/A-18E/F Super Hornet is a system-of-systems. The Navy continues to evaluate subsystems separately with individual Test and Evaluation Master Plans (TEMPs) and test plans. This approach detracts from total mission level evaluation of the Super Hornet platform.

### System

- The Super Hornet is replacing earlier F/A-18 Hornets and F-14 Tomcats in the Navy's carrier air wings. The F/A-18E is a single-seat aircraft and the F model has two seats.
- The H3E software upgrade provides functionality essential to the integration and operation of all Super Hornet Block 2 hardware upgrades. These upgrades provide capabilities including:
  - Single pass multiple targeting for Global Positioning System (GPS) weapons
  - Use of all AIM-9 series infrared-guided missiles, AIM-120, and AIM-7 radar-guided missiles
  - Off-board target designation
  - Improved data link target coordinate precision
  - Implementation of air-to-ground target points
- The APG-79 radar is one of several sub-systems that comprise the F/A-18E/F planned common avionics suite upgrade (Block 2), which will be integrated into Lot 26 aircraft and beyond.
- The aircraft carries the Advanced Targeting Forward Looking Infrared (ATFLIR) system that the aircrew uses in order to locate surface and airborne targets. The ATFLIR will



have an infrared marker and laser target designator/ranger capability in addition to being able to provide infrared and/or electro-optical streaming video via data link. The laser target designator/ranger provides the F/A-18E/F with the ability to obtain GPS-guided weapons quality target coordinates. The laser designator/ranger can also be used for delivery of laser-guided bombs, while the infrared marker provides air-to-ground cueing to both ground and aerial observers equipped with night vision devices.

- The Super Hornet is also fitted with the Shared Reconnaissance Pod, the Multi-Function Information Distribution System for Link 16 tactical data link connectivity, the Joint Helmet Mounted Cueing System, and the Integrated Defensive Electronic Countermeasures system. The Joint Mission Planning System – Maritime is the fleet mission planning system.

### Mission

- Carrier Strike Group Commanders and Joint Force Air Component Commanders use the F/A-18E/F to:
  - Conduct air combat missions
  - Attack ground targets with most of the U.S. inventory of GPS-guided, laser-guided, and free-fall weapons, as well as the 20 mm cannon
  - Fire the High Speed Anti-Radiation missile at enemy radar systems
  - Provide in-flight refueling for other tactical aircraft
  - Provides the fleet with an organic tactical reconnaissance capability available for tasking by the Carrier Strike Group Commander and supported Joint Task Force

# NAVY PROGRAMS

## Activity

- The Navy conducted FOT&E of the Software Configuration Set (SCS) H3E from June through December 2006. F/A-18E/F aircraft flew 976 flight hours in 657 sorties. The APG-79 AESA radar IOT&E was conducted concurrently with AESA H3E FOT&E; four F/A-18F aircraft equipped with LRIP-1 AESA radars flew 377 sorties for 515 flight hours.
- DOT&E approved the TEMP for the H4E software upgrade in April 2007; the APG-79 TEMP revision is in coordination. Simultaneous testing of the APG-79 AESA and H4E is planned. Additional FOT&E is expected for this program to ensure electronic protection functionality.
- DOT&E approved the ATFLIR TEMP for Block 2 testing to be conducted concurrently during the H4E FOT&E period.
- Other sub-systems in test this year include the Combined Interrogator Transponder, Accurate Navigation, and Infrared Search and Track

## Assessment

- The APG-79 radar system, as installed in the F/A-18E/F with SCS H3E, is neither operationally effective nor operationally suitable for combat. The APG-79 IOT&E revealed 22 major deficiencies, which COTF recommended be fixed prior to FOT&E. The program has implemented fixes for 16 deficiencies. These corrections require flight test verification. The program intends to correct the remaining deficiencies in future software releases.
- The program did not demonstrate the APG-79's ability to support multiple AIM-120 missiles in-flight.
- The Navy has expended significant efforts on APG-79 anti-tamper and associated deficiencies with limited time

available to mature and develop deferred modes and capabilities. Electronic protection, the final remaining deficiency from the Super Hornet IOT&E, has been deferred by the program office to a later software release.

- The test program is now event driven with an anticipated spring 2008 fleet deployment. It is highly likely that the first deployment of the AESA-equipped F/A-18F will be prior to FOT&E completion. In this case, the warfighter will deploy without full knowledge of current system performance and limitations.

## Recommendations

- Status of Previous Recommendations. The program has taken effective action on the two remaining FY05 recommendations. However, the following FY06 recommendations remain valid:
  - COTF should continue its efforts to refine and codify its integrated test framework for use by other Navy programs in future testing.
  - The Navy should strengthen its efforts to relieve the shortages of trained personnel at the test squadrons in China Lake.
- FY07 Recommendations. The program should:
  1. Conduct live, end-to-end missile shot testing demonstrating multi-AIM-120 shot capability.
  2. Fully characterize the current AESA electronic protection capability and continue to develop and refine the full electronic warfare capability of the AESA radar.

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

### Executive Summary

- The Navy restructured the program to add a fourth low-rate initial production (LRIP) lot and second phase of operational evaluation (OPEVAL) in FY08.
- All scheduled Live Fire tests have completed.

### System

- This program upgrades two Marine Corps H-1 aircraft:
  - The AH-1W attack helicopter becomes the AH-1Z
  - The UH-1N utility helicopter becomes the UH-1Y
- The aircraft have identical twin engines, drive trains, four-bladed rotors, tail sections, digital cockpits, and helmet-mounted sight displays (HMSD).
- The AH-1Z has a new high-fidelity targeting sensor for delivery of air-to-ground and air-to-air missiles, rockets, and guns.
- The UH-1Y has twice the payload and range of legacy UH-1N aircraft, and it can deliver eight combat-ready Marines 110 nautical miles and return without refueling.

### Mission

- Marine light/attack helicopter squadron detachments are typically deployed with a mixture of UH-1 and AH-1 helicopters.



- Detachments equipped with the AH-1Z attack helicopter conduct rotary-wing close air support, anti-armor, armed escort, armed/visual reconnaissance, and fire support coordination missions.
- Detachments equipped with the UH-1Y utility helicopter conduct command, control, assault support, escort, air reconnaissance, and aeromedical evacuation missions.

### Activity

- In FY07, Commander, Operational Test and Evaluation Force (COMOPTEVFOR) conducted the Operational Evaluation Phase One (OT-IIC- 1) at China Lake, Camp Pendleton, and Twentynine Palms, California; Marine Corps Air Station, Yuma, Arizona; and aboard USS *Bonhomme Richard* (LHD 6) at sea, in accordance with a DOT&E-approved Test and Evaluation Master Plan and Test Plan.
- COMOPTEVFOR used two UH-1Y and two AH-1Z helicopters for the test. As planned, test operations were restricted to mostly daytime and land-based operations.
- The LFT&E program is complete. Nearly 300 shots at components, subsystems, and full-up aircraft were performed. Reporting on the results of the LFT&E program is in process.
- Phase Two operational testing (OT-IIC-2) is planned to begin in January 2008 to support a full-rate production decision in FY08.

### Assessment

- The OT-IIC-1 test was adequate to identify needed performance improvements and the program is working to correct those deficiencies.

- Encouraging performance:
  - Both the UH-1Y and the AH-1Z provide increased range, payload, speed, and maneuverability over legacy aircraft.
  - The UH-1Y nearly met the planning goal for utility helicopter mission success (71 percent attained versus 75 percent goal).
  - In both aircraft, the digital moving map display and navigation aids improve pilot situational awareness and reduce pilot workload.
- The AH-1Z is not yet on a path to be operationally effective.
  - The assault support mission success was 36 percent (17 of 48).
  - Target sight system reliability was poor and had performance issues.
  - Rocket and Hellfire missile delivery was not effective.
- Problem areas for both aircraft:
  - Poor helmet performance limits operations in the expected low-light operational conditions.
  - Both aircraft had poor reliability, numerous human factors issues, and failed to provide over-the-horizon communications.

# NAVY PROGRAMS

- Replacement of composite rotor system components was delayed by the small number of repair parts in the supply system.
- Main rotor gearbox vulnerability to certain ballistic impacts did not meet requirements.
- Poor availability of the LRIP test aircraft for developmental test flights has put the DT program in crisis getting ready for OPEVAL completion, with no spare time available.
- FY07 Recommendations.
  1. OPEVAL Phase Two (OT-IIC-2) should be structured to complement OPEVAL Phase One. Phase Two should include:
    - Ship-based operations, to include take-off and landing in low light levels
    - Assault support operations, with the majority of those operations taking place at night
    - Improved instrumentation for evaluation of gun and rocket engagement accuracy
    - Adequate numbers of flight hours to evaluate aircraft reliability
  2. The main rotor gearbox improvement should be pursued and tested in additional LFT&E.

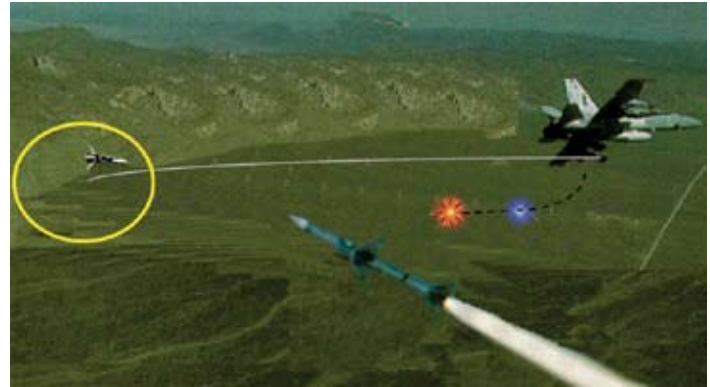
## Recommendations

- Status of Previous Recommendations. The program is making progress complying with DOT&E's FY06 recommendations.
  - For the UH-1Y: Identify and correct the sources of low system readiness
  - For the AH-1Z: Identify and correct the sources of Targeting Sight System failures
    - Develop software that reduces pilot workload, especially during weapons employment
    - Eliminate rocket delivery restrictions

## Integrated Defensive Electronic Countermeasures (IDECM)

### Executive Summary

- The Navy decertified the Integrated Defensive Electronic Countermeasures (IDECM) Block 3 (IB-3) from operational testing in FY07 pending resolution of significant reliability problems related to the decoy deployment that appeared in the FY06 IOT&E.
- The Navy added follow-on development flight tests in FY07 to assess if the decoy was striking the aircraft on decoy deployments. This testing verified one instance of the decoy striking the aircraft, thus damaging the decoy, and causing minor damage to the skin of the aircraft.
- The Navy flight tested corrections to mitigate the IB-3 launcher installation and decoy production issues in FY07 and the Navy confirmed they were corrected on 11 successful decoy deployments. However, the Navy discovered intermittent decoy failures and improper countermeasures transmissions on these development test flights.
- The Navy has identified the root causes of some of the intermittent decoy problems, but some remain unresolved. If these problems are not corrected, they will negatively impact IDECM effectiveness and suitability.
- The Navy should improve ALE-55 Fiber Optic Towed Decoy reliability prior to resuming the IOT&E in FY08.



- 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).

### System

- The IDECM system is a radio frequency, self-protection electronic countermeasure suite on F/A-18 E/F aircraft. The system is comprised of onboard components, which receive radar signals, and employ onboard and off-board electronic jammers.
- There are three IDECM variants: Block I (IB-1), Block II (IB-2), and Block III (IB-3). All three variants combine an onboard radio frequency self-protection receiver and jammer installed on the F/A-18 with an expendable towed decoy that functions as an off-board self-protection radio frequency jammer.

### Mission

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

### Activity

- The Navy decertified IB-3 from operational testing in FY07 pending resolution of significant reliability problems related to the decoy deployment that appeared in the FY06 IOT&E.
- The IB-3 IOT&E was designed to allow the Navy to evaluate the operational effectiveness and suitability of the system as installed in the F/A-18 E/F, and is now planned to re-start in 1QFY08 in support of a 3QFY08 full-rate production decision.
- The Navy added follow-on development flight tests in FY07 to assess if the decoy was striking the aircraft on decoy deployments thus damaging the decoy and the aircraft. These new tests were also designed to provide the Navy developers and operators more flight envelope data, and intermittent failure mode information.
- At DOT&E's request, the Navy's Operational Test Agency, Commander, Operational Test and Evaluation Force,

conducted laboratory testing at the Naval Air Warfare Center's facilities at Point Mugu, California, to evaluate combinations of threat radar signals not available at open air ranges.

- Additional development and operational laboratory testing was carried out against two modern Surface-To-Air-Missile (SAM) systems for the first time at the Air Force's Electronic Warfare Evaluation Simulator (AFEWES) in Fort Worth, Texas.
- IDECM testing in FY07 was conducted in accordance with the DOT&E-approved Test and Evaluation Master Plan and test plans.

## Assessment

- The Navy's IDECM IB-3 fiber optic towed decoy demonstrated improved operational effectiveness compared to the legacy ALE-50 towed decoy, but poor reliability is also adversely impacting operational effectiveness.
- As a result of the follow-on decoy deployment flight testing, the Navy confirmed that the decoy actually struck the aircraft, thus damaging the decoy, and causing minor damage to the skin of the aircraft, on one of four follow-on test IB-3 deployments, resulting in significant delays to operational testing.
- The Navy flight tested IB-3 corrections to mitigate the decoy deployment and decoy production problems in FY07. These problems were confirmed as corrected on 11 successful decoy deployments. However, the Navy discovered intermittent decoy failures and improper countermeasures transmissions on these development test flights.
- The Navy identified the root causes of a portion of the intermittent decoy problems, but some remain unresolved. If these problems remain unresolved, they will negatively impact IDECM effectiveness and suitability, while also driving the decoy use rates well above planned quantities.

- The IDECM failure to track and/or transmit a countermeasure technique against specific threat radar signals was confirmed in laboratory testing. The Navy is investigating this anomaly related to the ALQ-214 onboard receiver jammer which negatively impacts the performance of the off-board ALE-55 Fiber Optic Towed Decoy.
- Only 67 percent of key threats are available for high quality testing due to lack of test resources on open air ranges and in hardware-in-the-loop facilities. However, the four main categories of threats will be adequately represented in development and operational testing prior to the full-rate production decision.
- The primary test resource limitation is the lack of a modern threat using a complex guidance system, which was needed to provide a full quantitative assessment of the primary IB-3 key performance parameter. This limitation is noted in the approved Test and Evaluation Master Plan, and an adequate alternative method of test was used to generate a qualitative assessment.

## Recommendations

- Status of Previous Recommendations. Although the Navy is focusing on improving the ALE-55 Fiber Optic Towed Decoy reliability, both DOT&E recommendations from FY06 remain unresolved. These recommendations center on the Navy improving ALE-55 Fiber Optic Towed Decoy reliability prior to resuming the IOT&E, and the Services providing a validated end-to-end advanced radio frequency guided threat test capability to quantitatively assess airborne self-protection suites.
- FY07 Recommendations. None.

## Joint Primary Aircraft Training System (JPATS)

### Executive Summary

- The Joint Primary Aircraft Training System (JPATS) program reported a Nunn-McCurdy breach in January 2007 and was certified to Congress in June 2007.
- Production of 452 T-6A aircraft for all primary Air Force pilot training is more than two thirds complete. The Navy intends to replace approximately 249 T-34Cs for Navy primary pilot training with the T-6 Avionics Upgrade Program (AUP) aircraft.
- The T-6 AUP incorporates Navy-specific modifications to the cockpit, increases the operational gross weight of the aircraft, requires modification of the two flight training simulators, and modifies academic courseware.

### System

- The JPATS is a system-of-systems for primary flight training, tailored to meet Air Force and Navy initial pilot training requirements.
- JPATS is designed to replace the Air Force T-37B and Navy T-34C aircraft and their associated ground-based training components.
- The JPATS consists of the T-6 Texan II air vehicles, simulators, and associated ground-based training devices; a Training Integration Management System (TIMS); instructional courseware; and contractor logistics support.
- The Navy intends to procure the T-6 AUP, which is a Navy-specific version. In it, the Navy will replace the 3-inch and 5-inch cockpit displays in the T-6A with 5 by 7 inch multifunctional displays; add up-front control panels, two Integrated Avionics Computers (with Global Positioning System (GPS) and flight management system), an inertial reference system, integrated backup flight instruments, and a heads up display. The AUP modifications (including ballast



add approximately 400 pounds to the aircraft weight and raise the maximum takeoff gross weight to 6,900 pounds.

- The Navy anticipates that the AUP will mitigate component obsolescence risks, comply with future Federal Aviation Administration mandated navigational requirements, and reduce the total instrumentation count.

### Mission

- The Air Force, Navy, and Marine Corps use JPATS to train entry-level student pilots in primary flying skills to a level of proficiency at which they can transition into advanced training.
- The Navy intends to transfer some T-45 advanced jet training to the T-6 AUP aircraft.

### Activity

- The JPATS program experienced a Nunn-McCurdy breach in FY07.
- DOT&E participated in multiple meetings to review program information and determine the appropriate steps leading to certification that the program meets Nunn-McCurdy requirements.
- The T-6 AUP avionics upgrades are being developed by the manufacturer, Hawker Beechcraft Corporation, as a company-funded, independent research and development (IR&D) effort.
- DOT&E participated in the Test and Evaluation Master Plan (TEMP) update process. The draft TEMP includes a combined developmental/operational test prior to the T-6 AUP

production decision scheduled for November 2008. A formal follow-on operational test and evaluation will be conducted in FY09. The evaluation will include an end-to-end system level operational test of the T-6 AUP aircraft, simulators, and courseware with a class of students.

### Assessment

- Based upon the cockpit avionics upgrades, the flight training simulators for the T-6 AUP training will be modified to reflect the differences from the T-6A Air Force version. Development of required hardware, software, and courseware will be needed to complete the system-level evaluation.

# NAVY PROGRAMS

- The Navy intends to award a production contract for the T-6 AUP variant in November 2008 if the cost, schedule, and performance requirements are met.
- FY07 Recommendation.
  1. The Navy should conduct a combined developmental/operational test to support the T-6 AUP production decision.

## **Recommendations**

- Status of Previous Recommendations: There are no previous recommendations.

## Joint Standoff Weapon (JSOW) Baseline Variant and Unitary Warhead Variant

### Executive Summary

- The Air Force and Navy test agencies completed testing of a new Joint Standoff Weapon (JSOW) Operational Flight Program (OFP) software configuration that is common to both Baseline and Unitary variants.
  - Testing realized notable improvements in previously deficient JSOW Unitary mission planning software.
  - Testing did not resolve JSOW Baseline submunitions pattern placement inconsistencies observed in previous JSOW Baseline OFPs.
- The Navy completed developmental testing of JSOW Unitary Block II and certified the system ready for IOT&E that will begin in early FY08.
- JSOW Unitary FY08 Block II testing requires survivability model verification with live weapons testing in the appropriate threat environment.



### System

- JSOW is a family of 1,000-pound class, air-to-surface glide bombs intended to provide low observable, standoff precision engagement with launch and leave capability. JSOW employs a tightly coupled Global Positioning System/Inertial Navigation System.
- The JSOW Baseline payload consists of 145 BLU-97/B combined effects submunitions.
- JSOW Unitary utilizes an imaging infrared seeker and its payload consists of an augmenting charge and a follow-through bomb that can be set to detonate both warheads simultaneously or sequentially.

### Mission

- Combatant commanders use JSOW Baseline to conduct pre-planned attacks on soft point and area targets such as air defense sites, parked aircraft, airfield and port facilities, command and control antennas, stationary light vehicles, trucks, artillery, and refinery components.
- Combatant commanders use JSOW Unitary to conduct pre-planned attacks on point targets vulnerable to blast and fragmentation effects and point targets vulnerable to penetration such as industrial facilities, logistical systems, and hardened facilities.

### Activity

- Air Force and Navy operational testing was conducted in accordance with DOT&E-approved Test and Evaluation Master Plans for both the Baseline and Unitary JSOW variants.
- FY07 test activity included the execution of Air Force and Navy operational testing of new JSOW software, OFP Version 10.3 that is common to both Baseline and Unitary variants. At the end of FY07, formal OFP test reporting was in progress.
- In addition to OFP testing, the Navy concluded developmental testing of the JSOW Unitary Block II weapon. At the end of FY07, the Navy certified JSOW Unitary Block II ready for Initial Operational Test and Evaluation (IOT&E). Block II IOT&E will begin in early FY08.

### Assessment

- JSOW OFP 10.3 testing was adequate to support Navy and Air Force decisions to field the upgraded weapon software.
- JSOW Unitary weapons configured with OFP 10.3 demonstrated effective performance and adequate suitability. Notable improvements in the JSOW Unitary mission planning system enable operational users to effectively plan JSOW missions with acceptable work-arounds for minor deficiencies compared to previous JSOW Unitary mission planning capabilities.
- FY05 test results indicated that JSOW Baseline weapons did not achieve consistent payload placement on the desired target in the presence of winds in the target area. Software changes were incorporated into OFP 10.3 to attempt to mitigate

weapons guidance factors that contributed to previously observed submunitions pattern accuracy inconsistencies. At the end of FY07 OFP 10.3 testing, aggregate results for Navy and Air Force testing showed that JSOW Baseline accuracy was within Operational Requirements Document threshold specifications, but anomalies in submunitions pattern accuracies continued to be observed.

- JSOW Baseline submunitions pattern placement inconsistencies still remain largely unexplained in testing. Potential factors that affect weapons pattern placement relative to the desired aim point include differences in weapons release ranges relative to the target, target elevation, wind effects, and/or inherent limitations in JSOW Baseline guidance capabilities. Consistently predictable JSOW Baseline submunitions pattern placement is critical to weapon effectiveness and determines the number of weapons needed to ensure success against a given target. Operational units will have to compensate for pattern placement inconsistencies by employing additional weapons with combinations of offsetting and overlapping patterns and/or weapons dispensing directions to kill targets via target area weapons saturation. Force planners will need to take this into consideration to ensure adequate numbers of aircraft are available to deliver multiple weapons to achieve combat success with JSOW Baseline.

- JSOW Unitary successfully completed Block II developmental testing. The system is ready for IOT&E scheduled for early FY08. DOT&E's 2004 Report on IOT&E and LFT&E of JSOW Unitary cited the requirement to validate JSOW Unitary survivability modeling by actual weapons deliveries in the appropriate threat environment. This testing is to be accomplished as part of Block II testing, though specific details have not been provided by the Navy.

## Recommendations

- Status of Previous Recommendations. Outstanding recommendations from FY05 and FY06 include the requirement for the Navy to identify a test venue to confirm combat effectiveness, suitability, and survivability through operational testing of live JSOW Unitary weapons flown through realistic integrated air defenses.
- FY07 Recommendation.
  1. The Navy should identify a test venue and test approach to confirm the JSOW Unitary survivability modeling with live weapons deliveries in the appropriate threat environment as part of FY08 Block II test efforts.

## Littoral Combat Ship (LCS)

### Executive Summary

- The Navy is pursuing purchase of at least 15 baseline configuration or “Flight 0” ships through FY09, up from 13 reported in FY05.
- The Navy’s Test and Evaluation Strategy is inappropriate for the proposed acquisition strategy.
- Early Operational Assessment reports indicate high-level risks in systems integration, manning, and survivability.

### System

- The Littoral Combat Ship (LCS) is a new class of ship designed to operate in the shallow waters of the littorals where larger ships cannot maneuver as well. It can accommodate a variety of individual warfare systems (mission modules) assembled and integrated into interchangeable mission packages.
- There are two competing basic ship (seaframe) designs:
  - The Lockheed Martin design is a steel monohull.
  - The General Dynamics design is an aluminum tri-maran style hull.
- The designs propose different combat systems for self-defense against anti-ship cruise missiles.
- Both designs use combined diesel and gas turbine engines with waterjet propulsors.
- More than a dozen individual programs of record, involving sensor and weapon systems and other off-board vehicles, have been chosen to make up the individual mission modules. All but three are Acquisition Category (ACAT) II and ACAT III programs.

### Mission

- The Maritime Component Commander can employ LCS to conduct Mine Warfare (MIW), Anti-Submarine Warfare,



- or Surface Warfare, based on the mission package fitted into the seaframe. Mission packages are designed to be interchangeable, allowing the Maritime Component Commander flexibility to reassign missions.
- Commanders can employ LCS in a maritime presence role regardless of the installed mission package based on capabilities inherent to the seaframe.
- The Navy can deploy LCS alone or in conjunction with other ships.

### Activity

- No developmental or operational testing was conducted in 2007.
- In March 2007, the Navy announced that it was restructuring the LCS program because of significant cost growth. The revised acquisition plan reduced the number of Flight 0 ships to be acquired, included a “Fly-Off” between the two seaframe designs in 2009, and called for the start of Flight 1 ship acquisition in 2010. Flight 1 was to be based on the seaframe design selected during the Fly-Off, but would include a Common Combat System and Common Command, Control, Communications, Computers, and Intelligence Systems provided by the government. The revised acquisition plan also called for renegotiation of the contract for LCS 3.

- Those negotiations were ultimately unsuccessful and the LCS 3 contract was terminated.
- In July 2007, the Navy announced its intention to amend the new acquisition strategy to retain the option of acquiring Flight 1 ships based on both seaframe designs.
- The first LCS Mission Package, a partial MIW Mission Package, was delivered at Naval Surface Warfare Center, Panama City, Florida, in September 2007.
- The Integrated Test Team continued to develop plans for LCS 1 and LCS 2 Post-Delivery Tests and Trials, developmental testing, and operational testing, which are now expected to commence in the fall of 2008.

# NAVY PROGRAMS

- Commencement of the System Development and Demonstration Phase (Milestone B) has been postponed to 2008.

## Assessment

- The LCS program does not have an approved acquisition strategy that reflects the acquisition decisions announced during 2007. The multitude of program changes has delayed development of an appropriate test and evaluation strategy, and pending congressional action, appears likely to cause further program revisions.
- The Navy's citation of urgent operational need and stated intention to deploy LCS 1 and LCS 2 as early as possible threatens to compress the post delivery schedules for LCS 1 and LCS 2 and reduce the time available for critical tests and trials normally conducted on lead ships. These tests and trials include developmental testing, deficiency correction, signature measurements, sensor accuracy determination, and determination of operational effectiveness and suitability of the sea frames.
- Pending an approved acquisition strategy, DOT&E's intention is that IOT&E be conducted on LCS 1 and LCS 2 seaframes prior to fleet introduction even though only MIW Mission Packages will be available and those packages will be incomplete. This will provide the warfighters a system for which sea frame mission capability has been determined.
- Several phases of follow-on operational test and evaluation will be required to assess the operational effectiveness and operational suitability of the baseline (fully-capable) MIW,

Anti-Submarine Warfare, and Surface Warfare mission packages.

- The lead Flight 1 ship should also undergo IOT&E before it is introduced into the fleet. If the Navy opts to acquire Flight 1 ships based on both seaframe designs, then IOT&E of both lead ships will be required.

## Recommendations

- Status of Previous Recommendations. The Navy fully addressed two of eight prior recommendations and is making progress on two others. The Navy still needs to complete the risk assessment to confirm that Level I survivability is sufficient for a class of small combatants (FY05). It also must continue its analysis to determine the minimum number of MIW mission module programs of record that will be sufficient to provide genuine MIW capability (FY05). Additionally, the Navy must revise the test and evaluation strategy to conduct IOT&E on the lead ships (seaframes) of each design (FY06). It must also revise LCS lead ship post delivery schedules to include test events such as signature measurement, analysis of performance characteristics, and sensor accuracy to determine basic performance baselines before deployment (FY06). Finally, the Navy must continue detailed manning analyses to determine the appropriate number of personnel necessary to man LCS, with mission packages, given its level of automation and systems integration (FY06).
- FY07 Recommendations. None.

## LPD 17 *San Antonio* Class Amphibious Transport Dock

### Executive Summary

- The Navy postponed LPD 17's IOT&E because of deficiencies in the ship's material condition identified by the Navy's Board of Inspection and Survey. IOT&E is scheduled to commence in early FY08.
- Post-Delivery Tests and Trials (PDT&T) identified significant interoperability problems with the AN/SPS-48E radar enclosed in the Advanced Enclosed Mast Structure (AEM/S).
- Confirmation of self-defense capability against Anti-Ship Cruise Missiles (ASCM) requires an adequate number of high-diver surrogates.

### System

The LPD 17 class ship is a diesel engine powered ship designed to embark, transport, and deploy ground troops and equipment. The troops and equipment move ashore by way of Landing Craft Air-Cushion (LCAC), by displacement Landing Craft Utility (LCU), by helicopter, or by MV-22 tiltrotor aircraft.

- The LPD 17 has a floodable well deck for LCACs.
- Flight deck and hangar facilities accommodate Navy and Marine Corps helicopters and the MV-22 aircraft.
- For self-defense against ASCMs, the Ship Self-Defense System Mark 2 (with Cooperative Engagement Capability) is the combat system that integrates weapons (Rolling Airframe Missiles and MK 53 NULKA electronic decoys) and radars (AN/SPQ-9B short-range radar and AN/SPS-48E long-range radar). Radars are housed in radomes to reduce detection of the ship by enemy radars.
- Two Mk 46 (30 mm) gun systems and smaller caliber machine guns defend against small surface threats.
- Command and Control facilities and equipment to support Marine Corps Landing Force operations are part of the program of record.



### Mission

The Expeditionary Strike Group Commander employs LPD 17 class ships to conduct amphibious warfare. The Commander will use the ship to:

- Accommodate combat and support elements of a Marine Expeditionary Unit or Brigade
- Embark, discharge, and recover LCACs, LCUs, amphibious assault vehicles, and expeditionary fighting vehicles for seaborne assault missions
- Participate in aerial assault by embarking Marine Corps aircraft
- Carry and discharge combat service support elements and cargo to sustain the landing force
- Support non-combatant evacuation operations
- Be loaded and configured to conduct various crisis response missions such as humanitarian assistance

### Activity

- Using representative landing force communications personnel, the Program Office (PMS-317) conducted a developmental test event in January and February 2007 to assess the ship's capability to integrate and support Marine Corps Command, Control, Communications, Computers, and Intelligence (C4I) systems. A similar event is planned for early FY08.
- The Navy's Board of Inspection and Survey attempted to conduct LPD 17's Final Contract Trials (FCT) in March 2007. The FCT transitioned to an unsuccessful trial status when the ship was unable to achieve minimum acceptable equipment for underway operation. The FCT has been rescheduled for October 2007.
- Testing of LPD 17's combat system onboard the Self-Defense Test Ship (SDTS) was not completed. Target issues delayed testing, underscoring longstanding difficulties in acquiring and presenting targets that are representative of challenging ASCM threats. The SDTS-based events are now scheduled to be completed in FY08.
- Commander, Operational Test and Evaluation Force (COMOPTEVFOR) began the first phase of LPD 17 IOT&E in February 2007. To reduce test costs, this phase was conducted in tandem with a Ship Self-Defense System Mark 2 Follow-On Test and Evaluation event. Neither scheduled missile firing event was conducted because of weather

restrictions on the targets. This phase is rescheduled for November 2007.

- The Amphibious Warfare phase of the IOT&E was scheduled to start in July 2007. However, the Navy's Board of Inspection and Survey identified deficiencies in the ship's material completeness during the ship's (incomplete) Final Contract Trials. As a result, the ship's 10-week Post-Shakedown Availability maintenance period was extended an additional five weeks and the Final Contract Trials were rescheduled. The Marine Corps unit tasked with supporting the Amphibious Warfare phase was unable to accommodate these delays because of other operational commitments. Since a replacement unit will not be available until February 2008, the amphibious phase has been postponed until then.
- A third IOT&E phase, also focused on combat systems performance, is scheduled by COMOPTEVFOR aboard LPD 18 in December 2007. This phase will include both "soft-kill engagements" against anti-ship cruise missile targets (BQM-34SH drones) using the NULKA electronic decoy system and non-firing detect, track, and engage exercises against other anti-ship cruise missile targets. As a result of delays in BQM-34SH flight testing, the "soft-kill engagement" operational test may be jeopardized. The final IOT&E phase is a modeling and simulation effort to support an assessment of the ship's Probability of Raid Annihilation requirement. This is expected to be completed in FY09.
- The LFT&E Program has two test events remaining: the Total Ship Survivability Trial is planned for March 2008 and the Full Ship Shock Trial is planned for September 2008.

## Assessment

- During the FCT, the Navy's Board of Inspection and Survey found significant deficiencies related to steering, water production, low-pressure air compressors, air conditioning units, and fire pumps. Significant progress was reported during the subsequent Post-Shakedown Availability, but additional maintenance periods will be required in the fall of 2007 in order to finish incomplete work.

- Once material readiness issues are resolved and the ship is equipped with fully integrated and tested systems, LPD 17 should provide considerable amphibious lift as well as greatly improved information technology, reduced susceptibility, and enhanced living conditions for the crew and embarked Marines.
- The C4I developmental test event clearly showed progress had been made in mitigating risks associated with supporting landing force C4I requirements. The Marine Corps Operational Test and Evaluation Activity observed the event and reported several concerns about C4I capability.
- PDT&T identified AN/SPS-48E radar performance degradation while enclosed in the AEM/S. PDT&T and combat system ship qualification trial have not demonstrated the capability to defend against anti-ship cruise missiles; however, the IOT&E includes a self-defense phase focused primarily on this capability.
- The survivability of the *San Antonio* class ships should be significantly improved over the 1970's-era amphibious ships they will replace. The increased survivability is attributed to: reduced RCS signature design features, strengthened hull girder design, improved bulkhead connections, improved fragmentation protection, fire insulation at fire zone boundaries, and redundant and separated vital systems.
- Aerial target support issues may jeopardize LPD 18 IOT&E in December.

## Recommendations

- Status of Previous Recommendations. The three recommendations made in FY06 remain valid.
- FY07 Recommendations.
  1. Because the AN/SPS-48E radar is critical to the ship's capability to control aircraft and to defend itself, the Navy should correct the problem and conduct OT&E on the fix before deploying the ship.
  2. The Navy should aggressively resolve the shortage of high-diver ASCM targets. Deficiencies with anti-ship cruise missile targets used to test NULKA must also be resolved.

## Mark XIIA Identification Friend or Foe (IFF) Mode 5

### Executive Summary

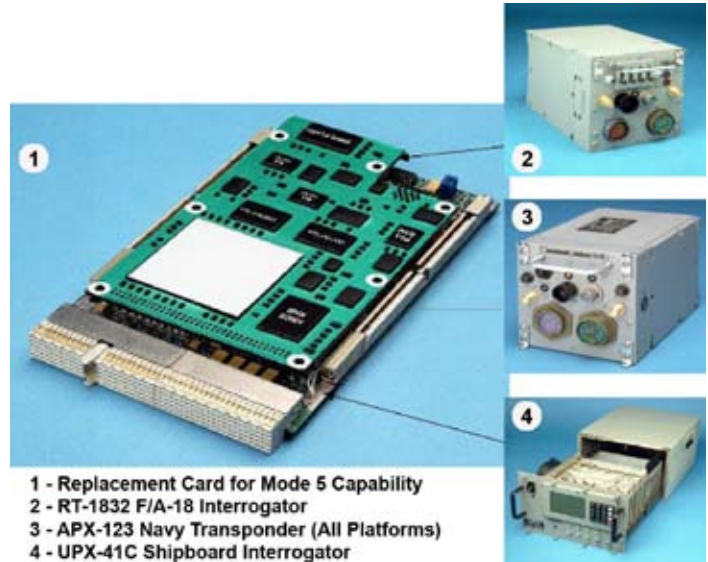
- Independent Mode 5 programs exist in each U.S. Military Service as well as some NATO countries. Although not a joint program, the Services are developing equipment capable of employment on multiple Service platforms. Of the four separate Service efforts, the Navy has the only established Acquisition Category level II program, with incorporation of Service-specific Mode 5 capability through platform specific Engineering Change Proposals (ECPs). The Joint Requirements Oversight Council (JROC) validated a joint requirement for Mode 5 Initial Operational Capability (IOC) of 2014 to achieve Full Operational Capability (FOC) by FY20.
- In 2006, the Navy approved a low-rate initial production (LRIP) decision based on the results of a limited operational assessment, but without a DOT&E-approved Test and Evaluation Master Plan (TEMP).
- Although the Mark XIIA Mode 5 systems are being designed and built to comply with NATO and DoD Identification Friend or Foe (IFF) standards, DOT&E established oversight because of the concern that the multiple programs and vendors add risk to achieving joint interoperability.
- The Navy is planning to lead an IOT&E of Mode 5 capability in FY09 to include significant U.S. joint and allied participation. Successful planning and execution of this IOT&E should resolve DOT&E concerns about the lack of a coherent Mode 5 acquisition and test strategy, joint interoperability, and prevention of fratricide.

### System

- The Mark XIIA IFF Mode 5 is a cooperative identification system that uses interrogators and transponders located on host platforms to send, receive, and process friendly identification data.
- Mode 5 is a military-only identification mode, which modifies the existing Mark XII system and addresses known shortcomings of Mode 4. Mode 5 will eventually replace Mode 4 and allows National Security Agency (NSA) certified secure encryption of interrogations and replies. Primary features include:
  - A lethal interrogation format, which is used by a “shooter” prior to weapons release as a final attempt to get a Mode

### Activity

- The Navy’s 2006 LRIP decision was for Mode 5 equipment intended for Navy platforms and represented 8 percent of the total Navy procurement. For efficiency and savings, the Army utilized the Navy contract to procure nearly one-third of the Army’s Aviation Mode 5 equipment. Individual Army



- 5 reply from the target even with his Mode 5 system in standby; this is intended to reduce fratricide
- A random-reply-delay, which prevents distorted replies from closely spaced platforms
- Mode 5 offers more modern signal processing, compatibility with legacy Mode 4 IFF systems and civilian air traffic control, and secure data exchange through the new waveform.
- Mode 5 serves as a component of a combat identification process used on ground-based systems such as Patriot, sea-based systems such as Aegis-equipped ships, and military aircraft to include the E-3 Airborne Warning and Control System and E-2 Hawkeye.

### Mission

The combatant commander employs the Mode 5 to provide positive, secure, line-of-sight identification of friendly platforms equipped with an IFF transponder. In the future, this system’s information will be combined with other cooperative and non-cooperative combat identification techniques in order to provide identification of all platforms – enemy, neutral, and friendly.

- aviation platform managers are responsible for the integration of Navy supplied Mode 5 equipments into their platforms.
- The Army is developing a Mode 5 Air Defense Interrogator (Lethal Only) for use in the Patriot system.

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- The Air Force Operational Test and Evaluation Center (AFOTEC) intends to test the integration of Mode 5 on the F-15 in mid-FY08.
- Under the OSD-sponsored International Cooperation Initiative for Coalition Warfare, the Navy Mode 5 program office conducted developmental flight tests of Mode 5 with Italian production representative Mode 5 capability. Expanded Cooperative Warfare Program (CWP) trials involving Mode 5 capability integrated into U.S. and allied aircraft will occur over the next several years.
- The Navy is currently developing a strategy for the conduct of an operationally realistic IOT&E of Mode 5 capability that will involve the use of interrogator and transponder-equipped joint Service aircraft of a variety of types using representative flight profiles.
- The Navy submitted, and DOT&E approved, a revised TEMP that will insure that Mode 5 is assessed in an operationally realistic environment that includes, in addition to Navy ship and aircraft platforms, a variety of Army and Air Force systems equipped with Mode 5 capability.
- OSD/AT&L and DOT&E are working with the Services to develop a Joint Acquisition and Test Strategy (JATS) and a Joint Operational Test Approach (JOTA) for Mode 5 across the DoD.

## Assessment

- Although Mode 5 demonstrated good potential to be a significant improvement versus the existing Mode 4, the limitations to scope of testing prevented an adequate operational assessment.
- The Mode 5 equipment used in the operational assessment did not meet all the NATO or U.S. standards, increasing the risk that, without corrective actions, Navy Mode 5 equipment may not be interoperable with other Service or allied developed equipment.

- The Navy operational assessment was not adequate to support the Army's Mode 5 procurement.
- Integration of Mode 5 capability with Army aircraft and the Aegis Combat System was outside the scope of the Navy operational assessment and was therefore not evaluated.
- Ongoing Mode 5 development, integration, and test activities across the Services, although still lacking an overall integration strategy, are increasingly coming together with the Navy taking the lead in developing a TEMP for an IOT&E of Mode 5 capability.
- The JATS and JOTA efforts (as well as the CWP) should help to insure that Mode 5 development, integration, and joint test and evaluation get the proper level of joint coordination and oversight across U.S. and allied Services.

## Recommendations

- Status of Previous Recommendations. In order to ensure interoperability between interrogators, transponders, and combined interrogator-transponders, the Service program managers must continue to integrate their test schedules and look for opportunities to test in a joint environment. The Services should also jointly develop a capstone TEMP (FY05). The FY06 recommendations have been adequately addressed by DoD.
- FY07 Recommendations.
  1. All Services should fully participate in the JATS/JOTA process to insure that Mode 5 capabilities are tested in a realistic joint Service environment.
  2. The Navy should continue to refine its IOT&E strategy to support its Mode 5 full-rate production decision.

## MH-60S Fleet Combat Helicopter

### Executive Summary

- The MH-60S Armed Helicopter (Block 3A) variant underwent IOT&E in FY07.
- The Navy's Operational Test and Evaluation Force (OPTEVFOR) found the Armed Helicopter operationally effective for Carrier Plane Guard, Maritime Interdiction Operations, and daytime Surface Warfare missions. The helicopter was not operationally effective in Combat Search and Rescue and Special Warfare Support missions due to a significant number of Mission Planning deficiencies.
- OPTEVFOR found the Armed Helicopter operationally suitable for the Carrier Plane Guard and Maritime Interdiction Operations missions. The helicopter was not operationally suitable for the Combat Search and Rescue, Special Warfare Support, and Surface Warfare missions due to deficiencies in safety, compatibility, and human factors.
- IOT&E for the Block 2A Airborne Mine Countermeasures (AMCM) variant is scheduled for the first quarter of FY08.

### System

- The MH-60S is a helicopter modified into three variants (Blocks) from the Army UH-60 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 – Vertical Replenishment: precision navigation and communications, maximum cargo, or passenger capacity
  - Block 2 – Airborne Mine Countermeasures (AMCM): AMCM systems operator workstation, tether/towing system, any one of five available mine countermeasure systems

### Activity

- OPTEVFOR conducted dedicated IOT&E for the Armed Helicopter from April through June 2007. The IOT&E consisted of 57 sorties for a total of nearly 173 flight hours. The test covered all of the Armed Helicopter missions. Salvo launch and nighttime HELLFIRE capability were not evaluated due to insufficient HELLFIRE missile availability.
- OPTEVFOR conducted some events under Integrated Testing using mixed developmental and operational testing flight crews. These events included testing of the Integrated Self-Defense systems at Eglin Air Force Base, Florida, and the live fire of HELLFIRE missiles.
- Due to the non-availability of fleet aviation capable ships, VX-1 flew all airborne missions from shore establishments.



- Block 3 – Armed Helicopter: Tactical moving map display, forward-looking infrared with laser designator, crew-served side machine guns, Hellfire air-to-surface missiles, and defensive electronic countermeasures
- Pre-Planned Product Improvements add tactical data link (Link 16) and related upgrades to both Block 2 and Block 3.

### 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 installed on the aircraft
- Block 3: Combat Search and Rescue, Anti-Surface Warfare, Aircraft Carrier Plane Guard, Maritime Interdiction Operations, and Special Warfare Support

- The only shipboard operations conducted were onboard USS *Harry S. Truman* (CVN 75) while pierside at Naval Station Norfolk, Virginia. These operations assessed the carrier's ability to handle, store, and service the Armed Helicopter.
- The Armed Helicopter requirements were set in the Operational Requirements Document (ORD) Change 1, dated June 2006. Recognizing the aircraft would not meet many of those requirements, the Navy drafted ORD Change 2, modifying, lowering, and deleting some thresholds. Change 2 was unsigned as of the end of FY07. At the January 2007 Operational Test Readiness Review, the MH-60S Program Office (PMA-299) acknowledged that it did not expect to meet the Change 1 requirements. In view of this acknowledgement,

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OPTEVFOR and VX-1 designed the operational test to encompass both Change 1 and Change 2 mission profiles.

However, with Change 2 remaining unsigned, the only valid changes to the original ORD are those contained in Change 1.

- The Navy Vulnerability Assessments for the Armed Helicopter and AMCM variant have been received by DOT&E and are under consideration in drafting the DOT&E combined OT&E/LFT&E Report.

## Assessment

- In October 2007, the Navy issued a report finding the Armed Helicopter not effective in Combat Search and Rescue and Special Warfare Support (Overland). In addition, the Navy found the Armed Helicopter not suitable in Combat Search and Rescue, Special Warfare Support (Overland), and Surface Warfare. The effectiveness assessment was due to the helicopter's inability to meet mission radii (all of these are Key Performance Parameters). In addition, many mission planning deficiencies were noted.
- For suitability, the Armed Helicopter failed to meet its Full Mission Capability threshold (a Key Performance Parameter),

and exhibited other reliability, safety, and human factors deficiencies.

- DOT&E regards the IOT&E as inadequate because of its limited scope, particularly the failure to conduct any tests aboard ship as called for in the DOT&E-approved test plan, and the restricted number and type of HELLFIRE shots.
- DOT&E finds that the Armed Helicopter meets its survivability requirements.

## Recommendations

- Status of Previous Recommendations. There were no recommendations made in FY06.
- FY07 Recommendations.
  1. Future testing must include actual embarked shipboard operations as appropriate. When properly structured, the operational test events can provide an excellent training opportunity for the fleet.
  2. The Navy should conduct Pre-Planned Product Improvement testing for the MH-60S and MH-60R during FY08, making use of surface ship assets as needed.

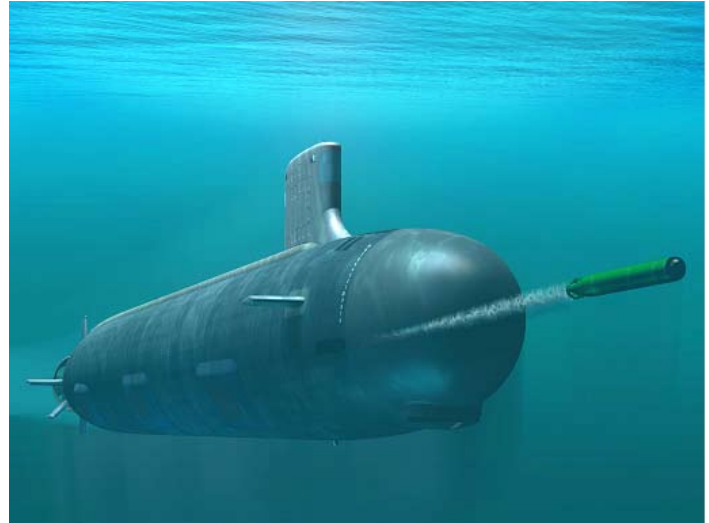
## Mk 48 Advanced Capability (ADCAP) Torpedo Mods

### Executive Summary

- The Mk 48 Mod 7 Common Broadband Advanced Sonar System (CBASS) torpedo successfully completed shallow-water operational testing in May 2006 and deep-water model and simulation regression testing in July 2007. The torpedo's performance is equivalent to the Mk 48 Advanced Capability (ADCAP) Mod 6.
- Due to the Navy's fielding of the Mk 48 Mod 7 CBASS before completing all operational testing, DOT&E issued an Early Fielding Report on CBASS in June 2007.
- The Navy is incorporating some Mk 48 Mod 7 CBASS software features into the Mk 48 Mod 6 torpedo. Initial operational testing started in September 2007.

### System

- The Mk 48 ADCAP torpedo is the primary anti-submarine warfare (ASW) and anti-surface ship warfare (ASuW) weapon used by U.S. submarines.
- Mk 48 ADCAP torpedo mods are a series of hardware and software upgrades to the Mk 48 torpedo.
- Mk 48 Mod 4, Mod 5, Mod 6, Mod 6 Advanced Common Torpedo – Guidance and Control Box (ACOT-GCB), and Mod 7 CBASS are fielded torpedoes.
- Mk 48 ACOT-GCB replaces obsolete Mod 6 hardware and rewrites the software allowing an open architecture torpedo design to allow future software upgrades. Mk 48 ACOT-GCB is designed to have the same performance as the Mk 48 Mod 6.
- The Mk 48 Mod 6 Spiral 1 torpedo is the last planned software upgrade to the Mk 48 Mod 6. This upgrade uses software algorithms from the CBASS to improve shallow-water performance.



- Mk 48 Mod 7 CBASS upgrades the Mk 48 ACOT-GCB with a new sonar and improves torpedo effectiveness through future software upgrades, called Advanced Processor Builds (APB). CBASS is a co-development program with the 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

### Activity

- The Navy's Commander, Operational Test and Evaluation Force (COMOPTEVFOR) accredited the Naval Undersea Warfare Center's (NUWC) Weapons Analysis Center (WAF), a hardware-in-the-loop model and simulation, for side-by-side regression testing of the Mk 48 Mod 6 and the CBASS torpedoes in deep water ASW and ASuW scenarios in July 2007.
- The Navy conducted CBASS side-by-side comparison testing with the Fleet baseline Mk 48 Mod 6 torpedo using the WAF simulation from August 2006 to July 2007. This testing focused on deep-water ASW and ASuW performance. The Navy previously completed in-water, shallow-water operational testing of the CBASS in December 2005 and March 2006. COMOPTEVFOR issued their final report on the OT&E of the Mk 48 Mod 7 CBASS torpedo in July 2007.
- The Navy fielded the CBASS in November 2006 without completing deep-water regression operational testing. In accordance with the FY06 National Defense Authorization Act, DOT&E subsequently issued an Early Fielding Report describing the torpedo's operational effectiveness and suitability based on the testing conducted before fielding.
- The Navy conducted a successful Mk 48 Mod 6 warshot Sink Exercise and Surface Weapons Test in May 2007.
- DOT&E approved the Mk 48 Mod 6 Spiral 1 Test and Evaluation Master Plan (TEMP) in July 2007.
- The Navy conducted shallow-water OT&E of the Mk 48 Mod 6 Spiral 1 torpedo in September 2007.

## Assessment

- The Navy completed adequate operational testing of the Mk 48 Mod 7 CBASS. CBASS in-water test results indicate CBASS shallow-water performance is similar to the legacy Mk 48 Mod 6 torpedo. WAF side-by-side comparisons also indicate similar deep-water performance. However, the original 1998 CBASS Operational Requirements Document (ORD) demanded a considerable effectiveness improvement in more challenging scenarios. The Navy revised the ORD in 2002, requiring that the first phase of CBASS match current Mk 48 Mod 6 performance. This effectiveness goal is remarkably modest since the Mk 48 Mod 6 did not meet its own requirements thresholds.
- Mk 48 ADCAP performance has remained relatively stagnant for more than a decade, despite multiple hardware and software upgrades. The Navy now hopes to achieve ambitious effectiveness improvements with CBASS delivering full capability by the end of the decade via a software APB process.
- In response to two Mk 48 ADCAP failures during a 2003 Ship Sink Exercise, the Navy conducts annual warshot test firings to verify the inventory. Three torpedoes were successfully fired in 2005, one in 2006, and two in 2007. This process is essential in order to verify performance of the inventory of torpedoes.
- The Navy incorporated some CBASS software algorithms into the Mk 48 Mod 6 Spiral 1 torpedo in an attempt to improve shallow-water torpedo performance. Based on the shallow-water performance of the CBASS and the performance thresholds, DOT&E expects the performance improvements to be marginal and still below the threshold set in the original Mk 48 ADCAP ORD.

- The Navy began software development and developmental testing of future CBASS software APBs without completing a TEMP update to cover the developmental and operational testing.

## Recommendations

- Status of Previous Recommendations. The Navy continues to experience test delays, as fleet submarine assets are not available for conducting operational testing. Some improvement has been realized 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 the WAF simulations (FY05). The CBASS torpedo requirements thresholds require significant improvement in torpedo performance in difficult acoustic environments by 2010. The Navy must lay out a credible plan and resources to achieve and test effectiveness improvements with CBASS, delivering full capability by the end of the decade via APB software upgrades (FY06). Although the Navy has started development and developmental testing of future CBASS APBs, a TEMP governing planned development and operational testing has not been developed (FY06).
- FY07 Recommendations.
  1. The Navy must complete an update to the Mk 48 Mod 7 CBASS TEMP.
  2. Operational testing of torpedoes should include a combat system test perspective in achieving mission success of target detection through target kill vice only the combat system element (torpedo) focus.

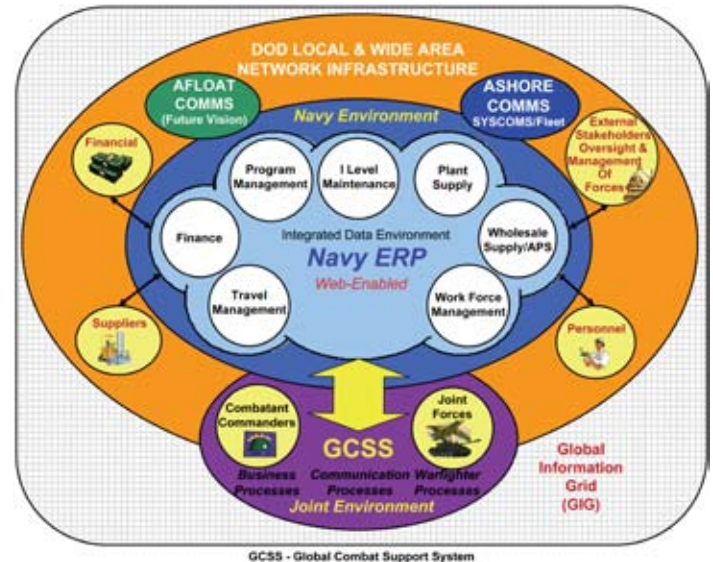
## Navy Enterprise Resource Planning (ERP) Program

### Executive Summary

- During 3Q and 4QFY07, Commander Operational Test and Evaluation Force (COMOPTEVFOR) conducted an operational assessment in a laboratory environment employing both typical users and subject matter experts.
- The Navy Enterprise Resource Planning (ERP) program demonstrates the potential to be operationally effective, suitable, and survivable in the operational environment.
- The system achieved Milestone C in late 4QFY07. The project manager began a limited fielding of the system to Naval Air Systems Command (NAVAIRSYSCOM) in preparation for IOT&E, which COMOPTEVFOR will conduct during 1Q and 2QFY08.

### System

- A major component of the Navy's Global Combat Support System, Navy ERP uses commercial ERP software to manage financial and logistical activities. Some additional software development is necessary to perform unique military requirements.
- Navy ERP provides ERP web services to users worldwide through a Navy Enterprise Portal.
- The program manager is implementing the system in three stages, or releases: financial and acquisition management; wholesale and retail supply; and intermediate level maintenance.
- Navy ERP replaces four Navy ERP pilot systems (Supply Maintenance Aviator Reengineering Team (SMART), SIGMA (Financial System), Navy Enterprise Maintenance Automated Information System (NEMAIS) and CABRILLO (Warfare Center Management)), converging them into a single, integrated system.



### Mission

- The Navy utilizes the Navy ERP program to provide end-to-end management of the Navy's major resources (forces, support material, and funds) from forward deployed forces back to supporting entities.
- The Navy intends to use the ERP program to transform key acquisition, logistics, and financial business activities into an integrated network of decision-making processes and business activities.

### Activity

- During 3Q and 4QFY07, COMOPTEVFOR conducted an operational assessment in a laboratory environment employing selected users and subject matter experts from four Navy System Commands, including NAVAIRSYSCOM, Naval Sea Systems Command, Space and Naval Warfare Systems Command, and Naval Supply Systems Command. The operational testers worked alongside developmental testers.
- During user acceptance testing, the program manager used realistic master scenarios that provided a comprehensive examination of the Navy ERP business processes. Upon completion of the developmental testing, COMOPTEVFOR ran its own scenarios to ensure that high risk areas had been adequately assessed. The operational assessment was

- performed in accordance with the DOT&E-approved Test and Evaluation Master Plan and the Operational Assessment Test Plan.
- The system achieved Milestone C in September 2007 and limited fielding to NAVAIRSYSCOM activities began in preparation for IOT&E, which COMOPTEVFOR will conduct during 1Q and 2QFY08.

### Assessment

- Navy ERP Release 1.0 demonstrates the potential to be operationally effective, suitable, and survivable in the operational environment.
- The commercial software is complex and is sometimes difficult to use; however, the required capabilities work. The

system met developmental test exit criteria with no critical errors in functionality.

- While the business processes appear to have been effectively reengineered, the degree of change is substantial and the learning curve for users will be steep. User roles will need continued adjustments as the system is placed in operation.
- When the system goes live, problems can be expected with managing large files and processing large, data-intensive reports. There will be residual data errors resulting from the legacy system data conversion.
- Penetration and Information Assurance testing found some system vulnerabilities, but they are assessed to be low risk.
- At the time of the operational assessment, the continuity of operations plan lacked sufficient detail. The system's alternate

data center at China Lake, California, will not be fully operational until late November 2007.

## Recommendations

- Status of Previous Recommendations. This is the first annual report for this program. There are no previous recommendations.
- FY07 Recommendations.
  1. The program manager should closely monitor data conversions from the legacy system to preclude major difficulties following limited fielding.
  2. COMOPTEVFOR should test the continuity of operations plan rigorously during IOT&E.

## P-8A Multi-Mission Maritime Aircraft (MMA)

### Executive Summary

- Contractor developmental ballistic vulnerability testing determined dry bay fire suppression system requirements.
- The Critical Design Review and Design Readiness Review took place in June and August 2007, respectively.
- The delivery and first flight of the initial P-8A test aircraft will be delayed approximately 6 months. This has not yet affected the scheduled start of the IOT&E in 2012.
- DOT&E approved the updated Test and Evaluation Master Plan (TEMP) in March 2007.

### System

- The Multi-Mission Maritime Aircraft (MMA) is the Navy's next generation maritime patrol aircraft that will replace the P-3C.
- The MMA is based on the Boeing 737-800 aircraft, but uses the 737-900 extended-range wing.
- It carries and employs anti-ship missiles, air-to-surface weapons, depth bombs, torpedoes, naval mines, sonobuoys, and other expendables.
- The P-8A carries onboard sensors, including radar, electro-optic sensors, and a magnetic anomaly detector.
- Survivability enhancement and vulnerability reduction features are incorporated into the P-8A design.
  - Susceptibility is reduced with an integrated Aircraft Survivability Equipment (ASE) suite that consists of a radar warning receiver, chaff/flare dispenser, directed infrared countermeasures (DIRCM) and Tactical Data Unit (TDU) to control the system. Radio frequency countermeasures, based on a towed decoy, 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 MMA 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 missions

### Activity

- The contractor conducted developmental ballistic testing which evaluated the vulnerability of several dry bays.
- The Critical Design Review, originally scheduled for January 2007, took place in June 2007. The schedule slipped due to delays in completing architectural design drawings, especially for the P-8A mission systems and wiring drawings. Because of the schedule slip, the delivery and first flight of the initial P-8A test aircraft will be delayed approximately 6 months.
- DOT&E approved the updated TEMP with the provision that P-3 flights be retained in the test program to validate the modeling and simulation efforts used to characterize the P-3 baseline performance. Side-by-side comparison P-3 flights can be reexamined in the next TEMP update once the baseline performance is fully understood and validated.

### Assessment

- Ballistic testing demonstrated that contractor designed dry bay fire suppression systems provide significant reductions in vulnerability to threat induced dry bay fire.
- The flight test requirements for the S-1 full-scale structural test article pose a potential risk to the planned LFT&E timeline and Beyond Low-Rate Initial Production (BLRIP) completion timing. Further delays in delivery of the S-1 Live Fire test aircraft will delay the full-scale LFT&E and the completion date of the BLRIP report.
- During the Critical Design Review, the Navy and contractor identified a new high risk area that could potentially further delay the delivery of the Live Fire test aircraft. They are concerned about the continued increases in the amount of

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installation and checkout required during the production of the aircraft.

- FY07 Recommendation.

1. The program should initiate planning for higher fidelity testing and analyses of fuselage fuel tank leakage rates.

## **Recommendations**

- Status of Previous Recommendations. The Navy has initiated planning with DOT&E for future full-scale vulnerability testing of the structural test article and wings (FY06).

## Ship Self Defense System (SSDS)

### Executive Summary

The Ship Self Defense System (SSDS) Mark 2, Mod 1 integration of sensor and weapons systems enhances ship self defense and battle force command/control. However, significant deficiencies with sensor coverage, multi-ship interoperability (command and control), weapon integration, hardware/software reliability, and training must be corrected before the system is operationally effective and suitable.

### System

SSDS is a fiber-optic local area network that uses open computer architecture and standard Navy displays to integrate a surface ship's sensor and weapon systems.

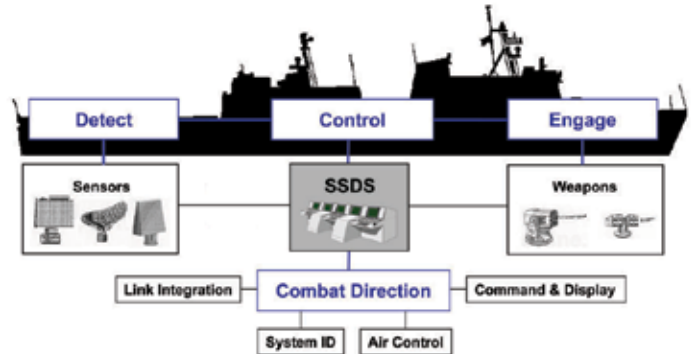
- SSDS Mark 1 is fielded as the combat system in LSD 41/49-class ships.
- SSDS Mark 2 has four variants:
  - The Mod 1 is in development for CVN 68 class aircraft carriers.
  - The Mod 2 is in development for LPD 17 class amphibious ships.
  - The Mod 3 is in development for LHD 1 class amphibious ships.
  - The Mod 4 is in development for LHA replacement amphibious ships.

### Activity

- The Commander, Operational Test and Evaluation Force (COMOPTEVFOR) commenced Follow-on Operational Test and Evaluation (FOT&E) of the SSDS Mark 2 Mod 1 (CVN variant) and Mod 2 (LPD 17 variant) in accordance with DOT&E-approved test plans in mid-FY07. Testing was conducted aboard the Self Defense Test Ship. SSDS Mark 2 Mod 1 testing used the SSDS computer program planned for use during the upcoming USS *Ronald Reagan* (CVN 76) deployment. Testing is planned to complete in mid-FY08.
- COMOPTEVFOR also commenced FOT&E of SSDS Mark 2 Mod 2 aboard USS *San Antonio* (LPD 17) in accordance with a DOT&E-approved test plan in mid-FY07. Testing is planned to complete in mid-FY08.
- The Navy initiated planning for SSDS Mark 2 Mod 2 FOT&E testing to be conducted in early FY08 aboard the USS *New Orleans* (LPD 18).

### Assessment

- Completed SSDS Mark 2 Mod 1 tests indicate that significant deficiencies continue to exist in the areas of weapons system integration and sensor system integration.



### Mission

Navy surface forces use the SSDS to provide automated engagement capabilities for faster and more effective accomplishment of self-defense missions. Maritime Commanders intend to use:

- Mark 1 and Mark 2 to provide automated and integrated detect-to-engage capability against anti-ship cruise missiles.
- Mark 2 to provide faster and more effective command and control for air and surface warfare areas.

- Completed SSDS Mark 2 Mod 2 tests have highlighted problems regarding sensor performance in addition to weapon performance in scenarios that include potential fratricide.
- As a result of deferred SSDS Mark 2 interfaces to the Global Command and Control System-Maritime (GCCS-M) and TPX-42A(V) command and control systems, operators must manually fuse the air and surface pictures displayed on the SSDS console with the blue force picture on the separate consoles. This increases the likelihood of blue-on-blue engagements.

### Recommendations

- Status of Previous Recommendations. The following recommendations remain valid:
  - The Navy should address outstanding computer program trouble reports for future CV/CVN deployments.
  - The Navy should update the Test and Evaluation Master Plan to address the FOT&E of the Evolved Sea Sparrow Missile integration with SSDS Mark 2 Mod 1, Mod 3, and Mod 4.

## NAVY PROGRAMS

- The Navy should fund deferred SSDS Mark 2 interfaces to the GCCS-M and the TPX-42A(V) command and control systems.
- FY07 Recommendations. The Navy should:
  1. Correct the identified SSDS Mark 2 Mod 1 weapon system integration and sensor system integration problems and complete planned FOT&E testing prior to the next USS *Ronald Reagan* (CVN 76) deployment.
  2. Correct the identified SSDS Mark 2 Mod 2 sensor and weapon performance problems and complete planned FOT&E testing prior to the first deployment of the USS *San Antonio* (LPD 17).

## SSGN *Ohio* Class Conversion

### Executive Summary

- The Navy completed full IOT&E of SSGN strike capability and partial IOT&E of SSGN special operations capability. The Navy deferred the remaining SSGN events to Follow-on Operational Test and Evaluation (FOT&E).
- Preliminary analysis indicates that the SSGN is effective and suitable for the land attack strike mission and for special operations missions utilizing a single Drydeck Shelter (DDS). DOT&E expects to publish a Beyond Low-Rate Initial Production Report as required by Title 10 in February 2008.

### System

- The SSGN conversion program involves the conversion of four *Ohio* class ballistic missile submarines into strike and special operations platforms.
- In a full strike configuration, an SSGN is intended to carry up to 154 Tomahawk cruise missiles for land attack strike, with 22 missile tubes carrying seven missiles per tube. In the standard configuration planned for normal operations, an SSGN is intended to carry one DDS or Advanced SEAL Delivery System (ASDS), embarked SEAL teams, and 105 Tomahawk cruise missiles in 15 tubes.
- The SSGN is designed to carry up to two ASDS and/or DDS, allowing submerged lockout and delivery of large numbers of Special Forces personnel. Additionally, the Navy converted two SSGN missile tubes into lockout chambers (LOCs) to allow submerged delivery of smaller numbers of Special Forces without use of ASDS or DDS.
- The conversion includes extensive modernizations to forward electronics, radio, navigation, sonar, and fire control systems.



It also develops an extensive payload capability for future off-board systems and weapons.

### Mission

The Maritime Force Commander can employ the *Ohio* class SSGN for:

- Land attack strike mission, capable of launching Tomahawk cruise missiles
- Special operations missions including all support and planning for two SEAL submersible vehicles
- Traditional attack submarine missions

### Activity

- The Navy conducted SSGN IOT&E from February to August 2007 in accordance with the DOT&E-approved Test and Evaluation Master Plan (TEMP) and Test Plan.
- The Navy completed IOT&E of SSGN strike capability from April to May 2007. USS *Florida* conducted strike communications and simulated Tomahawk missile launches in the Atlantic Ocean while avoiding opposition air, surface, and submarine assets. USS *Florida* also conducted four Tomahawk missile test launches on the Eglin Air Force Base Range Facility, Florida; two of the four missiles were launched in rapid succession as a salvo.
- The Navy completed IOT&E of SSGN special operations support using a single DDS in February and August 2007. The Operational Test Agency conducted two scenario-based test events. The first event utilized Combat Rubber Raiding Craft to deliver Special Operations Forces (SOF) personnel to shore; the other utilized a Swimmer Delivery Vehicle.
- The Navy was unable to demonstrate SSGN Dual DDS capability during IOT&E because of wave damage to the available DDS. The Navy deferred dual DDS testing to FOT&E currently scheduled for December 2008.
- During developmental testing in July 2007, the Navy discovered a design problem that affected the safe operation of LOC hatches while submerged. The Navy deferred testing of special operations LOC capability to FOT&E in order to correct this problem.
- As a result of significant reliability and performance problems with the first ASDS, the Navy determined that the ASDS program could not support SSGN IOT&E in FY07. The Navy deferred testing of the SSGN with ASDS to FOT&E, currently scheduled for March 2008.
- The Navy conducted two tests of the Acoustic Rapid Commercial Off-the-Shelf Insertion (A-RCI) sonar system

installed on an SSGN in April and May 2007. These events tested the ability of the SSGN to search for an enemy submarine and to safely detect and avoid a minefield.

- Concurrent with strike and special operations testing, the Navy completed IOT&E of the SSGN variant of the Common Submarine Radio Room (CSRR).
- DOT&E approved Change 1 to Revision A of the SSGN TEMP in November 2007. This change documents the deferral of LOC, Dual DDS, and ASDS capability to FOT&E.
- The Navy completed SSGN Total Ship Survivability Trials and issued the final installment of the detailed design Vulnerability Assessment Report in support of the SSGN LFT&E program.

## Assessment

- Preliminary analysis indicates that the SSGN is effective and suitable for the land attack strike mission and for special operations missions utilizing a single DDS. DOT&E expects to publish a Beyond Low-Rate Initial Production Report as required by Title 10 in February 2008.
- When configured with a single DDS, the SSGN's capability to deliver SOF personnel to shore is commensurate with the existing capability of DDS-configured SSNs. However, the SSGN provides a significantly improved onboard environment for SOF operations, including better command, control and communications, equipment storage, berthing, and exercise facilities.
- SOF delivery using the SSGN LOCs is limited by the lack of oxygen recompression capability in case of a diver accident. U.S. Special Operations Command (USSOCOM) will not certify the LOCs without this capability. The Navy currently plans to complete the first installation in 2008.
- The existing inventory of six DDS appears to be inadequate to support all four SSGNs and DDS-capable SSNs over the long term.

- The deferral of ASDS and Dual DDS significantly reduces the current SSGN special operations capability. USSOCOM has identified a number of critical potential missions that would require the greater effective range of ASDS and/or the greater capacity of ASDS or Dual DDS.
- The Navy achieved their goal of maintaining the original ballistic missile submarine (SSBN) level of survivability by completing conversion to SSGN without introducing any new survivability deficiencies. However, SSGN missions require the submarine to operate closer to shore and assume a more detectable communications posture. As a result, the SSGN is more susceptible to detection than a typical SSBN.
- SSGN operations would be enhanced by modifying the SSGN High Data Rate (HDR) antenna in order to achieve the same antenna height as the HDR on *Ohio* class SSBNs. The shorter SSGN HDR antenna forces the SSGN to operate at a shallower depth while communicating. This makes control of the SSGN more difficult and results in greater periscope exposure, increasing the submarine's susceptibility to detection.

## Recommendations

- Status of Previous Recommendations. The Navy satisfactorily addressed the FY06 DOT&E recommendation.
- FY07 Recommendations.
  1. The Navy should consider modifying the SSGN HDR antenna in order to achieve the same antenna height as the HDR on *Ohio* class SSBNs.
  2. The Navy and USSOCOM should evaluate and address the apparent shortfall in DDS inventory.
  3. The Navy should add organic oxygen recompression capability for SSGN's to enable SOF delivery without an installed DDS.

## T-AKE *Lewis & Clark* Class of Auxiliary Dry Cargo Ships

### Executive Summary

- The Navy took delivery of T-AKE 2 (*Sacagawea*) and T-AKE-3 (*Alan Shepard*) in 2007. The Navy plans to build 11 ships for the Combat Logistics Force and expects to build three slightly modified ships for the Maritime Prepositioning Force (Future). Nine ships are now under contract and a contract modification for long lead time material for the tenth ship has been awarded.
- IOT&E, integrated with developmental testing, began in August 2006 with T-AKE 1 as the test ship and ended in February 2007 without conduct of the planned Information Assurance testing. The Navy declared Initial Operational Capability in May 2007 and the ship deployed in July 2007. DOT&E issued a combined Operational/Live Fire Test and Evaluation Report in October 2007.



### System

T-AKE *Lewis & Clark* is a class of non-combatant ships designed to carry dry cargo, ammunition, and fuel (in limited amounts) for naval combat forces at sea. Three ships of the class have been delivered to the Navy, and six are under construction or contracted. Eleven ships are planned for the Combat Logistics Force, and options for three additional ships for the Maritime Prepositioning Force (Future) have been negotiated. The T-AKE is:

- Constructed to commercial standards (American Bureau of Shipping) with some additional features to increase its survivability in hostile environments
- Operated by civilian mariners from the Military Sealift Command and a small U.S Navy military detachment
- Propelled with a single shaft and propeller; the shaft will be turned with electric motors powered by diesel generators like many modern commercial cargo ships

- Designed to employ a computerized cargo inventory management system for both ordnance and non-ordnance cargo

### Mission

The Maritime Component Commander will employ the T-AKE *Lewis & Clark* class of ships to:

- Re-supply other ships while connected underway using Standard Tensioned Replenishment Alongside Method rigs and embarked helicopters
- Serve as a shuttle ship to move cargo and ammunition between a port and a larger consolidating replenishment ship, which stays with the Carrier/Expeditionary Strike Group
- Be part of the hybrid combination of ships of the Maritime Prepositioning Force (Future)

### Activity

- LFT&E test activity concluded in November 2006 with the completion of the Total Ship Survivability Trial. The Probability of Kill given a Hit study is nearing completion and the final Vulnerability Assessment Report was completed and signed in October 2007.
- Commander, Operational Test and Evaluation Force (COMOPTEVFOR) began IOT&E in August 2006 using a DOT&E-approved test plan and declared testing complete in February 2007 although the planned Information Assurance testing was not conducted. The lead ship, U.S. Naval Ship *Lewis and Clark*, deployed in July 2007.

### Assessment

- COMOPTEVFOR conducted the IOT&E through observation of at-sea operations and 15 event phases, eight of which coincided with Post Delivery Test and Trials events. Testing was time and cost efficient, as there was minimal duplication of major events. Test planning was adequate. Test execution was not adequate because the planned Information Assurance testing was not conducted.
- The ship exceeded the threshold minimum cargo transfer rate requirement during testing. The ship also exceeded the minimum threshold requirement for fuel transfer.

# NAVY PROGRAMS

- The ship exceeded speed requirements during testing. The calculated range capability exceeded the requirement.
  - COMOPTEVFOR's testing of the torpedo decoy system could not be conducted due to a system design problem.
  - The infrastructure is not in place to conduct full testing and calibration of the Advanced Degaussing System that is intended to reduce the ship's magnetic signature and susceptibility to mines. The facilities in San Diego, California, and Norfolk, Virginia, needed to complete testing will not be available until FY09.
  - The automated cargo management system (Shipboard Warehouse Management System) was not available for testing during IOT&E.
  - The T-AKE is being constructed to commercial American Bureau of Shipping standards, using commercial construction materials and processes that are not as robust as those used in constructing combatant ships. The Navy has incorporated some additional survivability features, such as emergency power and communications that exceed the American Bureau of Shipping standards.
  - The T-AKE is survivable when operating in benign conditions but needs to operate in the company of other naval forces that can provide protection against hostile forces.
- FY07 Recommendations. The Navy should:
    1. Promptly conduct Follow-on Operational Test and Evaluation (FOT&E) to complete the test events required to evaluate Information Assurance and Survivability as contained in the DOT&E-approved IOT&E test plan. In particular, COMOPTEVFOR should operationally test and evaluate the Information Assurance controls for providing capabilities to protect, detect, react, and restore the Information Technology systems in the event of attempted or actual intrusion. An Information Assurance Red Team assessment should be conducted in a realistic operational environment.
    2. Conduct FOT&E to demonstrate correction of deficiencies found during the IOT&E. For Survivability, the ability of the AN/SLQ-25A to reduce the ship's susceptibility to threat torpedoes should be tested and evaluated.
    3. Conduct FOT&E to demonstrate effectiveness and suitability of the Shipboard Warehouse Management System.
    4. Promptly complete the infrastructure upgrade necessary for Advanced Degaussing System testing so COMOPTEVFOR can conduct the deferred phase of that testing.
    5. In collaboration with DOT&E, identify and implement the changes in scheduling and policy required to ensure that required operational testing is completed before ships are made available for deployment.
    6. Incorporate lessons learned from the T-AKE program into appropriate future ship designs such as the Maritime Prepositioning Force (Future) squadron.

## Recommendations

- Status of Previous Recommendations. The FY06 recommendations for testing the acoustic decoy, cargo management system, and degaussing system were not accomplished during the FY07 testing and must be included in future scheduled tests.

## Tomahawk Missile and Weapon System

### Executive Summary

- The upgraded Tomahawk Weapon System is effective for operation with both Baseline III and Baseline IV tactics and procedures, including post-launch command and control of Baseline IV missiles.
- The Navy successfully demonstrated the ability to launch Baseline IV Tomahawk missiles from submarine torpedo tubes.
- Based on FY07 test flights, the Navy appears to have successfully addressed the quality control problems that led to FY06 test flight failures.
- The Navy continues to conduct Operational Test Launches to verify reliability and performance of fielded Baseline II, III, and IV Tomahawk missiles; their associated weapon control systems; and the Tomahawk Command and Control System (TC2S). DOT&E considers the planned Operational Test Launch program to be adequate for continued verification of system reliability and accuracy.

### System

- Tomahawk Land Attack Missile is a long-range, land attack cruise missile designed for launch from submarines and surface ships. Submarine launch can be accomplished from either standard submarine torpedo tubes or separate vertical launch tubes.
- Tomahawk Baselines II and III completed production. There are currently three fielded variants, delivering a nuclear warhead (Baseline II only, not deployed), a conventional warhead, or a conventional warhead with submunitions.

### Activity

- The Navy continues to conduct Operational Test Launches to verify reliability and performance of fielded Baseline II, III, and IV Tomahawk missiles; their associated weapon control systems; and the TC2S. The Navy conducted a total of 12 Tomahawk missile test launches during FY07, including four test launches from an *Ohio* class Guided Missile Submarine (SSGN) in May 2007. The SSGN crew launched two of these missiles in rapid succession to demonstrate SSGN salvo launch capability.
- The Navy successfully launched a Baseline IV missile from a submarine torpedo tube in March 2007 and completed a second successful launch from a United Kingdom submarine in June 2007.
- The Navy completed the current phase (OT-IIID) of Follow-on Operational Test and Evaluation (FOT&E) for Baseline IV Tomahawk missiles, their associated weapon control systems, and the TC2S. OT-IIID included



- Tactical Tomahawk (Baseline IV) is currently in production as the follow-on to the Baseline 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. Although Baseline III weapons can be launched from submarine torpedo tubes, the initial Baseline IV delivery did not include this capability.
- The TC2S provides for targeting, mission planning, and distribution of Tomahawk tactical data.

### Mission

The Maritime Force Commander can employ the Tomahawk missile for long-range, precision strikes against land targets.

- demonstration of torpedo tube launch capability for Baseline IV missiles, a comprehensive operational test of Baseline IV Tomahawk mission planning, execution and post-launch control, and verification of corrective action for deficiencies identified during Baseline IV IOT&E. All testing was conducted in accordance with the DOT&E-approved Test and Evaluation Master Plan and test plan.
- Commander, Operational Test and Evaluation Force (COMOPTEVFOR), the Navy's operational test agency, published the Tomahawk OT-IIID test report in August 2007. COMOPTEVFOR concluded that the Baseline IV Tactical Tomahawk Weapon System (TTWS) was effective, but not suitable. They based this suitability determination on poor software reliability of the Mission Distribution System (MDS), a major element of TC2S.
- The Navy corrected the MDS software reliability problem and completed a satisfactory operational retest in October 2007.

## Assessment

- The Navy OT-IIID test program was adequate to determine the effectiveness and suitability of the upgraded Tomahawk Weapon System.
- The TTWS is effective and suitable for operation with both Baseline III and Baseline IV tactics and procedures, including post-launch command and control of Baseline IV missiles.
- The Navy successfully demonstrated the ability to launch Baseline IV Tomahawk missiles from submarine torpedo tubes.
- Based on FY07 test flights, the Navy appears to have successfully addressed the quality control problems that led to FY06 test flight failures.
- The Navy plans further upgrades to the TC2S and TTWCS in FY08. DOT&E is working with the Navy to ensure the FOT&E program adequately tests the upgraded system prior to fleet introduction.
- 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, the Navy has not funded Baseline II test launches after FY11 and Baseline III test launches after FY12. The Baseline III missiles are expected to remain in operational use until 2020. DOT&E places high value on the continuing collection of flight data to evaluate end-to-end system performance and reliability for all deployed and deployable Tomahawk missile variants.

## Recommendations

- Status of Previous Recommendations. The Navy has adequately addressed the FY06 recommendation.
- FY07 Recommendation.
  1. The Navy should consider extending the Operational Test Launch program for Baseline III Tomahawk missiles to cover the entire period they remain in the fleet inventory.

## V-22 Osprey Joint Advanced Vertical Lift Aircraft

### Executive Summary

- There are two variants of the V-22: the U.S. Marine Corps MV-22 and the Air Force/U.S. Special Operations Command (USSOCOM) CV-22.
- MV-22 Block B integrated testing took place throughout 2007 and culminated with a dedicated operational test period including realistic end-to-end missions. The Block B aircraft demonstrated that it is operationally capable of supporting the required Marine Corps missions, but deficiencies with its radar signal detecting set (APR-39A(V)2), ice protection system, and fuel system should be addressed as soon as possible.
- The Marine Corps declared initial operational capability for the MV-22 in June 2007. The MV-22 Block B deployed to Iraq in the fall of 2007 with Marine Medium Tiltrotor Squadron (VMM)-263.
- CV-22 integrated testing this year included electronic warfare integrated assessments, special operations tactics development, and shipboard interoperability.
- The CV-22 IOT&E planned for FY08 will address USSOCOM missions with a phased approach to electronic countermeasures. The first phase includes the full capability of the radar warning receiver and infrared countermeasures and partial capability of the radio frequency jammer. The second phase of operational testing will follow installation of a new high power jammer and will evaluate the remaining threat systems.

### System

- The MV-22 is the replacement for aging medium-lift CH-46E and CH-53D helicopters.
- It is a tilt-rotor aircraft capable of conventional fixed-wing flight and vertical takeoff and landing.
- It operates from shipboard or shore bases.
- It can carry 24 combat-ready Marines 228 nautical miles (nm) and return.
- It can carry a 10,000-pound external load 40 nm ship-to-shore and return.

### Activity

- All MV-22 and CV-22 testing has been in accordance with the DOT&E-approved Test and Evaluation Master Plan.
- MV-22 Block B Integrated Testing (IT/OT-III A) took place throughout 2007 to assess the operational effectiveness and suitability of the Block B aircraft and to support the initial operational capability decision. This testing also evaluated the correction of MV-22 Block A deficiencies identified in the



- The V-22 can self-deploy up to 2,267 nm with one aerial refueling.
- The CV-22 variant will augment Air Force Special Operations MC-130 aircraft. It has terrain-following, terrain-avoidance radar, and a more robust electronic defense suite.
- Incremental upgrades include several unrelated airframe changes, a ramp-mounted weapon system, a retractable aerial refueling probe, and a personnel hoist.

### Mission

- Squadrons equipped with the MV-22 will provide medium lift of Marines and equipment in support of:
  - Ship-to-Objective Maneuver
  - Sustained Operations Ashore
  - Tactical recovery of aircraft and personnel
  - Self-deployment
  - Amphibious evacuation
- Air Force squadrons equipped with the CV-22 will provide high-speed, long-range insertion and extraction of special operations forces to and from high-threat objectives.

2005 IOT&E. A total of 551.1 MV-22 Block B flight hours were flown during IT/OT-III A.

- The Integrated Testing culminated with a dedicated operational test period (OT-III A), which VMX-22 conducted in February to March 2007. Operationally realistic end-to-end missions were conducted in day and night conditions including fast rope, hoist, aerial refueling, external load, and remote desert

operations. The test encompassed 95.3 Block B flight hours in 22 flight events over an 18-day period at Naval Air Facility El Centro, California.

- Air Force Operational Test and Evaluation Center (AFOTEC) started the CV-22 IOT&E (OT-IIIC) in October 2007. AFOTEC will conduct USSOCOM missions with the CV-22-unique radar and defensive electronic countermeasures systems. Survivability testing will be at Nellis AFB, Nevada; China Lake, California; and Eglin Range Complexes, Florida. Cold weather testing is scheduled to be conducted in Alaska, and an outside the continental United States deployment is planned. The 18th Flight Test Squadron (FLTS) is the Air Force Special Operations Command Operational Test Unit for the CV-22.
- The planned CV-22 cold weather evaluation in Alaska was delayed until the IOT&E. AFOTEC participated in two test events in preparation for IOT&E. The 18th FLTS assessed the ability of the CV platform to support development of swimmer insertion techniques for special operations forces teams and the ability of the aircraft to hoist swimmers. In August, one CV-22 deployed to the USS *Bataan* to demonstrate that the CV-22 can operate in the same shipboard environment as the MV-22.
- The Navy and Air Force conducted a 12-hour Electronic Warfare Integrated Assessment during FY07. The objective of these tests was to perform a limited demonstration of the susceptibility of the CV-22 as a platform in a radio frequency threat environment using a combination of the capabilities provided by the Suite of Integrated Radio Frequency Countermeasures (SIRFC) radar warning, electronic jamming, expendable chaff, and tactics.

## Assessment

- The MV-22 Block B aircraft demonstrated significant improvements over the Block A aircraft and is operationally capable of supporting the required Marine Medium Tiltrotor Squadron (VMM) missions. The V-22 demonstrates improvements in survivability over conventional helicopters, but the current MV-22 radar signal detecting set (APR-39A(V)2) does not adequately address the fixed wing aspect of the MV-22's envelope. The Ice Protection System has reliability problems, and the increased capacity fuel system is cumbersome and workload intensive, requiring significant in-flight attention to manage fuel distribution.
- In December 2006, an MV-22 experienced a post-landing fire in the left nacelle. No one was hurt but high repair costs drove the incident to be a major mishap. The final report on

this incident was released in February 2007 and revealed a degraded fan system within the engine, which caused pressure spikes beyond the capability of the Titanium tubing. The program developed corrective actions.

- In February 2007, the entire fleet of V-22s was grounded for a technical problem with their flight control computer chips. Testing found that in extreme cold temperatures the chip could fail. Every aircraft was inspected and the faulty chips were replaced. The V-22 fleet returned to flight within a week.
- The ability of the CV-22 to perform special operations missions from a ship will be limited. Gross takeoff weight restrictions will limit its ability to perform long-range missions. Radar and SIRFC sensor restrictions in the vicinity of the ship will limit overwater missions (such as search and seizure events). The missile warning sensor was found to have electromagnetic compatibility problems with the shipboard environment and must be reconfigured to operate at the ship. This issue is under investigation.
- A full analysis of the data from the Electronic Warfare Integrated Assessment flight tests is not yet available. Preliminary results indicate that the SIRFC radar warning receiver is mature and ready for IOT&E.
- The electronic warfare defensive suite is still facing challenges. Flight testing in Nova Scotia during FY05 showed that the SIRFC antenna accumulates ice when the aircraft is flown in icing conditions. A redesign to correct the problem has still not been identified. The interim solution is to install a flat plate in place of the radome during a portion of the CV-22 IOT&E.

## Recommendations

- Status of Previous Recommendations. The program has taken effective action on three of the four FY06 and the two FY05 recommendations in DOT&E's FY06 annual report. The following recommendations remain valid:
  - Correct aircraft deficiencies noted in the CV-22 Operational Utility Evaluation report prior to IOT&E in FY08
  - Determine effectiveness of the engine bay fire extinguishing system against actual threat induced fires
  - Devise/improve cabin wall battle damage repair methods and procedures
- FY07 Recommendations. The program should:
  1. Address MV-22 deficiencies with the APR-39, Ice Protection System, and fuel management system.
  2. Work to ensure that the CV-22 defensive suite problems are fully corrected before the aircraft reaches Initial Operating Capability.

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

### Executive Summary

- The Vertical Take-off and Landing Unmanned Aerial Vehicle (VTUAV) program is highly schedule-driven.
- The system has not yet demonstrated the critical mission tasks of Tactical Common Data Link connectivity and payload functionality.
- Critical mission system functionality must be demonstrated before further production.

### System

- The VTUAV system is a helicopter-based tactical UAV consisting of up to three Fire Scout air vehicles with payloads, a Littoral Combat Ship (LCS) integrated Ground Control Station with associated tactical common data link equipment, and the Unmanned Aerial Vehicle Common Automatic Recovery System.
- The VTUAV system is intended to have the following performance:
  - Combat radius: 110 nautical miles
  - Endurance at combat radius: 3 hours on station
  - Target Identification: Fast Inshore Attack craft at 6 km slant range



- Initial payloads include electro-optic and infrared imagers and laser designators.

### Mission

Aviation detachments equipped with VTUAVs will perform reconnaissance, surveillance, target acquisition, and communications relay missions in support of LCS anti-submarine warfare, anti-surface warfare, and mine warfare operations.

### Activity

- The Navy completed an Operational Assessment on March 12, 2007, comprised of 1.8 MQ-8B flight hours and previously completed RQ-8A developmental flight test data, in accordance with a DOT&E-approved Test and Evaluation Master Plan (TEMP) and test plan.
- The Navy approved Milestone C on May 29, 2007. The first low-rate initial production contract procures up to four air vehicles, some payloads, and ground control equipment.
- MQ-8B developmental test flights (using three air vehicles) continue to expand the flight envelope.

### Assessment

- This is the first report on the VTUAV program.
- The system has yet to demonstrate a reliable data link, provide reliable payload imagery, or conduct shipboard operations in other than limited, benign conditions. VTUAV has not demonstrated software compatibility with the Coastal Battlefield Reconnaissance Asset (COBRA) payload.

- The dependency of VTUAV upon the LCS schedule could affect system development.
- The program has not demonstrated the capability to support the missions of an LCS, and does not have sufficient LCS deck time to meet the scheduled IOT&E date.
- Air vehicle survivability is degraded by the lack of a means to sense when it is being detected or engaged by threat systems.

### Recommendations

- Status of Previous Recommendations. DOT&E did not submit an FY06 report on VTUAV.
- FY07 Recommendations.
  1. The system should demonstrate critical mission capabilities before a second low-rate initial production decision.
  2. The Navy should rigorously pursue the activities outlined in the approved TEMP.

# NAVY PROGRAMS

## VH-71 Presidential Helicopter Fleet Replacement Program

### Executive Summary

- The VH-71 replaces existing presidential support helicopters.
- Increment 1 provides seven test articles and five production aircraft with reduced capability in the near term.
- Increment 2 provides two new test articles and 23 modified production aircraft that vary significantly from Increment 1 aircraft.
- The program remains schedule driven vice event based.
- The Navy initiated Increment 1 Live Fire testing.

### System

- The VH-71 aircraft replaces the current U.S. Marine Corps fleet of 11 VH-3D and eight VH-60N Helicopters flown by Marine Helicopter Squadron-One to perform the presidential lift mission.
- The VH-71 is a dual-piloted, multi-engine helicopter based on the Augusta EH-101 (pictured).
- The Navy intends the VH-71 to be capable of operating worldwide in day, night, or adverse weather conditions.
- The communications system will provide the ability to simultaneously conduct short- and long-range secure and non-secure voice, data, and video communications. It can also exchange situational awareness information with outside agencies, organizations, and supporting aircraft.
- Procurement of Increment 1 aircraft will include seven test articles and five pilot production (low-rate initial production) aircraft.
- Procurement of Increment 2 aircraft will include 10 low-rate initial production aircraft and eight full-rate production aircraft. If it proves impractical to retrofit the five pilot



production aircraft, five more production aircraft will be added at the end of Increment 2 production.

### Mission

- Marine Helicopter Squadron-One, using the VH-71 aircraft, will provide safe and timely transport of the President and Vice President of the United States, Foreign Heads of State, and other parties as directed by the White House Military Office.
- The VH-71 is required to operate from commercial airports, military airfields, Navy ships, and austere sites throughout the world.

### Activity

- The DoD is working to restructure the VH-71 program. DOT&E has not approved the Test and Evaluation Master Plan (TEMP) for the VH-71. DOT&E continues to support the established and long-standing policy of “fly-before-buy.”
- The Navy initiated Increment 1 Live Fire testing in accordance with the approved strategy.
- The program conducted a successful Increment 2 System Requirement Review in April 2007.
- Test Vehicle 1 (a pre-production EH-101 prototype) conducted landings on the White House lawn during January 2007. Landings assessed rotor downwash effects and pilot workload.
- Test Vehicle 2, the first government test article, achieved first flight on July 3, 2007.

- The integrated test team, including operational test personnel from Marine Helicopter Squadron One, continues to refine and merge developmental and operational test plans.

### Assessment

- The LFT&E is progressing as planned.
- The Increment 2, Milestone C decision is essentially a full-rate production decision as most Increment 2 aircraft will be on contract before completion of IOT&E.
- Significant differences between Increment 1 and Increment 2 aircraft increase the amount of required testing for Increment 2.

# NAVY PROGRAMS

- The current design is overweight. Increment 1 and Increment 2 performance will likely fall short of required range and airspeed.

## **Recommendations**

- Status of Previous Recommendations, The program should execute the VH-71 program on an event-based, rather than schedule driven, basis. The program has made little progress in this regard (FY06).
- FY07 Recommendations. The program should:
  1. Increase the scope of the Operational Assessment conducted to support the Increment 2, Milestone C decision.
  2. Conduct additional Operational Assessments to reduce the risk of an unsuccessful IOT&E and to support subsequent production decisions.
  3. Continue with the planned LFT&E program.



## **Air Force Programs**



## **Air Force Programs**

## 20 mm PGU-28/B Replacement Combat Round

### Executive Summary

- The Air Force conducted LFT&E of the Penetrator with Enhanced Lateral Efficiency (PELE) in accordance with a DOT&E-approved test plan.
- The PELE exhibited lethality against all targets engaged during qualification and Live Fire testing.
- The PELE exhibited the capability to produce damage off the main axis of penetration as a result of the lateral fragmentation produced upon target impact.

### System

- The Air Force initiated the PGU-28/B replacement program following significant safety issues with the PGU-28/B that resulted in its removal from use. The Air Force sought to restore a combat capability through non-developmental means and chose the PELE 20 mm projectile as the candidate system.
- Alliant-Tek Systems (ATK) and Diehl Munitionssysteme of Germany, in a cooperative effort, developed the 20 mm PGU-28/B replacement cartridge by integrating the PELE projectile with an ATK 20 mm cartridge case.
- The PELE does not use explosives or a fuzing mechanism. Rather, it is a kinetic energy projectile that converts forward momentum into lateral fragmentation and penetration.
- The projectile case is steel, whereas the inner core is plastic. Target impact causes the plastic filler to expand in diameter with very high pressure. The rapid expansion of the plastic filler ruptures the steel case, achieving fragmentation with lateral velocities of about 300 meters per second.



- The PELE cartridge is intended to be compatible with F-15, F-16, and F-22 aircraft.

### Mission

Fighter aircraft pilots will use the PELE cartridge to produce mission kills against enemy fighter and light civilian aircraft, produce mobility kills against light utility vehicles, and to inflict personnel casualties.

### Activity

- In 1996, the Air Force's 46th Test Wing of the Air Armament Center conducted side-by-side ballistic testing of four candidate replacement rounds for the PGU-28/B semi-armor-piercing high explosive incendiary projectile. Based upon those results, the Air Force selected the PELE as the most suitable candidate and proceeded toward completing developmental and operational testing, and ultimate fielding of the replacement projectile.
- During the 3/4QFY07, the 46th Test Wing conducted qualification and Live Fire testing of the PELE.
- The Air Force conducted test shots from a fixed gun mount against personnel targets (plywood mannequins) and against materiel targets (trucks with diesel and gasoline stowed, armored personnel carriers, and a Cessna aircraft).
- The Air Force also conducted F-16 air combat missions from various altitudes, attack azimuths, and attack elevations against personnel targets (plywood mannequins) and against materiel targets (trucks, armored personnel carriers, and a parked F-16 aircraft).

- The Air Force has completed LFT&E and OT&E (Force Development Evaluation). The Air Force 53rd Wing is preparing a fielding recommendation based upon test results and will present that recommendation to the Air Combat Command (ACC) during 2QFY08. Future procurements of the PELE will be based upon ACC's fielding decision.

### Assessment

- The PELE exhibited significant lethality against personnel targets.
- The PELE exhibited significant lethality against the truck targets and the Cessna target. The main penetrator exhibited potential to penetrate not only the thin skin of the targets, but also the engine blocks. The penetrator exhibited adequate fragmentation (breakup) to achieve lethality effects off the main axis of penetration. The penetrator also exhibited potential to initiate fires when impacting stowed gasoline.

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- The PELE perforated the armor on the armored personnel carrier with sufficient energy to cause internal damage to components and personnel.
- The PELE exhibited lethality along and adjacent to the main axis of penetration against the F-16 aircraft. Fragmentation caused significant damage to electrical, control, and hydraulic lines.

## **Recommendations**

- Status of Previous Recommendations. This is the first annual report for this program. There are no previous recommendations.
- FY07 Recommendations. None.

## Advanced Extremely High Frequency (AEHF) Satellite Communications System

### Executive Summary

- Production representative user terminals will not be available at the start of Advanced Extremely High Frequency (AEHF) operational testing for sea and air platforms. If the Navy and the Air Force terminal programs continue to lag in the development and modification of the user segment, adequate operational testing will be at risk.
- The contractor expended an unforeseen amount of schedule time to resolve first-time test article and satellite test fixture problems. This will most likely impact the launch schedule.
- Test planning activities are progressing satisfactorily to support integrated testing and dedicated operational test and evaluation. However, operational testing of the AEHF satellite's anti-jam capabilities in a realistic threat environment poses unique challenges for the AEHF program.

### System

- AEHF represents the third generation of Extremely High Frequency Satellite Communications capability protected from nuclear effects and jamming activities.
- The AEHF system will follow the Military Strategic, Tactical, and Relay (Milstar) program as the protected backbone of 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: The space segment comprises an integrated constellation of Milstar and AEHF satellites.
  - Mission Control segment: The control segment includes fixed and mobile telemetry, tracking, and commanding sites; fixed and transportable communication planning elements; and the common user interface with the Space Ground-Link Subsystem and the Unified S-Band capability.



- Terminal (or User) segment: The terminal segment includes ground fixed, ground mobile, man-portable, transportable, airborne, submarine, and shipboard configurations.
- The first AEHF satellite will have the capabilities of a Milstar II satellite at launch, but the software will be upgraded to full AEHF capability after the launch of the second satellite, which will be launched as a fully capable AEHF satellite.
- The Defense Acquisition Board authorized fabrication and assembly of the first three satellites and development of the Control and User segments.

### Mission

Combatant commanders and operational forces worldwide intend to use the AEHF system to provide secure, responsive, and survivable space-based, strategic and tactical military communications.

### Activity

- The integrated test team's planning activity focused on preparation for operational test of three distinct segments: communications planning, command and control, and resource monitoring.
- The program conducted inter-segment testing using a Milstar satellite simulator which demonstrated interoperability and backward compatibility of the AEHF Satellite Mission Control System with the legacy Milstar system. This was an important step in preparation for the control of the legacy Milstar system with the new AEHF control segment next year.
- The program conducted interoperability testing of the Milstar crosslinks with the AEHF crosslinks, and it conducted

significant risk reduction testing of the AEHF control segment with the AEHF space segment.

- An extensive rewrite of the Test and Evaluation Master Plan (TEMP) is underway to accommodate the substantial program changes that have occurred since the original TEMP was approved in 2001.
- During integrated system testing, the program identified a potential technical problem with Low Data Rate (LDR) legacy terminal satellite acquisition in the presence of the Extended Data Rate (XDR) waveform.

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## Assessment

- For effective mission performance and successful Multi-Service Operation Test and Evaluation, the program must aggressively synchronize the development of AEHF space, mission control, and user segments.
- If the potential LDR legacy terminal problem is significant, and the XDR waveform interferes with legacy terminal operation, legacy terminal users will be obliged to either accept a degradation in performance or retrofit a filter.
- The contractor expended an unforeseen amount of schedule time to resolve first-time test article and satellite test fixture problems. This will most likely impact the launch schedule.
- Test planning activities are progressing satisfactorily to support integrated testing and dedicated operational test and evaluation.

## Recommendations

- Status of Previous Recommendations. There were no FY06 recommendations. The Air Force made progress on FY05 recommendations; two of the original five FY05 recommendations remain valid. While the Air Force is planning for integrated testing of AEHF, the Services should resolve user terminal delivery schedules to support both space segment operations and operational testing requirements. The integrated testing should exercise network control interoperability and user segment terminal configuration compatibility.
- FY07 Recommendation.
  1. The Air Force should test the anti-jam capabilities of the AEHF antennas in an operationally relevant manner.

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

### Executive Summary

- AIM-120C-7 Advanced Medium-Range Air-to-Air Missile (AMRAAM) operational testing completed in August 2007. Nine of 11 operational test events were successful.
- AIM-120D is currently in developmental testing by the Air Force and Navy at Eglin Air Force Base and China Lake Naval Weapons Station.

### 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.
- The AMRAAM program develops and incorporates phased upgrades periodically.
- The latest version, the AIM-120C-7, completed operational testing in August 2007. It incorporates 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 will deliver performance improvements over the AIM-120C-7 through the use of an internal Global Positioning System, an enhanced data link, 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.
- A single launch aircraft can engage multiple targets with multiple missiles simultaneously when using AMRAAM.

### Activity

- The AIM-120C-7 operational testing started in February 2005 and was originally scheduled to complete in March 2006. Air Force and Navy operational testing discovered two minor software deficiencies. The Air Force lead test agency combined operational testing with the software corrections into the remaining test period in 2007. Of 11 operational test events scheduled, nine were successful in completing their objectives.
- Developmental testing of AIM-120D, the next variant of AMRAAM, continues. The AIM-120D is planned to provide significant improvements in capability, to include Global Positioning System-assisted guidance and data link.

### Assessment

- The AIM-120C-7 completed operational testing over a year behind schedule.

- With the exception of the timeline, testing to-date has been in accordance with the DOT&E-approved Test and Evaluation Master Plan and associated test plan.
- AIM-120D developmental and operational testing has been impacted by AIM-120C-7 developmental delays. The model for AIM-120C-7 must be validated prior to modeling for the AIM-120D.
- Range scheduling priorities between major defense programs, coupled with target presentation failures, have caused significant delays in completing live fire and captive carry tests.
- Potential software changes made as a result of operational testing may need to be retested on AIM-120D to ensure operational effectiveness.
- Failed target presentations of full-scale targets (QF-4) and sub-scale targets (MQM-107) caused multiple missile shoot

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delays. Failures included availability, operator performance, and in-flight malfunctions altering target presentation and/or delayed testing. DOT&E estimates there were 6-8 months in program delays due to target related issues.

## Recommendation

- Status of Previous Recommendations. The following FY05 and FY06 recommendations remain valid:
  - DOT&E recommended the program office include enough test missiles to adequately characterize effectiveness and suitability for the AIM-120D. DOT&E remains concerned the current number of shots planned may be insufficient to address all requirements and fully characterize operational effectiveness.
  - The Navy and Air Force should establish an independent validation plan for the models used for effectiveness evaluation. This plan must be approved by DOT&E prior to use.
- The Range Commander's Council, in coordination with all test ranges and laboratories, must incorporate a seamless exchange of information between the various range and laboratory subject matter experts and provide better access to test resource availability for range users.
- FY07 Recommendations. The program office should:
  1. Ensure that modeling is complete and validated for the AIM-120C-7 prior to modeling for the AIM-120D.
  2. Seek changes to the Air Force full-scale and sub-scale target programs to ensure proper target presentation, target reliability, and availability.

## ALR-69A Radar Warning Receiver (RWR)

### Executive Summary

- The Air Force entered the first phase of low-rate initial production (LRIP) (10 units) for the ALR-69A Radar Warning Receiver (RWR). However, due to limited performance, the Air Force's Milestone Decision Authority established specific entry criteria in the LRIP Acquisition Decision Memorandum prior to entering a larger second LRIP in FY08.
- Following the formal completion of the Operational Assessment (OA), the Air Force incorporated several key re-designs to ALR-69A software, hardware, and aircraft integration efforts.
- The Air Force, in coordination with DOT&E, added a series of additional tests in FY07 to augment the OA and provide more recent information on ALR-69A maturity prior to the LRIP decision.
- DOT&E concurred with Air Force Operational Test and Evaluation Center (AFOTEC) that during the formal portion of the OA, the ALR-69A did not demonstrate potential for operational effectiveness and suitability. Additional testing prior to the LRIP decision demonstrated some system performance improvement however there was also system performance regression in other areas based on developmental test provided SoftWareVersion 6.X test data. DOT&E observed considerable improvements to ALR-69A hardware stability, aircraft integration, and system stability.
- The Air Force must ensure that ALR-69A maturity and ground testing meet the Milestone Decision Authority's required entry criteria prior to commencing the second OA in FY08.

### System

- The ALR-69 is a RWR that detects, identifies, and locates threat electronic signals.
- The Core ALR-69A RWR is designed to improve performance over the Air Force's primary RWR system, the ALR-69, by enhancing:
  - Detection range and time
  - Accuracy of threat identification
  - Location of threat emitter systems
  - Performance in a dense signal environment
  - Reliability and maintainability
- It is designed for transport and fighter aircraft. Lead platforms are the C-130H and F-16C Block 30.
- Core ALR-69A RWR components include:
  - Digital quadrant receivers
  - Countermeasures computer



- Control indicator
- Azimuth indicator
- The Air Force incorporated spiral developments, which are incremental improvements to the core system, to provide the most significant new ALR-69A capabilities. These ALR-69A spirals are designed to improve the Core ALR-69A's threat-locating capabilities, which enable the following:
  - Spiral 1: Accurate threat-locating capability by single aircraft
  - Spiral 2: Location of threat emitters through a multi-aircraft network, accurate enough for destruction with Global Positioning System-guided munitions
  - Spiral 3: Specific Emitter Identification. Currently RWRs classify threats as general threat systems, but the Specific Emitter Identification is designed to "fingerprint" a specific threat.
- Spiral 1 is temporarily unfunded and development is on hold. Spiral 2 is part of the program of record and being assessed as an advanced concept technology demonstration effort. Spiral 3 is unfunded.

### Mission

- Combatant commanders will use ALR-69A to enhance the survivability of transport, fighter, and special operations aircraft on missions that penetrate hostile areas.
- Commanders use the ALR-69A to provide aircraft self-protection by warning pilots of radar threats, supporting threat avoidance, or permitting timely use of defensive countermeasures.

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## Activity

- The Air Force entered the first phase (10 units) of ALR-69A LRIP in FY07.
- AFOTEC, the Air Force's Operational Test Agency, completed the first OA of the ALR-69A in FY07 in support of the LRIP decision.
- The dedicated ALR-69A OA events were all ground-based test events. The Air Force utilized the Electronic Warfare Avionics Integrated Support Facility, Warner Robins AFB, Georgia, and the Integrated Demonstration and Applications Laboratory, Wright-Patterson AFB, Ohio. The Air Force tested ALR-69A aircraft integration on the MC-130/C-130 aircraft in the Benefield Anechoic Chamber, Edwards AFB, California.
- Following the formal completion of the OA, the Air Force incorporated several key re-designs to ALR-69A software, hardware, and aircraft integration efforts.
- The Air Force, in coordination with DOT&E, added a series of additional tests in FY07 to augment the OA and provide more recent information on ALR-69A maturity prior to the LRIP decision. These additional ALR-69A test events included MC-130 and C-130 flight tests at Eglin AFB and Duke Field, Florida.
- The Air Force replaced the MC-130 lead transport aircraft for ALR-69A integration with the Air Mobility Command's (AMC) C-130H.
- DOT&E approved a second revised ALR-69A Test and Evaluation Master Plan (TEMP) in FY07. This revised TEMP supports LRIP requirements, the new phased ALR-69A LRIP acquisition strategy, and clarifies suitability resources needed for ALR-69A IOT&E.
- FY07 ALR-69A testing was conducted in accordance with the DOT&E-approved TEMP.

## Assessment

- The Air Force's OA was adequate to support the ALR-69A LRIP decision.
- The ALR-69A experienced software stability problems in the first OA.
- DOT&E concurred with AFOTEC that during the formal portion of the OA, the ALR-69A did not demonstrate potential for operational effectiveness and suitability. However, based on additional testing prior to the LRIP decision, DOT&E observed considerable improvements to ALR-69A hardware stability, aircraft integration, and system stability.
- ALR-69A end-to-end utility as a RWR has not been demonstrated because onboard operators could not see the simulated threats due to a cluttered display. However, the availability of manually derived post-flight detection information in the follow-on testing mitigates some of the risk.
- The Air Force entered the first phase of LRIP (10 units) and the Milestone Decision Authority established specific entry criteria in the LRIP Acquisition Decision Memorandum prior to entering a larger second LRIP in FY08.

## Recommendations

- Status of Previous Recommendations. The Air Force has taken effective actions on DOT&E's previous recommendation.
- FY07 Recommendation.
  1. The Air Force should ensure ALR-69A maturity and ground testing meet the Milestone Decision Authority's required entry criteria prior to commencing the second OA in FY08.

## B-2 Radar Modernization Program (B-2 RMP)

### Executive Summary

- The B-2 Radar Modernization Program (RMP) experienced technical maturity problems in developmental testing that precluded the system from entering IOT&E in FY07.
- Developmental test efforts were temporarily suspended in mid-FY07 to enable the Air Force to re-evaluate RMP progress and re-structure the program to resolve the technical challenges that had resulted in performance deficiencies. All aspects of the revised RMP strategy were not yet finalized at the end of FY07; however, resumption of developmental testing in late FY07 indicated that the system was making progress in resolving the problems that had occurred earlier in the year.
- At the end of FY06, the program had little margin to meet its planned classified fielding date. The additional challenges realized in FY07 suggest that the program is unlikely to meet this date. The program's Milestone C date has moved from FY07 to FY08 in light of technical maturity challenges.

### System

- The B-2 is a multi-role, low-observable bomber capable of delivering conventional and nuclear munitions. It has four turbofan engines and twin side-by-side weapons bays.
- The B-2 RMP features an Active Electronically Scanned Array radar operating on a new frequency.
- System avionics include a multi-mode radar, Global Positioning System-aided navigation, and a Defensive Management System for radar warning functions.
- The bomber's principal conventional weapons are the 2,000-pound and 500-pound Joint Direct Attack Munition.

### Activity

- B-2 RMP testing was conducted in accordance with the January 2004 DOT&E-approved B-2 Capstone Test and Evaluation Master Plan.
- Developmental test and evaluation, as part of the System Development and Demonstration (SDD), was ongoing throughout FY07. Technical maturity problems in SDD hampered RMP progression in developmental testing. The Air Force temporarily suspended testing and initiated program re-planning efforts. The program's FY07 Milestone C date will not occur as planned but will instead slide to calendar year 2008 in concert with Air Force re-planning efforts. As of the end of FY07 the Air Force had yet to finalize the revised RMP program strategy.
- An Air Force Operational Test and Evaluation Center Operational Assessment (OA) of RMP progress in developmental testing was ongoing in FY07. The OA was suspended in light of the technical maturity problems realized



### 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.

in developmental testing. Further OA data collection will be required to assess RMP maturity in FY08 prior to system entry into IOT&E.

### Assessment

- RMP did not demonstrate sufficient progress in developmental testing to meet the program's planned FY07 Milestone C date. Technical maturity problems resulted in numerous system failures and re-starts during flight, misrepresentation of radar-displayed weather phenomena, and inconsistent radar return display in the cockpit during developmental testing.
- The Air Force initiated re-planning efforts to resolve RMP maturity challenges, and at the end of FY07 progress was noted in resumed developmental testing. The Air Force RMP re-structure strategy is expected to be formalized in early FY08.

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- Due to the program re-structure, Milestone C is not anticipated until mid-calendar year 2008, and the program is not likely to meet its original classified operational fielding date.
- FY07 Recommendation.
  1. The Air Force should finalize RMP re-structure efforts as soon as is practicable to enable operational test planners to adequately prepare for RMP IOT&E.

## **Recommendations**

- Status of Previous Recommendations. There are no outstanding recommendations from FY06.

## Battle Control System – Fixed (BCS-F)

### Executive Summary

- The Battle Control System – Fixed (BCS-F) is used in North American Aerospace Defense (NORAD) air defense sectors (ADS) and regional air operations centers (RAOC) to provide surveillance, identification, and control of U.S. and Canadian airspace.
- The Air Force and Combatant Commander Northern Command (NORTHCOM) approved the merging of the Southeast ADS and Northeast ADS into a single Eastern ADS located at the previous Northeast site.
- NORTHCOM approved fielding BCS-F Spiral 2 at the Western ADS and Eastern ADS.
- The National Capital Region (NCR) Integrated Air Defense System (IADS), established after 9-11, underwent baseline testing.

### System

- BCS-F is a tactical air battle management command and control system.
- BCS-F is intended to replace the legacy AN/FYQ-93 and the NORAD Contingency Suite. The NORAD Contingency Suite is a system that was put in place after 9-11 to help with the increased operator workload. However, BCS-F (the system of record) provides the mainland U.S. ADS and Hawaii and Alaska RAOC with common commercial off-the-shelf hardware and an open architecture software configuration.
  - Spirals 1 and 2, developed through September 2007, have satisfied many of the BCS-F requirements. These spirals relied upon a 9-11 contingency system to do much of the over land analysis.
  - Spiral 3 will transition to a Linux operating system and use the Solipsys Tactical Display Framework. This spiral will eliminate the need for the contingency system. Additionally, this spiral will share much of the software used on a similar ground-based system, BCS-Mobile.
- Each BCS-F system requires some customization due to the different interfaces required at each of the sites.



- BCS-F is a bi-national program with Canada.
- The NCR IADS was established after 9-11 to coordinate air defense of the NCR. In addition to the civilian aviation system, it added Sentinel radars and optical/infrared sensors for detection and identification of air traffic. The NCR IADS includes both pedestal-mounted Stingers and ground-based Advanced Medium-Range Air-to-Air Missiles for defense.

### Mission

- NORAD forces and Homeland Defense forces use BCS-F to monitor and control U.S. and Canadian airspace.
- Forces use the BCS-F to monitor air traffic in and approaching U.S. airspace, and to pass information regarding air traffic onto air defense and national command authorities.
- The Air Force uses the BCS-F to control air defense assets, including fighters, to intercept and identify potential air threats to U.S. airspace.
- The NCR IADS is charged with defending the NCR from air threats.

### Activities

- The BCS-F team conducted Spiral 2 software load periods for Interim Contractor Support (ICS) Builds 1 and 2 at the Eastern and Western ADS facilities. Builds, or software repairs, fix system deficiencies between spirals.
- BCS-F Spiral 2 ICS Build 3 system fix is undergoing contractor and developmental testing, with a software load period scheduled for November 2007 at the Eastern and Western ADS facilities.
- NORTHCOM approved the BCS-F Spiral 2 fielding at the Western and Eastern ADS facilities.
- While the BCS-F program has been working on developing a Spiral 3 Test and Evaluation Master Plan (TEMP), it has not been submitted for DOT&E approval.
- BCS-F Spiral 3 has begun contractor testing with observation by government testers.
- The Air Force and the Army conducted baseline and certification testing of the NCR IADS. This testing included both the developmental and operational testing and

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evaluation, Information Assurance certification testing, and interoperability certification testing.

- The NCR IADS testing is ongoing and is scheduled to conclude with an Operational User Evaluation (OUE) in November 2007.

## Assessment

- The current Operational Requirements Document was developed prior to 9-11, with annex updates dated February 20, 2003. Therefore, the Air Force needs to review and update their test planning documents for DOT&E review and approval.
- DOT&E's emerging results are that the testing was adequate to demonstrate that the BCS-F Spiral 2 is an improvement over the legacy air defense command and control software, the FYQ-93, but not as effective as the current NORAD Contingency Suite for the Western and Northeastern ADS facilities.
  - Deficiencies include human-machine interface immaturities (the ability to connect to the NCR Sentinel radar network); a remote display system being delivered to higher headquarters locations; operator handbook updates; and displaying flight plans generated by the Federal Aviation Administration.
  - Testers also experienced workstation and server failures.
- Spiral 2 testing was accomplished without a DOT&E-approved TEMP or Operational Test Plan, as testing was conducted during a transition to DOT&E oversight. The BCS-F program

has been adjusting to OSD oversight since becoming an Acquisition Category-1 program in March 2006.

- BCS-F Spiral 3 operational testing may be delayed due to the lack of an approved TEMP. The program development is hindered by an inability to develop and maintain a stable acquisition, testing, and fielding schedule.
- Ongoing development of the Spiral 2 ICS builds place the BCS-F Spiral 3 schedule at risk.
  - The program has provided DOT&E a plan for managing the parallel development and testing of two separate Spirals.
  - Scarce test resources and personnel place Spiral 3 efforts at risk if Spiral 2 continues at its current pace.

## Recommendations

- Status of Previous Recommendations. The Air Force has not updated its test planning documentation. The Air Force needs to update the Operational Requirements Document (ORD) to reflect changes in BCS-F's mission requirements (FY06). The Air Force should reconsider funding upgrades to the NORAD Contingency Suite if BCS-F is the objective system for the ADS and RAOC facilities, while keeping the NCS in-place at both the Western and Northeastern ADS facilities until Spiral 3 is fielded (FY06).
- FY07 Recommendations. The Air Force must:
  1. Expedite the completion of Spiral 3 TEMP to avoid jeopardizing program progress.
  2. Develop a plan for managing the parallel development and testing of two separate Spiral 2 and 3 efforts.

## C-5 Avionics Modernization Program (AMP) and Reliability Enhancement and Re-engining Program (RERP)

### Executive Summary

- The C-5 Reliability Enhancement and Re-engining Program (RERP) experienced a Nunn-McCurdy breach in September 2007. OSD is reviewing the current program.
- The existing acquisition strategy is no longer executable due to cumulative program delays and funding shortfalls. An updated C-5 acquisition strategy for full modernization should include both RERP completion and programmed correction of AMP deficiencies.
- DOT&E approved a C-5A/C AMP operational test that was completed in July 2007.
- The observed performance of the C-5 AMP modifications on A/C-models, as well as previously tested B-models, is not adequate as a baseline for RERP.
- The C-5 AMP modifications are not operationally suitable.

### System

- The C-5 is the largest four-engine, military transport aircraft in the United States. The C-5 has 36 pallet positions and can carry a maximum payload of 270,000 pounds. The typical crew size is seven.
- The Avionics Modernization Program (AMP) 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 functionality.
- The RERP provides 50 reliability enhancements, plus new commercial engines, nacelles, thrust reversers, and pylons.



### Mission

- Units equipped with the C-5 perform strategic airlift, emergency aero-medical evacuation, transport of brigade-size forces in conjunction with other aircraft, and delivery of outside or oversize cargo to the warfighter.
- The C-5 must be able to execute missions at night, in adverse weather conditions, and in civil-controlled air traffic environments around the world.
- The C-5 receives in-flight aerial refueling for extended-range missions.

### Activity

- The C-5 RERP experienced a Nunn-McCurdy breach in September 2007, at the end of the fiscal year. OSD is reviewing the current program.
- The C-5A/C AMP OT&E flying began on January 16, 2007, at Travis AFB, California. Data collection ended with a simulator mission on May 11, 2007. The single C-5C aircraft completed test flights and entered Programmed Depot Maintenance on April 26, 2007. Review of maintenance data ended in July 2007.
- The C-5C OT&E consisted of 13 overseas airlift sorties and 18 local training sorties for a total of 115.4 flight hours.
- The C-5C AMP operational test was similar to the B-model test conducted in 2006, but on a smaller scale. It included real-world airlift transport missions, simulator missions, maintenance demonstrations, and Information Assurance evaluations. Operational missions provided opportunities to evaluate the aircraft in typical environments.
- DOT&E observed the C-5A/C AMP testing and noted no significant difference in AMP capabilities between the C-5A/C and the C-5B models.
- The Program Office held a critical design review for correction of 24 AMP deficiency reports plus eight general improvements in September 2007. This is part of a series of planned changes to correct deficiencies identified in operational testing.
- The first developmental test flight of a C-5B RERP aircraft occurred on June 19, 2006. A second B-model began flight tests on November 17, 2006, and an A-model flew in January 2007.

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- The content and timeline of the RERP developmental flight tests changed in 2006. A combination of legacy system problems, development delays, and funding constraints contributed to uncertainty regarding the planned completion of RERP developmental test and evaluation. Developmental test is now scheduled to complete in August 2008.
- RERP operational testing is currently scheduled to begin in September 2009.

## Assessment

- The observed performance of the C-5 AMP modifications is not adequate as a baseline for RERP. The instability of the flight management system, Information Assurance vulnerabilities, and frequent autopilot disconnects were contributing factors. Operator workarounds increased crew workload and impacted operational effectiveness. However, situational awareness regarding navigation and other air traffic improved. Navigation and data link capabilities performed well in OT&E.
- The C-5 AMP is not operationally suitable. High AMP component failure rates, inadequate integrated diagnostics, lengthy technical order trouble shooting times, and high

maintenance man-hours per flight hour adversely impacts the ability to generate aircraft missions.

- The AMP/RERP acquisition strategy is no longer executable due to program delays and funding shortfalls. Correcting AMP deficiencies, including the 14 delayed AMP capabilities, and completing RERP are not part of the current program of record.
- The current assets for RERP OT&E do not include a low-rate initial production aircraft in operational test as requested by DOT&E.

## Recommendations

- Status of Previous Recommendations. The Air Force has not yet delivered an updated executable acquisition strategy (FY05), which should include RERP completion and programmed correction of AMP deficiencies (FY06). The Air Force should also apply lessons learned from the C-5 AMP development to RERP (FY06).
- FY07 Recommendation.
  1. The Air Force should include a low-rate initial production aircraft in the operational test.

## C-17A – Globemaster III Aircraft

### Executive Summary

- Live Fire testing demonstrated that the C-17 composite horizontal tail can survive impacts from threats tested and that the damaged tail could fully support expected flight loads during egress.
- The Traffic Collision Avoidance System (TCAS) overlay offers a limited increase in operational capability.
- The new combat lighting system increases C-17 capability supporting tactical and covert/night vision required missions.
- The On-Board Inert Gas Generating System (OBIGGS) II met both effectiveness and suitability requirements.

### System

- The C-17 is a four-engine turboprop 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.
- Planned improvements include:
  - New inert gas generation system
  - Upgraded communications, navigation, and surveillance for air traffic management
  - Improved formation flight capability
  - Enhanced landing system

### Mission

Units equipped with the C-17:

- Provide worldwide theater and strategic airlift and airdrop



- Augment aero-medical evacuations and special operations
- Deliver loads to austere airfields, including:
  - Passengers
  - Bulk, oversize, and outsize cargo
  - Special equipment

### Activity

- A Live Fire report documented the results of testing conducted by the 780th test squadron at Wright-Patterson Air Force Base and contractor conducted analyses.
- The Air Mobility Command (AMC) Test and Evaluation Squadron (TES) conducted a Force Development Evaluation of a TCAS overlay system, in accordance with the FY07 DOT&E-approved plan, in October 2006. The TCAS overlay is designed to remove current Instrument Meteorological Conditions (IMC) formation flight restrictions on the C-17 fleet. The test was conducted using up to six C-17 aircraft during a multiple day/night, multiple formation Joint Forcible Entry Exercise with Army's XVIII Corp from Fort Bragg, North Carolina.
- AMC TES completed developmental/operational testing of the Combat Lighting System, an embedded upgrade in the Block 17 configuration, in accordance with the FY07 DOT&E-approved plan, during a two-ship training mission in July 2007. The expanded lighting options are designed to

provide expanded capability to covert and special operations missions.

- The AMC TES executed logistics service test of an upgraded OBIGGS II, as required by the current Test and Evaluation Master Plan and in accordance with the FY06 DOT&E-approved plan. Maintenance data was collected on the new system from June 1, 2006, to June 1, 2007. Block 16 and 17 aircraft flew with an upgraded OBIGGS. The 28 aircraft accumulated 24,728.9 flight hours.

### Assessment

- Live Fire ballistic testing showed that the threat tested did not produce significant structural damage to the composite horizontal tail. Post-test structural analyses showed that the damaged tail could fully support expected flight loads during egress.
- TCAS overlay offers a limited increase in operational capability. The AMC TES operational test was limited in

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scope and did not fully evaluate multi-element formation operations. Previously, AMC released the TCAS overlay procedure for use in IMC for single element formations.

- The combat lighting system increases C-17 capability supporting tactical and covert/night vision imaging system (NVIS)-required missions. The new system permits different modes of NVIS compatibility and covert lighting configurations for both the exterior lighting schemes and the cargo compartment.
- OBIGGS II meets both effectiveness and suitability requirements. The OBIGGS initialized the fuel tanks during flight and maintained inert status throughout various flight profiles. The mean time between removal was over 1,000 hours, exceeding the 500 mean time between removal requirement.

## Recommendations

- Status of Previous Recommendations: There were no previous recommendations.
- FY07 Recommendations:
  1. AMC should develop a robust test plan for evaluating formation flight system capability to ensure C-17 can fully support strategic brigade airdrop delivery requirements.
  2. The Air Force should consider planning, scheduling, and funding retrofits for earlier block aircraft to minimize the logistical and operational impact of multiple configured aircraft within the mobility system.

## C-130 Avionics Modernization Program (C-130 AMP)

### Executive Summary

- Due to Nunn-McCurdy breaches, USD (AT&L) recertified the C-130 Avionics Modernization Program (AMP) to Congress in June 2007. The Air Force is restructuring AMP to the OSD-certified baseline.
- The certification process resized the C-130 AMP program from the original 519 (which included all variants) to 222. The program only includes the H2, H2.5, and the H-3 models.
- The Air Force intends to submit an update to the Test and Evaluation Master Plan (TEMP) in November 2007.

### System

- Legacy C-130s (excluding the C-130J) are four-engine turboprop aircraft used by the Air Force, Navy, Marines, and Special Operations units. Crew size varies from four to 13 depending on aircraft mission.
- The AMP adds glass cockpits, integrated digital avionics, and an integrated defensive systems suite. It eliminates the need for a navigator on all Combat Delivery missions. AMP provides new communications, navigation, and surveillance capabilities for Air Traffic Management functions.
- Combat Delivery C-130 AMP aircraft have six pallet positions for cargo.

### Mission

- Units equipped with the C-130 primarily perform the tactical portion of the airlift mission, flying shorter distances and using austere airfields within combat zones.



- Combat Delivery includes:
  - Airdrop of paratroopers and cargo (palletized, containerized, bulk, and heavy equipment)
  - Airland delivery of passengers, troops, and cargo

### Activity

- The C-130 AMP experienced a Nunn-McCurdy breach in FY07. The OSD-led recertification process ran from January 2007 to June 2007.
  - DOT&E participated in multiple meetings and venues to review program information and determine the appropriate steps leading to certification of a revised, executable C-130 AMP that meets Nunn-McCurdy certification requirements.
- The Air Force intends to submit an update to the TEMP for DOT&E approval in November 2007.
  - Mitigating technical and schedule risks
  - Determining low-rate initial production quantities to support operational testing
  - Updating of the Capability Production Document
  - Approving an adequate TEMP
- The operational test includes a minimum of four production representative aircraft with at least two of those being LRIP aircraft.

### Recommendations

- Status of Previous Recommendations. The Air Force has taken adequate action on the FY05 and FY06 recommendations.
- FY07 Recommendation. None.

### Assessment

- The program has scaled back from the original 519 (which included all variants) to 222 combat delivery aircraft (H2, H2.5, and H3 models).
- Major issues being addressed due to the Nunn-McCurdy breach resolution are:

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## C-130J Aircraft

### Executive Summary

- The C-130J continues in production with periodic Block upgrades to correct deficiencies and to provide capability enhancements. No milestone decision reviews are planned for the C-130J. The initial multi-year contract expires in February 2008.
- The C-130J is effective in performing single ship airland and airdrop missions in a permissive threat environment.
- The C-130J is not effective in performing formation airdrop missions in Instrument Meteorological Conditions where the use of Station Keeping Equipment is required.
- The C-130J is not effective for worldwide operations in a non-permissive threat environment.
- The C-130J has shortfalls in meeting user suitability requirements due to maintainability issues.
- Operational tests of Block Upgrade 6.0 are scheduled for 1QFY08 and the ALR-56M improvements are scheduled for 3QFY08.
- C-130J operational testing will likely continue past 2010 because some initial OT&E deficiencies have not been corrected and new capabilities will be added in Block Upgrade 7.0, with OT&E scheduled for 2011.
- The engine nacelle fire suppression system successfully suppressed fires generated by the threats tested. The C-130J Live Fire test program is complete.

### 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
- Combat Delivery units operate in all weather conditions, use night-vision lighting systems, and may be required to operate globally in civil-controlled airspace.
- Combat Delivery aircraft can perform emergency aeromedical evacuations.

### Activity

- Developmental Test and Evaluation of Block Upgrade 6.0 started in the 3QFY07 and concluded in the fourth quarter.
- A combined operational and developmental test crew flew a successful Integrated Systems Evaluation mission at the end of Block Upgrade 6.0 development.
- Air Mobility Command completed and DOT&E approved a Test Plan for the Force Development Evaluation of Block Upgrade 6.0 in the first quarter of FY08.
- Live Fire ballistic tests, conducted by the 780th test squadron at Wright-Patterson AFB, Ohio, in March to April

2007, evaluated engine nacelle fire suppression system effectiveness. The C-130J Live Fire test program is complete.

### Assessment

- The C-130J with Block Upgrade 6.0 modifications appears ready for an operational evaluation covering four flight missions in October 2007.
- The C-130J with Block Upgrade 6.0 should continue to be effective in performing single ship airland and airdrop

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- missions in a permissive threat environment. Both capabilities were successfully demonstrated in Phase II OT&E.
- The C-130J with Block Upgrade 6.0 will not be effective in performing formation airdrop missions using Station Keeping Equipment in Instrument Meteorological Conditions. Station Keeping Equipment anomalies observed during Phase II OT&E were not planned to be corrected by Block Upgrade 6.0.
  - The C-130J is not effective for worldwide operations in a non-permissive threat environment.
    - The AAR-47 infrared missile/laser warning system is operationally effective as installed on the C-130J, but has one significant classified limitation.
    - The ALR-56M radar warning receiver has not been fully characterized because it was not ready for operational testing. Operational testing is planned for 3QFY08.
  - The C-130J with Block Upgrade 6.0 will still have shortfalls in meeting user suitability requirements due to maintainability issues. The integrated diagnostics false alarm rate is high and the poor performance of the portable maintenance aid impacted the ability to generate sorties. The Air Force reported more than 90 open deficiencies at the end of Phase II OT&E, three of which are addressed by Block Upgrade 6.0. Some maintainability issues are planned to be addressed in Block Upgrade 7.0.
  - The engine nacelle fire suppression system successfully suppressed fires generated by all threats tested.

## Recommendations

- Status of Previous Recommendations. The Air Force has taken adequate action on the previous recommendations.
- FY07 Recommendation. None.

## Combat Survivor Evader Locator (CSEL) and the PRC Family of Handheld Survivor Radios

### Executive Summary

#### CSEL

- The Combat Survivor Evader Locator (CSEL) program continued development of a Web-based rescue center application that reduces Air Operations Center support. The program is also developing Terminal Area Communication and Terminal Area Guidance capabilities.
- A highly publicized rescue of two Army pilots in Iraq demonstrated the importance and value of a robust, secure, precision-location, data radio that can locate, authenticate, and communicate in a matter of minutes.
- The Services should fully support CSEL development efforts by providing stable funding and sufficient support to complete adequate operational testing of the developed CSEL capabilities.

#### PRC

- Operational units continued small scale procurement of commercial PRC radios as a gap filler, but continue to incur the risk of an increasing number of radio variants with an inherent higher level of required support.

### System

The CSEL is a radio system that allows a survivor to contact rescue forces, report status, and communicate for recovery. It includes:

- A handheld radio that includes a military Global Positioning System (GPS) receiver and navigation system
- A satellite communication system
- Encrypted data and voice capability on multiple programmable frequencies
- Ultra High Frequency base station computers that route the data messages to rescue command and control elements
- Equipment to program and update the handheld radios

PRC radios are similar to CSEL radios. The Services fielded several variants of PRC radios, including the 112B, 112D, 112G J001, and 112G J002. PRC radios include:



- Commercial GPS and navigation system
- Line-of-sight communication with unique receivers carried on theater force aircraft
- Commercially-encrypted data and voice capabilities on programmable frequencies
- The PRC-112G J002 incorporates new features including an over-the-horizon data messaging capability, more software-programmable waveforms for beacons and messages, and an option for military-only GPS.

### Mission

Rescue forces equipped with CSEL or PRC 112 systems use them to identify, locate, and authenticate isolated persons quickly and accurately.

- Survivors use the CSEL to send a data message via satellite to a central rescue center. The center forwards that message to rescue forces, who then communicate with the survivor via voice communications to facilitate recovery.
- Survivors use the PRC to send a data message that is received by aircraft pre-positioned in theater and specially equipped to receive PRC messages. These aircraft may be rescue forces or support aircraft that pass the messages to rescue forces. Rescue forces contact the survivor via either data or voice communications, in order to facilitate recovery.

### Activity

#### CSEL

- The CSEL program delayed testing of a Web-based application from FY07 until FY08. Program management changes within the Air Force and required contract re-negotiations triggered the changes. The Web-based application is intended to create “virtual” rescue centers at any location where a secure Internet terminal exists. This

capability should allow the large-scale air operations centers to remove rescue center consoles as needed and reduce required operations center support.

- The CSEL program outlined new approaches for developing, testing, and fielding two new capabilities: TAC for Army and Navy units and TAG for Air Force units. Operational test participants identified these capabilities as the most important

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new capabilities to pursue. Development is underway and testing is planned for 2009.

## **PRC**

- The Army and Navy continue to replace legacy radios with CSEL radios. Some Air Force units are replacing legacy radios with CSEL while others await the TAG capability.

## **Assessment**

### **CSEL**

- DOT&E approved the current Web-based application development and test strategy. The program is implementing DOT&E inputs for the TAC/TAG test strategies. CSEL continues to experience delays in development and fielding that reflect unstable Service funding.
- In a highly-publicized incident, the Army rescued two Kiowa Warrior pilots equipped with a CSEL radio who were shot down and surrounded by 20-30 enemy combatants while on patrol in Iraq. This rescue would not have been successful

without a robust, secure, precision-location, data radio that can locate, authenticate, and communicate in a matter of minutes.

## **PRC**

- Updates and improvements to PRC radios continue but procurement of annually-updated commercial PRC radios adds to the number of radio variants in operational units, thus complicating supportability (training, maintenance, and programming), and decreasing interoperability because the new radios are not backwards compatible.

## **Recommendations**

- Status of Previous Recommendations. The program office is addressing the previous DOT&E recommendations.
- FY07 Recommendation.
  1. The Services should fully support CSEL development efforts by providing stable funding and sufficient support to complete adequate operational testing of the developed CSEL capabilities.

## Combatant Commanders Integrated Command and Control System (CCIC2S)

### Executive Summary

- The Air Force Operational Test and Evaluation Center (AFOTEC) conducted an IOT&E in 1QFY07, and determined that the Combatant Commanders Integrated Command and Control System (CCIC2S) Spiral 2 is operationally effective and suitable. DOT&E concurs with this assessment.
- The 17th Test Squadron is preparing to conduct operational testing on Communications Processing System release 3 (CPS3) in 3QFY08.
- The Air Force modified the CCIC2S Block 2 scope into three separate efforts: sustainment of current capability, initiation of the Space Command and Control (C2) program, and future upgrade efforts.



### System

- The Air Force initiated CCIC2S to integrate existing and legacy systems and update functionality supporting Integrated Tactical Warning and Attack Assessment, Information Operations, Shared Early Warning, and Theater Battle Management Core System functions. It provides terrestrial and space-based sensor data, processing and control nodes, Battle Management Command and Control nodes, and communications and dissemination links, including U.S. and Canadian defense information networks.
- The CCIC2S effort is structured in two blocks: Block 1 to address CCIC2S Operational Requirement Document requirements from January 2004 and Block 2 to address the Space C2; Space Situational Awareness; Air/Missile Warning; and Core Command and Control Capability Development Documents (CDDs).
- CCIC2S Block 1 consists of:
  - Air Warning - Completed as part of Spiral 1, January 2004
  - Missile Warning - Completed as part of Spiral 2, December 2006
  - Space Battle Management Core System (SBMCS) - Completed as a precursor to Space Mission, June 2004
  - Communications Processor System 3 (CPS3) - Planned for operational testing in 3QFY08

- Space Data Server - Replacement (SDS-R) - will be addressed by future Space Defense Operations Center capabilities
- CCIC2S Block 2 has been restructured to address each individual CDD with separate acquisition programs including Space C2, Integrated Space Situation Awareness, and the Rapid Attack Identification and Reporting System.

### Mission

The North American Aerospace Defense Command (NORAD) and U.S. Strategic Command (USSTRATCOM) use CCIC2S as a comprehensive command and control tool to execute existing and future space operations and missile defense missions including support to other combatant commanders. Commanders will use CCIC2S capabilities to:

- Monitor worldwide sensor networks for potential threats
- Identify, assess, and characterize threats
- Warn the U.S. and Canadian National Command Authorities
- Recommend appropriate engagements based on the threats

### Activity

- AFOTEC conducted an IOT&E on CCIC2S Spiral 2 during 1QFY07 in accordance with the DOT&E-approved Test and Evaluation Master Plan and Test Plan.
- AFOTEC completed its test report on the IOT&E of CCIC2S Spiral 2 with a final briefing to DOT&E on March 26, 2007.
- The 17th Test Squadron is developing the Test and Evaluation Master Plan for testing CPS3, the scaled-down part of the third spiral of CCIC2S Block 1.

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## Assessment

- AFOTEC successfully completed the IOT&E of CCIC2S Spiral 2 and evaluated the system to be operationally effective and suitable. DOT&E concurs with that evaluation.
- AFOTEC deferred testing of CPS3 to the 17th Test Squadron based upon an AFOTEC assessment that CPS3 represents a technology update rather than the addition of new capability. DOT&E determined that operational testing of CPS3 is necessary.

## Recommendations

- Status of Previous Recommendations. There are no previous recommendations.
- FY07 Recommendation.
  1. The 17th Test Squadron should conduct planned CPS3 operational testing to complete the re-structured CCIC2S Block 1 program.

## E-8 Joint Surveillance Target Attack Radar System (JSTARS)

### Executive Summary

- The Qualification Operational Test and Evaluation (QOT&E) intends to test the Joint Surveillance Target Attack Radar System (JSTARS) Block 30 upgrades. The Air Force Operational Test and Evaluation Center (AFOTEC) has scheduled the OT&E for late FY08 or early FY09.
- Major upgrades to the JSTARS E-8C aircraft, including the Enhanced Land Maritime Mode (ELMM) / Advanced Radar Modes (ARM) capabilities, require operational testing beyond the planned QOT&E.
- The Air Force needs to write a new Test and Evaluation Master Plan (TEMP), which defines the test and evaluation strategy for the ongoing JSTARS modernization program.

### System

- JSTARS E-8C is an airborne target acquisition and tracking system.
- JSTARS consists of an Air Force E-8C aircraft, Army and Marine JSTARS Common Ground Work Stations, and a Surveillance and Control Data Link connecting them.
- JSTARS has Moving Target Indicator Radar and Synthetic Aperture Radar systems; a High Frequency, Ultra-High Frequency, and Very-High Frequency Satellite Communications suite; a multi-data link capability; 18 operator workstations; and an air refueling capability.

### Activity

- Ground and laboratory testing of JSTARS upgrades took place during much of FY07 while the JSTARS test aircraft was in scheduled maintenance from January to May 2007.
- Initial flight-testing began on the ELMM/ARM upgrade, which consists of new radar modes, a new tracking algorithm, nearly one million lines of additional software code, a new processor, and a new concept for maritime operations.
- The JSTARS program made modifications to operator manuals and the concept of operations to address shortfalls in conducting Close Air Support and alternate Air Support Operations Center missions.
- The test plan for the re-engining of the JSTARS E-8C aircraft is in development. The Air Force is planning flight tests with the new engines during FY09, and the first jet is to receive the new engines during 2QFY09.
- The 116th Air Control Wing and AFOTEC conducted a combined test force assessment of Attack Support Upgrade (Phase II) from June through August 2007. AFOTEC compiled operational exercise results and the final report is in signature coordination.



- The Block 30 upgrade adds an air-to-ground attack support upgrade, which includes Airborne Command and Control Center (ABCCC) replacement software and hardware.

### Mission

- Air and ground commanders use JSTARS for battlefield surveillance, ground-to-ground and air-to-ground battle management, and intelligence indications and warnings.
- Warfighting commanders use JSTARS to find, detect, track, and classify time-sensitive moving and stationary ground targets.

- The Air Force assigned the 605th Test and Evaluation Squadron (TES) to operationally test many of the upgrades to the JSTARS E-8C. The 605th TES will specifically address the operational issues coming from the warfighters, including tactics development, concept of operations, operational employment, and training.

### Assessment

- JSTARS continues to provide commanders with surveillance and situational awareness within the battlespace that was not available without JSTARS. The Air Force distributed the decommissioned ABCCC capabilities to other airborne systems, of which JSTARS was one. However, JSTARS aircrews could not effectively conduct all mission tasks previously assigned to a cancelled ABCCC system.
- The ELMM/ARM upgrade to JSTARS is significant in cost and scope, and requires operational testing. This upgrade is designed to enable JSTARS to find, fix, and track targets in a maritime environment using a joint concept of operations

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with the Navy. Thus far, no operational test concept has been developed and submitted for approval.

- The modifications to fix the shortfalls in conducting Close Air Support, alternate Air Support Operations Center missions, and radio problems require operational testing. AFOTEC will conduct this OT&E during the QOT&E in FY08 or FY09.
- After 18 months the Marine Corps and Army have failed to review and codify their JSTARS requirements.

## Recommendations

- Status of Previous Recommendations. DOT&E recommended that the Air Force operationally test the ELMM / Affordable Moving Surface Target Engagement (AMSTE) and battle management upgrades and update the TEMP (FY06). The

Air Force has reassessed the AMSTE upgrade, and has informally decided to eliminate that capability upgrade. The Air Force has been working to update the JSTARS TEMP (FY06). The Services have not formally reviewed or evaluated whether current and planned upgrades to JSTARS meet their warfighting requirements and enhance the ability to conduct their missions (FY06).

- FY07 Recommendations.
  1. The Air Force should operationally test the ELMM/ARM upgrades utilizing a joint concept of operations developed with the Navy.
  2. The Air Force must write a new TEMP, which defines the test and evaluation strategy for the JSTARS modernization program.

## F-22A – Advanced Tactical Fighter

### Executive Summary

- The F-22A completed an aggressive array of follow-on testing to include enhanced mission capabilities, and the evaluation of new hardware and software capabilities. F-22A system maturity demonstrated positive trends and modest improvement in subsystem reliability and fault diagnostics accuracy. However, inspection and repair of low observables continues to impact F-22A maintainability. The Air Force is investing in reliability and maintainability programs which may enable the F-22A to continue progress toward meeting its long term requirements specified in the F-22A Operational Requirements Document.
- Air Force Operational Test and Evaluation Center (AFOTEC) Follow-on Test and Evaluation (FOT&E) of F-22A Increment 2 Operational Flight Program (OFP) capabilities demonstrated operational effectiveness in expanded air-to-ground missions against fixed targets. The FOT&E also demonstrated improvements in certain suitability metrics including modest gains in subsystem reliability and fault diagnostics accuracy.
- New hardware subsystems incorporated into Lot 5 aircraft were found to be interoperable with Increment 1 aircraft and found to be as effective and suitable as legacy Increment 1 subsystems.
- Air Combat Command electronic warfare Mission Data Optimization (MDO) testing was sufficiently integrated with AFOTEC FOT&E testing to evaluate defensive avionics suite performance with the Increment 2 OFP.
- Data collection and analysis to date has not identified significant trends in the stability of the F-22A Low Observables signature or effectiveness of the Signature Assessment System. It is likely that any trends will not be realized until further data becomes available during FY08 testing

### 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.

### Activity

- The Air Force implemented elements of its F-22A reliability and maintainability enhancement program resulting in improvements in some suitability metrics in FY07 testing.
- AFOTEC completed the second F-22A FOT&E in August 2007. The FOT&E 2 assessed the F-22A Increment 2 OFP aircraft software configuration, including expanded



- It maintains supersonic speeds without the use of an afterburner.
- Avionics that fuse information from the Active Electronically Scanned Array radar, other sensors, and data-linked information for the pilot enable employment of medium- and short-range air-to-air missiles and guns.
- The F-22A is designed to be more reliable and easier to maintain than current fighter aircraft.
- F-22A air-to-air weapons are the AIM-120C radar-directed missile and the AIM-9M infrared-guided missile.
- F-22A air-to-ground precision strike capability consists of two 1,000-pound Joint Direct Attack Munitions (JDAMs).
- The F-22A program is designed to deliver capability in increments.

### 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

- air-to-ground mission capability and improvements in system suitability.
- Air Combat Command conducted an Operational Utility Evaluation (OUE) of new hardware subsystems that will be in production F-22As starting with Lot 5 aircraft deliveries. The OUE assessed the effectiveness, suitability, and

interoperability of Lot 5 hardware with the currently fielded F-22 fleet. The Lot 5 hardware, which includes the F-22A fourth generation radar, digital electronic warfare suite, intra-flight data link, communications/navigation/identification system, and several diminishing manufacturing source replacement components, provides the foundation for future F-22A increments, beginning with Increment 3 in 2010.

- Air Combat Command continued electronic warfare MDO software development and testing throughout FY07. Upgrades to F-22A electronic warfare mission data software sets were released to the field in support of specific F-22A global mission tasking. Testing under the currently DOT&E-approved MDO Test Plan will be ongoing throughout FY08.
- Air Combat Command completed the second year of the F-22A Low Observables Stability Over Time test. This five-year test is designed to assess the durability and stability of the F-22A radar cross section, and to validate the F-22A Signature Assessment System, which is used at the flight line to ensure that aircraft have a sufficiently low signature for operational missions.

## Assessment

- FOT&E results demonstrated that F-22As configured with the Increment 2 OFP are operationally effective in the suppression and destruction of fixed enemy air defenses. Some of the outstanding system deficiencies and weapons integration problems that were significant detractors in previous testing were resolved, enabling Increment 2 OFP-configured F-22As to achieve success in this high threat mission area. F-22As executed increasingly complex missions in high threat environments. FOT&E testing increased the understanding of the capabilities needed for sustained operational use in air-to-air and air-to-ground roles.
- Air Combat Command testing determined Lot 5 hardware was interoperable with Increment 1 aircraft, and the new hardware subsystems exhibited the same level of effectiveness and suitability as the legacy Increment 1 aircraft configuration.

- Air Combat Command electronic warfare MDO testing was sufficiently integrated with AFOTEC FOT&E testing to evaluate defensive avionics suite performance with the Increment 2 OFP.
- Data collection and analysis to date has not identified significant trends in the stability of the F-22A Low Observables signature or effectiveness of the Signature Assessment System. It is likely that any trends will not be realized until further data becomes available from FY08 testing.
- Overall F-22A system maturity exhibited some positive trends and modest improvement in subsystem reliability and fault diagnostics accuracy. However, inspection and repair of low observables continues to impact F-22A maintainability. Test results demonstrated that maintaining the low-observable signature continues to require a significant effort and accounted for half of the overall maintenance man-hours expended in FOT&E 2. Additionally, restoration of the low-observable signature requires long durations to cure materials often resulting in extended periods of time during which aircraft are not available for operational missions.
- Though maintainability challenges continue to exist, reliability gains suggest incremental improvements in overall system suitability. FY07 test results suggest the Air Force's reliability enhancement program has had a positive effect. Evaluation of F-22A reliability and maintainability improvements in follow-on testing will be necessary to assess and confirm suitability as the F-22A progresses towards system maturity.

## Recommendations

- Status of Previous Recommendations. There are no outstanding recommendations from previous annual reports.
- FY07 Recommendation.
  1. The Air Force should continue to invest resources in reliability and maintainability improvement programs to provide the opportunity for the F-22A to meet the user's suitability requirements at system maturity.

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

### Executive Summary

- Fourteen Systems Design and Development (SDD) test aircraft are in production as of the end of FY07.
- Aircraft AA-1, the first SDD flight test aircraft, accomplished 19 flight test missions in FY07, providing valuable data on subsystem reliability and flying qualities.
- Program leadership has taken actions to reduce test assets in order to restore contractor management reserve funds. This increases the likelihood that IOT&E will be unsuccessful and become a period of discovery of deficiencies late in program life.
- Ground labs and models continue to mature and are now planned to be part of the verification strategy.

### System

- The F-35 Lightning II program is a joint, multi-national, single-seat, single-engine family of strike aircraft consisting of three variants:
  - F-35A Conventional takeoff and landing (CTOL)
  - F-35B Short takeoff and vertical landing (STOVL)
  - F-35C Aircraft carrier takeoff and landing (CV)
- It is designed to survive in an advanced threat (year 2010 and beyond) environment using a blend of advanced technologies with improved lethality compared to legacy multi-role aircraft.
- Using an Active Electronically Scanned Array 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 air-to-air missiles, and AIM-9 infrared air-to-air missiles.
- 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 threat areas at the strategic, operational, and tactical levels of warfare.
- Targets include: fixed and mobile land targets, enemy surface units at sea, and air threats, including advanced cruise missiles.

### Activity

- The program conducted 19 test flights with aircraft AA-1 in FY07. The test team reached a peak of eight flights in one month (April) and was also able to fly twice in one day. These activities demonstrated the team's ability to recover and turn to subsequent test missions. AA-1 flights began initial SDD validation of the helmet mounted display, flying qualities work, and flight envelope expansion.
- An electrical anomaly occurred in early May 2007 and flying has not yet resumed. The root cause was identified and a design change is being incorporated to the affected components. Testing is expected to resume in early FY08.
- Ground labs and test beds continue to mature as development and preparation continue for first flight of the first STOVL aircraft in May 2008, a key milestone as it is the first

- weight-optimized SDD aircraft. It is intended to increase the pace of flight sciences verification.
- The program activated an initial F-35 Autonomic Logistics Information System (ALIS) capability at the flight test operations center at Lockheed Martin, Fort Worth, Texas, in April, 2007. The system is intended to provide initial maintenance and sustainment capabilities in support of the flight test operations.
- Fourteen of 21 planned SDD test aircraft (flight and ground test articles) have entered production. Deliveries are currently forecast to be 2-3 months later than planned for the first 12 test articles. However, the program office and contractor team continue to re-work manufacturing plans and schedules to recover this delay.

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- A turbine blade failure occurred on an F-135 test engine in late September 2007. The root cause is under investigation.
  - The Operational Test Agencies conducted an operational assessment of the progress made by the F-35 program toward readiness for Block 2 operational testing and Block 3 IOT&E. The agencies will finalize their report in mid-FY08.
  - The Cooperative Airborne Test Bed (CATB) completed air worthiness certification and is undergoing modifications to integrate mission systems hardware and software. Flight testing is expected to begin supporting SDD verification by late FY08.
  - The Program Executive Officer initiated a Mid-Course Risk Reduction action in mid-FY07 that is intended to replenish the contractor's management reserve through reductions and restructures in the verification (SDD test) plan. The changes to the verification strategy include:
    - Foregoing build-up (intermediate) flight test points and going to end-points earlier in flight test sorties
    - Sharing more test sorties among multiple test disciplines to reduce the overall flight test effort required to complete SDD
    - Shifting verification events from F-35 flight test aircraft to existing ground labs and the CATB
    - Eliminating two SDD mission systems (avionics) flight test aircraft (one CTOL and one CV aircraft)
  - Negotiations regarding participation in the operational testing of the F-35 continued with representatives of the interested partner governments. Agreements are expected to be finalized in early FY08.
  - The Director of LFT&E approved the program's plan to replace BF-4 Full-up System Level (FUSL) LFT&E with an AA-1 FUSL ballistic test article and an addition of a STOVL full-scale structural test article (FSSTA) and stand-alone lift systems for ballistic testing.
  - The program office removed five of six dry bay fire suppression systems. The Director of LFT&E sent a memo to the program office urging the reconsideration of this decision.
  - The program conducted live fire composite panel ballistic tests, chemical/biological agent decontamination tests, and F-1 fuel tank ballistic tests.
- Assessment**
- The program greatly benefitted from the AA-1 flight test. Benefits range from discovering needed modifications to subsystem design to maturing the flight test planning, execution, and analysis process.
  - The new verification strategy, resulting from the mid-course risk reduction actions, requires careful monitoring to determine if the changes have unintended consequences such as an inadequate or unsuccessful IOT&E.
    - The high volume of "build-up" points set aside from flight test could impact multiple areas if it is determined after analysis of end-point performance that build-up points must be flown to verify system performance after all.
  - The transition of the ground labs and CATB to verification assets requires analysis and action to ensure proper integration with flight test operations through:
    - Adequate resourcing for planned and surge tempo in manpower, data analysis tools, communications/links, and spares
    - Successful accreditation of high fidelity ground labs and CATB for three variants
  - Concurrent flight testing through "ride along" or "shared sortie" plans emphasizes unprecedented integration and real time coordination among the multiple flight test components. Impact of poor, incomplete/inaccurate communications will be significant. The flight test force must also be adequately resourced for planned and surge tempo throughout the SDD test program. The analytical, scheduling, and decision-making power of the combined SDD force to discern an appropriate response to flight test data is even more crucial as this program will peak near 140 test flights per month (as compared to 65 for peak months in F-22 development test and evaluation).
  - Eliminating the last two SDD mission systems flight test aircraft increases the likelihood that IOT&E will be unsuccessful and become a period of discovery of deficiencies:
    - Mission systems flight testing will inevitably be in need of a higher than predicted pace of F-35 flight test operations as the program approaches IOT&E.
    - Important items were eliminated from the test:
      - Second CV flight test aircraft for ship suitability trials/demos
      - Flight test of a second CTOL aircraft for signature
      - A significant portion of autonomic logistics input/throughput and reliability data for mission systems test aircraft which may impact the ability to evaluate F-35 operational suitability
    - Fixes to problems identified through IOT&E and the follow-on development to IOT&E, Block 4, will need the planned full complement of mission systems flight test aircraft.
      - The improvements found necessary in IOT&E will need to be proven quickly through re-test
      - The follow-on development phase in legacy programs was poorly resourced and planned for very late
    - Attrition inventory is key to sustaining the intended tempo of F-35 verification plan. Eliminating two high-leverage test aircraft loses an important hedge against attrition or unavailability of mission systems assets.
  - Some mitigation features intended to lessen negative consequences of changes made to the verification strategy are being examined or put in place (such as planning a dual-role mission systems and flight sciences aircraft, funding the CATB throughout SDD, reasonable re-fly/regression factors, potential use of early production aircraft in SDD verification flight test). However, it is unknown if these actions will be sufficient if available flight test resources are not adequate for the pace

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- required in the 12-24 month period prior to the planned IOT&E start date.
- The proposed chemical/biological agent decontamination methods successfully decontaminated F-35 ground support equipment.
  - Removal of several vulnerability reduction features increased ballistic vulnerability of the F-35:
    - Threat impact on the F-1 fuel tank without the engine fuel ingestion suppression liner produced large fuel leakage rates into the engine. Testing with the liner demonstrated its effectiveness.
    - Ballistic damage to the STOVL propulsion system lift fan shaft can result in catastrophic failure upon transition to vertical landing. Detectable lift fan shaft vibrations occur from ballistic damage. The STOVL lift fan shaft vibration sensor is not part of the pilot caution and warning system.
    - Removal of five of six dry bay fire suppression systems increased the potential for aircraft loss from threat induced fires.
  - Live Fire tests showed that threat penetration of composite material aircraft skin are more likely to start fires than predicted.
  - The program is considering removal of shutoff valves for flammable liquid cooling system and engine fueldraulics. The removal of these valves will increase the likelihood of in-flight fires and possible aircraft loss.
- Recommendations**
- Status of Previous Recommendations. The joint program office and Services have made satisfactory progress on most of the FY05 and FY06 annual report recommendations. The following previous recommendations remain valid:
    - DOT&E recommended that the program identify all test resource shortfalls in opposing force/threats and present a solution that mitigates these (FY05).
    - DOT&E recommended that the program develop a predictive model to determine how test data on engine performance following “quick dump” fuel ingestion at the sea level test site could be extrapolated to predictions for higher operating altitudes (FY05).
    - DOT&E recommended that the program conduct additional full-up, system-level Live Fire ballistic tests to determine the vulnerability of the F-35 with only one dry bay fire suppression system (FY06). The program plans to conduct additional tests.
  - FY07 Recommendations. The program should:
    1. Retain the last two SDD mission systems flight test aircraft.
    2. Ensure the ground labs, CATB, and flight test components are adequately resourced to execute the verification strategy (manpower, spares, connectivity) at planned and surge pace of operations.
    3. Ensure that metrics under development to monitor the effects of the changes to the verification strategy adequately predict the need to invoke mitigation plans to avoid failing to prepare the system for IOT&E.
    4. Develop an executable transition plan for IOT&E from the end of SDD, using detailed entrance criteria for IOT&E. Of significant concern are: weapons integration testing, mission systems verification, fully trained operators, and sufficient operating envelope for production representative aircraft.
    5. Reinstate five dry bay fire suppression systems, previously removed.
    6. Reinstate the engine fuel ingestion suppression liner in the F-1 fuel tank.
    7. Add cockpit warning indicators to alert the pilot of STOVL system ballistic damage prior to transition to vertical landing.
    8. Retain engine fueldraulics and liquid cooling shutoff valves to improve F-35 survivability.

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## Global Broadcast Service (GBS) System

### Executive Summary

- The Air Force Operational Test and Evaluation Center (AFOTEC) conducted the second Global Broadcast Service (GBS) Multi-Service Operational Test and Evaluation (MOT&E) in 3QFY07.
- The test community is still evaluating data to determine if improvements to the system have corrected the deficiencies identified in the first MOT&E in September and October 2005 where the GBS receive segment was determined not to be operationally suitable due to failures in the receive suites' unattended mode.
- DOT&E completed the GBS Beyond Low-Rate Initial Production (BLRIP) Report in December 2006, reporting the system as effective with limitations, but not suitable.

### System

- The GBS is a satellite-based broadcast system providing near worldwide, high capacity, one-way transmission of operational military data.
- The GBS system consists of three segments:
  - The space segment includes four GBS transponders on each of two Ultra-High Frequency follow-on (UFO) satellites and an additional government-leased satellite capability to meet operational demand.
  - The transmit segment broadcasts data streams and manages the flow of selected information through the orbiting satellites for broadcast to the appropriate theaters of operation; has fixed Primary Injection Point and mobile Theater Injection Point antennas.
  - The receive segment consists of ground and sea mobile terminals that extract the appropriate information for distribution to the end users within selected areas of operation.
- GBS Phase 1 was the Joint Broadcast Service fielded in 1996 in support of the Bosnia Command and Control Augmentation operations.
- GBS Phase 2 contains block upgrades to augment and interface with other military communications systems:
  - Phase 2 Block 1 hosted payload packages on UFO satellites 8, 9, and 10 based upon 1997's available technology. Air Force Space Command declared the Initial Operational Capability (IOC) 1 for GBS Phase 2 in 2003.



1 - Space segment: UFO satellite hosting the GBS payload  
 2 - Transmit Segment in Theater; Theater Satellite Broadcast Manager (truck) and Theater Injection Point (antenna)  
 3 - Receive Broadcast Manager  
 4 - Receive Terminal  
 5 - Transmit Segment: Primary Injection Point (white dish antenna) and Satellite Broadcast Manager (buildings)

- Phase 2 Block 2 employs broadcast capability for the Wideband Global Satellite Communications (WGS SATCOM) with transponder-like downlinks across the Ka-band and X-band frequencies. Block 2 functions are based upon an Internet Protocol transport.
- The Military Satellite Communications Joint Program Director is responsible for integrating the GBS and the WGS space and control capabilities.

### Mission

- Combatant commanders and operational forces worldwide use GBS to provide a continuous high-speed and high-volume flow of data, audio, imagery, and video at multiple classification levels for sustained operations.
- Commanders use the GBS capability to provide intelligence and battlespace weather information, increasing the joint operations mission data available to deployed and garrisoned military forces across the globe.

### Activity

- AFOTEC, with participation from the other Service operational test agencies, conducted the GBS MOT&E 2 in 3QFY07 in accordance with DOT&E-approved test plans.

Results will provide the basis for Air Force Space Command to declare IOC 2 and 3 for GBS Phase 2 Block 2.

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- The test community is finalizing the AFOTEC MOT&E 2 Test Report.
- DOT&E completed the BLRIP report in December 2006.
- The Army receive suite modifications were integrated into the program suitability baseline.
- The program standardized and validated the Army receive suite equipment configurations, training, and technical orders.
- The program updated the Interactive Electronic Technical Manual for current full-rate production equipment configurations and standards.
- The program released the Joint Integrated Logistics Plan to sustain integrated GBS operations and fielding.
- The Air Force integrated the WGS-related operating capabilities of the GBS Phase 2 system into the WGS Multi-Service Test and Evaluation Strategy.
- The GBS upgrade transition to an Internet Protocol capability demonstrated the ability to deliver increased volumes of high-speed data, compared to the previous mission configurations.
- The GBS Theater Injection Points of the transmit segment demonstrated the capability to deliver theater information.
- In support of the extension of the GBS capability through the WGS, AFOTEC continues to integrate WGS MOT&E with the mission capability testing of the GBS Phase 2.

## Recommendations

### Assessment

- DOT&E completed the GBS BLRIP report in December 2006, assessing the system as effective with limitations but not suitable. The GBS receive suite terminals were operationally effective, but did not deliver the level of service and dependability required since receive suites did not demonstrate the capability required while operated in the “unattended” mode. The GBS receive suite terminals were not operationally suitable due to reliability difficulties, technical order deficiencies, Information Assurance changes, system logistics shortfalls, and the need for more comprehensive system training.
- Status of Previous Recommendations. The Air Force made progress on the previous FY05 and FY06 DOT&E recommendations. Three of seven FY06 recommendations remain valid. The Air Force should insist on correcting system performance shortfalls and reliability deficiencies, to include GBS receive suite failures in the unattended mode. The Air Force should continue to press for completed system certifying authorizations from the receive suites, and the Services should provide proper training documents and technical orders.
- FY07 Recommendations. The Air Force should:
  1. Plan and conduct end-to-end operational testing for future GBS upgrades to include WGS, Defense Enterprise Computing Center, DoD Teleport, and future upgrades to receive suites.
  2. Plan and conduct follow-on testing and Information Assurance assessments for upcoming spiral software upgrades.

## Global Hawk High Altitude Endurance Unmanned Aerial Vehicle, RQ-4

### Executive Summary

- The Global Hawk program continues to support Block 10 operations in the theater of operations and simultaneously develop the three remaining blocks of capability intended for the DoD's intelligence, surveillance, and reconnaissance force structure.
- The Air Force Operational Test and Evaluation Center (AFOTEC) Operational Utility Evaluation of the Block 10 system, completed in early FY07, revealed that the system is operationally effective at imagery intelligence missions, but not operationally suitable. Improvements to communications, imagery processing, reliability, and maintainability are needed.
- Ongoing Block 20 development and test is currently four months behind schedule. This puts production decisions in FY08 and the IOT&E planned for FY09 at risk.
- Block 30 and Block 40 payload development and test continue as planned, but need valid concepts of operations from the Air Force and Joint Staff to guide development and test planning.
- Block 20, 30, and 40 systems development need requirements traceability studies and reliability growth programs.

### System

- Global Hawk is a long-range surveillance and reconnaissance system.
- The Global Hawk system includes:
  - An Unmanned Aerial Vehicle (UAV) capable of high-altitude (above 60,000 feet) and long endurance (greater than 24 hours) operations
  - Launch/recovery ground station and mission control ground station
- The current Block 10 payload includes infrared, optical sensors, and synthetic aperture radar, all of which image ground targets and areas of interest.
- Ground crews use satellite and radio communications to control the air vehicle and transmit collected data.
- The Global Hawk mission control ground station receives, processes, and transmits imagery to distributed ground stations for exploitation to meet the theater commander's intelligence needs. Signals intelligence will be processed in a similar manner.



- The program plans to produce additional systems of air vehicles and ground stations (Blocks 20, 30, and 40) capable of greater payloads that include:
  - Imagery intelligence only (Block 20)
  - Multi-Intelligence: Imagery and Signals intelligence (Block 30)
  - Radar surveillance only (Block 40)

### Mission

- A unit equipped with this system would provide surveillance and reconnaissance imagery and data to the theater commander's exploitation assets, such as the Distributed Common Ground Station. Ground personnel assigned to exploit the collected material then develop the intelligence products to support theater operations.
- Units with Global Hawk provide persistent intelligence gathering through long-range and long-loiter capability when other assets are not available.
- The theater intelligence network tasks Air Force Global Hawk reconnaissance squadron detachments to collect imagery in order to answer essential elements of information identified by the theater commander.

### Activity

#### Block 10

- The Air Force completed the Block 10 Operational Utility Evaluation in November 2006. AFOTEC reported that the system was effective with limitations at performing the

imagery intelligence mission but not operationally suitable. Improvements to communications, imagery processing, reliability, and maintainability were recommended by AFOTEC.

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- Follow-on testing, including the verification of corrections to communications and navigation deficiencies, continued at Beale AFB and Edwards AFB, California.
- The Maritime Demonstration being conducted at Patuxet River Naval Air Station, Maryland, is providing proof of concept data and performance data for use of a maritime sensor on Global Hawk.
- Global Hawk flight operations (pilot training and test missions) at the Main Operating Base located at Beale AFB, California, continued, although at a slower pace than planned. The Air Force continues to work with Federal Aviation Administration (FAA) officials to resolve issues to allow normalized flight operations.

## **Block 20**

- Block 20 development and test are four months behind schedule. The program conducted two Block 20 test flights in the seven months since the first flight on March 1, 2007.
  - A landing gear door separated from the aircraft on the first flight, requiring a change in configuration. The second developmental test flight was consequently delayed until July 24, 2007.
  - The most recent mission took place on October 18, 2007, but returned early due to flight control surface anomalies.
  - An engine inlet distortion anomaly, requiring additional engineering analysis, was also discovered.
- An Operational Assessment, planned for September to October 2007, designed by AFOTEC to measure progress towards readiness for the IOT&E in 2009, has been delayed until early FY08.

## **Block 30**

- The first Global Hawk Block 30 air vehicle test flight is planned for January 2008.
- Development and initial testing of the Airborne Signals Intelligence Payload (ASIP), which is intended to provide the Block 30 multi-intelligence capability, continues on the U-2 aircraft. AFOTEC designed an Operational Assessment on the U-2 to measure progress towards readiness for the Global Hawk Block 30 IOT&E in 2009. This early involvement activity will provide a performance assessment for a December 2007 low-rate production decision on the ASIP payload.

## **Block 40**

- The first Global Hawk Block 40 air vehicle test flight is planned for June 2010.
- Initial testing of the Radar Technology Improvement Payload (RTIP), which is the sole intended payload for the Block 40, is being conducted on a surrogate unmanned air vehicle, Proteus. Proteus integration is similar to that intended for Global Hawk.

## **Assessment**

### **Block 10**

- The Air Force continued to mature the Block 10 system. DOT&E concurred with the findings of the AFOTEC report on the Block 10 Operational Assessment. Increased combat operational tempo combined with less-than-predicted reliability and limited spares of key components resulted in

a declining Block 10 mission capable rate. Remedial actions under investigation by the program now may improve Block 10 reliability.

- The limited number, duration, and frequency of flight authorizations from the FAA had an adverse impact on the Air Force's ability to conduct Global Hawk operations (pilot training and test missions) and mature the program as planned at the Main Operating Base located at Beale AFB, California. Low Global Hawk system reliability adversely affects the ability to consistently fly on a limited schedule.

### **Block 20**

- Block 20 air vehicle performance cannot be determined from flight test conducted thus far. The pace of flight test needs to increase in order to gain confidence in the new, larger aircraft design, propulsion system, and sensor operations.
- The program needs to recover approximately four months of schedule lag in the next six to nine months in order to reduce the risk that IOT&E for Block 20 will be delayed. The initiation of a new Combined Test Force organization at Edwards AFB, California, increases the likelihood that reasonable schedules and accurate performance assessments from developmental testing will be available in the future.
- It is high risk that the AFOTEC Operational Assessment will be available for the June 2008 production decision for Lot 7, which would be a breach of the integrated test strategy put in place through the 2006 Nunn-McCurdy certification.
- Block 20 development does not currently include a reliability growth program.

### **Block 30**

- Initial testing of the signals intelligence payload has progressed with minor delays. More comprehensive, integrated developmental testing, and an early FY08 AFOTEC Operational Assessment will yield a more complete understanding of the multi-intelligence capability planned for Global Hawk.
- Planning for the Block 30 IOT&E is hampered by the lack of a validated concept of operations for the multi-intelligence Block 30 capability. Among other issues, the concept of operations needs to address consolidating or separating exploitation of imagery and signals processing. This could affect how the system is tasked and operated. To be adequate, the operational test must provide an appropriate operational environment using the concept of operations.
- Block 30 development does not currently include a reliability growth program.

### **Block 40**

- Initial developmental test results for the RTIP payload are being sent to DOT&E for analysis. The test team has maintained the planned schedule thus far.
- The RTIP program documentation (test and evaluation master plan, acquisition strategy, acquisition program baseline) requires updates to reflect changes in the program since the cancellation of the E-10 platform.

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- As part of the updates, the Air Force test strategy needs an Operational Assessment of the RTIP payload capability, conducted by AFOTEC during the planned verification events, before production decisions in FY09.
- As with the Block 30 system, the Block 40 system lacks a validated concept of operations. The lack of this important piece means development and test planning proceed without benefiting from how the Service will integrate the Global Hawk system capability in the intended joint environment.
- Block 40 development does not currently include a reliability growth program.

## Recommendations

- Status of Previous Recommendations. The Air Force completed the Block 10 Operational Utility Evaluation and committed to conduct a Block 20/30 IOT&E (including a multi-intelligence Block 30 system) and a Block 40 IOT&E prior to making separate full-rate production decisions on these systems. The following three previous recommendations remain valid.
  - Contrary to DOT&E's recommendation to conduct a review and correct deficiencies in the intelligence, surveillance, and reconnaissance network in which Global Hawk operates, no comprehensive review has taken place, nor is one known to be planned by the Air Force. This recommendation could be largely answered by producing a valid concept of operations for the Block 30 and Block 40 systems (FY05).
  - In response to DOT&E's recommendation that low-rate initial production quantities should not be increased until after an adequate IOT&E of the Block 20 and Block 30 systems, the proposed acquisition strategy authorizes three additional lots of systems but reduces annual quantities of air vehicles to five per year until FY09. However, as recommended below, due to the delay in the Block 20 Operational Assessment, the DoD should place additional limits to production of air vehicles and/or sensor payloads in FY08 until the independent operational assessment is available for the defense acquisition executive (FY05).
    - The Air Force has not established a central government-managed archive of Global Hawk test and operational performance data and reports (FY06).
- FY07 Recommendations. The program should:
  1. Limit production quantities of air vehicles and/or payloads planned for FY08 until the Block 20 Operational Assessment is complete and this independent report on performance and progress towards the Block 20/30 IOT&E is available.
  2. Complete and validate the concepts of operations for initial deployment of Block 30 and Block 40 systems by the end of FY08.
  3. Consolidate test and evaluation planning for Global Hawk, ASIP, and RTIP to ensure there are no resource gaps for operational testing. For this purpose, develop a test planning working group that includes the developmental test and operational test directors for each Global Hawk block and all payloads programs.
  4. Demonstrate the degree to which requirements in the validated Global Hawk CDD are traceable to the performance that the actual design of the Block 20, 30, and 40 systems are predicted to yield.
  5. Develop and implement a reliability growth program for each Global Hawk block system.
  6. Re-engage with the FAA on unmanned air vehicle operations in continental operations - define and meet specific requirements for normalizing flying operations.
  7. Conduct an operational assessment of the RTIP payload before the FY09 production decision.

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## Integrated Strategic Planning and Analysis Network (ISPAN)

### Executive Summary

- U.S. Strategic Command (USSTRATCOM) and the Air Force Operational Test and Evaluation Center (AFOTEC) tested and then USSTRATCOM fielded the Integrated Strategic Planning and Analysis Network (ISPAN) Mission Planning and Analysis System (MPAS) Block 1, Spirals 4 and 5. Testing and performance was adequate.
- USSTRATCOM and AFOTEC conducted an Operational Assessment (OA) of ISPAN Collaborative Information Environment (CIE) Spiral 3 during the USSTRATCOM exercise "Global Storm" in March 2007. Because of several operational deficiencies, DOT&E determined the CIE spiral was neither operationally effective nor operationally suitable.

### System

- ISPAN is an operational planning and analysis network modernization program for USSTRATCOM being developed in three blocks. ISPAN consists of a family of customized software applications that run on commercial-off-the-shelf hardware and use a USSTRATCOM Enterprise Database. The system is currently developing and fielding Block 1.
- The MPAS, previously known as the Fielded Operational System, consists of the former Strategic Warfare Planning System. MPAS provides dedicated planning and analysis for all U.S. strategic nuclear forces. MPAS also provides planning and analysis to create plans for specified theater and strategic conventional forces. Maintenance and capability enhancements are tested and delivered every six months.
- Time sensitive planning is accomplished using the new CIE (previously called ISPAN Architecture and Integration) being developed in six spirals for Block 1. This capability will allow users from multiple Combatant Commander (COCOM) staffs, subordinate commands, as well as other agencies, to collaborate online while providing planning and analyses to senior decision makers.



- ISPAN modernization expands planning and analysis to new mission areas integrating the full spectrum of kinetic and non-kinetic weapons into strategic and theater plans.

### Mission

- USSTRATCOM uses ISPAN to perform deliberate and adaptive, strategic, nuclear, and non-nuclear planning and analysis. This includes developing the national deterrence war plans offering both nuclear and non-nuclear weapon options using the MPAS.
- The COCOMs, subordinate staffs, and other national agencies use the CIE for collaborative mission planning and analysis, course of action development, and commander's decision briefing preparation in support of time sensitive planning scenarios and time critical decisions regarding force employment.

### Activity

- USSTRATCOM and AFOTEC conducted ISPAN (MPAS) Block 1 Spiral 4 maintenance and modernization testing in December 2006. Testing included the evaluation of the enhancements to MPAS Missile Graphics Planning System (MGPS) and the Air Vehicle Planning System component applications, and the verification of the maintenance upgrades to the Data Management System, Data Processing System, and Theater Integrated Planning Sub-systems. USSTRATCOM fielded MPAS Spiral 4 in January 2007.
- USSTRATCOM and AFOTEC conducted ISPAN (MPAS) Block 1 Spiral 5 maintenance and modernization testing in May to June 2007. Testing included the evaluation of the enhancements to the MGPS and the Dynamic Application and Rapid Targeting System and the verification of the conversion of the legacy USSTRATCOM Enterprise Database to an Oracle Database. USSTRATCOM fielded MPAS Spiral 5 in July 2007.

- USSTRATCOM and AFOTEC conducted an OA of ISPAN CIE Block 1 Spiral 3 in conjunction with the USSTRATCOM exercise “Global Storm” in March 2007. AFOTEC issued an OA report in July 2007. AFOTEC evaluated the initial collaborative capability of CIE including:
  - Collaboration via the Secret Internet Protocol Router Network (SIPRNET) between USSTRATCOM planners and a remote component commander’s staff
  - Development of the commander’s course of action and decision briefs to national leadership
- The Air Force Program Executive Officer for Command, Control, and Combat Support notified OSD of an anticipated ISPAN program schedule breach on July 31, 2007. USSTRATCOM and the ISPAN program office are developing a recovery plan that includes development of the Block 1 Capability Production Document (CPD), definition of the new Block 1 end-state, and creation of a new Test and Evaluation Master Plan (TEMP).

## Assessment

- USSTRATCOM and the ISPAN program office executed a development and test schedule that delivers MPAS maintenance and modernization builds on a six-month schedule per the DOT&E-approved TEMP. A combined test team comprised of USSTRATCOM functional experts and AFOTEC testers found no significant operational issues with Spiral 4 and Spiral 5 releases. Testing and performance for ISPAN (MPAS) Spiral 4 and Spiral 5 was adequate to support the fielding decisions.
- USSTRATCOM and the ISPAN program office originally planned to deliver ISPAN CIE Spiral 3 in conjunction with ISPAN (MPAS). Emerging requirements led USSTRATCOM users to direct the program office to focus on planning in a net-centric and collaborative environment. This led to a delay of the CIE Spiral 3 OA until March 2007.
- The CIE Spiral 3 OA identified several operational issues, and DOT&E determined the spiral was neither operationally effective nor operationally suitable. CIE Spiral 3 did not

demonstrate the software maturity or capability to satisfy mission objectives. Deficiencies included:

- With only 10 percent of the desired users logged onto the system, latency was often 30 to 60 seconds (less than 5 seconds desired). In addition, some critical planning data were lost when routinely manipulated.
- The software was unstable and contained flaws. CIE software configuration management was inadequate. More robust developmental testing could have discovered the majority of these problems prior to the OA.
- Training and documentation, including the users’ concept of operations (CONOPS), were incomplete or inadequate and failed to provide the necessary guidance for users to effectively collaborate.

## Recommendations

- Status of Previous Recommendations. USSTRATCOM and the program office are addressing previous recommendations. USSTRATCOM must complete the CPD and TEMP revision for ISPAN Block 1. USSTRATCOM is developing requirements documents for ISPAN Block 2.
- FY07 Recommendations.
  1. USSTRATCOM and the ISPAN Program Manager should codify the desired end-state of Block 1 (capabilities to be delivered) for both the CIE and MPAS in an approved CPD. The ISPAN Block 1 TEMP revision should be approved to govern testing of the remainder of Block 1.
  2. USSTRATCOM should not field additional capabilities beyond those delivered in Spiral 3 until the developer can demonstrate, in a non-operational environment, that the existing baseline is stable and all mission-critical deficiencies have been fixed.
  3. USSTRATCOM should develop CONOPS and other applicable policies guiding the operation of the CIE so that users have a clear understanding of roles and responsibilities during collaborative planning.

## Joint Air-to-Surface Standoff Missile (JASSM)

### Executive Summary

- The Joint Air-to-Surface Standoff Missile (JASSM) program reported a Nunn-McCurdy cost breach in February 2007. OSD elected not to certify the program until the program demonstrates improved program management and system reliability.
- OSD directed the program to change from Acquisition Category (ACAT) IC (Service oversight) to ACAT ID (OSD oversight).
- OSD approved an Air Force strategy that changes program management, identifies reliability problems, and characterizes the reliability of corrected Lot 4 production missiles. The Air Force designed this strategy to support a Nunn-McCurdy certification in time to maintain current JASSM production schedules.
- The Air Force has not met OSD-required metrics for documenting the new management and test approaches.
- The program schedule for the testing prior to a certification is high-risk.
- OSD directed the program to cease development on other JASSM variants. If OSD certifies the baseline program, the Air Force should develop all new acquisition and test strategies for JASSM Extended Range (ER), Weapon Data Link (WDL), and Maritime Interdiction (MI) variants.
- After failures in sled track and qualification testing, the Air Force stopped testing the Electronic Safe and Arm Fuze (ESAF) and revamped the LFT&E test strategy. DOT&E approved this new strategy.

### System

- Baseline JASSM is a stealthy cruise missile that flies a preplanned route from launch to a target, using Global Positioning System (GPS) satellite information 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 planned 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 Electronic Safe and Arm Fuze (ESAF) adds a more reliable fuze with the same capabilities as the baseline fuze. Development is ongoing.



- JASSM Extended Range (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 Weapon Data Link (WDL) is intended to add capabilities for two-way communication that support battle damage assessment and in-flight re-targeting. Development has been on hold since June 2007.
- JASSM Maritime Interdiction (MI) will build on WDL capabilities and add the capability to attack maritime targets under certain circumstances. Development has been on hold since June 2007.

### 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 from up to 200 miles away
  - Execute missions using automated preplanned or manual in-flight mission planning
  - Attack a wide-range of targets including soft, medium, or 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 WDL and MI should have added flexibility and greater retargeting capabilities in executing JASSM missions.

## Activity

### JASSM Baseline

- The JASSM program experienced a Nunn-McCurdy cost breach in February 2007.
- DOT&E participated in multiple meetings with OSD to determine the appropriate steps that could lead to certification of an updated JASSM program that meets Nunn-McCurdy certification requirements.
- The Nunn-McCurdy certification requires OSD to certify four criteria:
  - The program is essential to national security.
  - There is no alternative of equal or greater capability at less cost.
  - The new program cost estimate is reasonable.
  - Program management is adequate to manage and control program cost.
- OSD determined that the JASSM program was essential to national security with no less costly alternative. However, OSD elected not to certify the program until the Air Force demonstrates sufficient system reliability and improved program management.
- OSD changed the program from ACAT IC (Service oversight) status to ACAT ID (OSD oversight) status based on the Nunn-McCurdy reviews.
- The Air Force proposed a series of steps to implement program management changes, identify reliability problems, and characterize the reliability of corrected Lot 4 production missiles. The proposal would support a Defense Acquisition Board (assuming favorable review of management changes and demonstrated reliability) and could support an OSD certification that continues program production without interrupting the program's current production timeline.
- OSD required the Air Force to incorporate the above changes into program documentation with the developer, complete an OSD-approved System Evaluation Plan (SEP) and a DOT&E-approved Test and Evaluation Master Plan (TEMP), and conduct additional testing before OSD will certify the program to Congress.
- OSD directed periodic OSD reviews and a series of actions the Air Force must accomplish before OSD will certify the program.
- OSD directed that the Air Force cease development work on JASSM ER, WDL, and MI. OSD approved limited activities on ESAF, and F-15E integration. OSD requested that the Air Force begin new analysis of ER, WDL, and MI requirements.

### JASSM ESAF

- After failures in sled track and qualification testing, the Air Force stopped testing the ESAF. The program office revamped the LFT&E test strategy in January 2007. The new plan eliminated concurrent testing, and conducts adequate testing on the fuze in progressively challenging environments before Live Fire missile testing, flight testing, and production. Qualification testing is ongoing.

## Assessment

### JASSM Baseline

- The Air Force began screening previous system and test information to identify other deficiencies that may impact reliability. The program agreed with OSD SEP and DOT&E TEMP strategies and initial plans to stress production missiles in captive carry environments, ground test them to identify new failures, implement corrections in missiles, and flight test them as directed. The program has agreed in principle with OSD on scoring criteria and methodology for the flight testing.
- OSD, DOT&E, and a reliability advisory panel of outside experts identified the Air Force schedule as high risk. DOT&E is concerned that pressure to maintain the production schedule will reduce reliability improvement steps, not incorporate corrections as needed, and/or reduce planned adequate testing. If the Air Force does not implement program management changes and reliability improvements, the program is likely to return to the previous cycle of producing missiles with low operational reliability.

## Recommendations

- Status of Previous Recommendations. The two FY06 recommendations regarding JASSM ER were overcome by the Nunn-McCurdy certification events.
- FY07 Recommendations.
  1. The Air Force should focus on characterizing reliability, incorporating reliability and program management improvements.
  2. If OSD certifies the baseline program, the Air Force should develop all new acquisition and test strategies for JASSM ER, WDL, and MI variants. Each strategy should reflect an event-driven approach that plans appropriate testing based on operational concepts, requirements, and system capability.

## Joint Direct Attack Munition (JDAM)

### Executive Summary

- Joint Direct Attack Munition (JDAM) operational testing of all variants continued to demonstrate satisfactory performance consistent with historic JDAM effectiveness and suitability.
- The Air Force Operational Test and Evaluation Center (AFOTEC) completed reporting on the Multi-Service Operational Test and Evaluation (MOT&E) of the 500-pound JDAM variant.
- Both the Air Force and Navy began test and procurement activities for a laser JDAM variant. Operational test planning for this new JDAM capability was ongoing throughout FY07. A laser JDAM AFOTEC Operational Utility Evaluation (OUE) is being planned to support Air Force fielding of a limited number of laser JDAMs in FY08. A Navy Quick Reaction Assessment (QRA) is being planned to support Navy fielding of a limited number of laser JDAMs in FY09.

### System

- The 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 bomb
- An inertial navigation system provides primary guidance to the weapon. Enhanced accuracy is provided by augmenting the JDAM inertial navigation system with the Global Positioning Satellite (GPS) system signals.

### Activity

- Test and evaluation of legacy JDAM capabilities was conducted in accordance with the August 2004 DOT&E approved JDAM Test and Evaluation Master Plan (TEMP).
- AFOTEC completed the 500-pound JDAM MOT&E and found this Mk 82 variant to be effective and suitable.
- The Air Force participated in contractor-led developmental testing and operational demonstration of a laser JDAM variant. Laser JDAM provides dual-mode weapon guidance capability using legacy JDAM guidance in conjunction with the ability to provide target location updates to the weapon in flight using a laser seeker/sensor capability in the nose of the 500-pound JDAM variant.
  - Favorable early test and demonstration results led the Air Force to begin procurement activities for a limited number (currently 400 units planned) of laser JDAM kits. Air Force procurement efforts will support a September 2006 Urgent Operational Need for enhanced weapons capability against targets in the Southwest Asia area of ongoing



- Guidance and control is designed to enable accuracy of less than 13 meters when GPS is available and less than 30 meters when GPS is absent or jammed after release.

### 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.

- combat operations. An AFOTEC OUE is being planned for FY08 to support a May 2008 Air Force limited quantities fielding.
- The Navy is also participating in procurement activities for a limited number of laser JDAM kits (currently 230 units planned). An FY08 QRA of capabilities is being planned to support an FY09 Navy limited quantities fielding.
- JDAM performance in other operational test venues included continued life-cycle sustainment testing in Air Combat Command's Weapon System Evaluation Program and F-22A follow-on test and evaluation. JDAM performance remained satisfactory consistent with legacy effectiveness and suitability.

### Assessment

- The AFOTEC JDAM MOT&E determined that the 500-pound JDAM variant of the legacy JDAM was effective and suitable

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for operational use. This JDAM variant continues to be widely employed in ongoing combat operations.

- Legacy JDAM performance throughout FY07 remained satisfactorily consistent with historic JDAM effectiveness and suitability.
- Laser JDAM presents the potential for significantly enhanced capabilities beyond the scope of the legacy JDAM weapon system. While not part of the currently approved JDAM TEMP, successful completion of the FY08 AFOTEC-led laser JDAM OUE will be adequate to support the Air Force's desired fielding of a limited number of laser JDAMs.
- The currently envisioned laser JDAM capability for FY08 operational fielding may or may not represent the end-state of laser JDAM capabilities development. Therefore, the JDAM TEMP will require an update to address future testing associated with laser JDAM procurement beyond the planned Air Force FY08 and Navy FY09 limited fielding quantities described above.

## Recommendations

- Status of Previous Recommendations. There are no outstanding recommendations from FY06.
- FY07 Recommendations.
  1. The Air Force should demonstrate successful completion of an FY08 AFOTEC OUE before fielding laser JDAM for operational use.
  2. The Navy should demonstrate successful completion of an FY08 QRA before fielding laser JDAM for operational use.
  3. The Air Force should update the JDAM TEMP specifically to address future testing associated with laser JDAM procurement beyond the planned Air Force FY08 and Navy FY09 limited quantities fielding. This update should include both Air Force and Navy laser JDAM testing.

## Large Aircraft Infrared Countermeasures (LAIRCM)

### Executive Summary

- The Large Aircraft Infrared Countermeasures (LAIRCM) Phase I system is fielded, is in full-rate production, and, as stated in DOT&E's FY05 Report to Congress, is operationally effective and suitable.
- DOT&E assessed LAIRCM Phase II (Guardian) testing and demonstrated capabilities as adequate to support a low-rate initial production (LRIP) decision, which was based on the Air Force's Operational Assessment (OA) of Guardian completed in FY07.
- The Air Force changed the Guardian acquisition strategy from development of a new capability to an engineering change proposal in FY07.
- This new Air Force Acquisition strategy for Guardian eliminated the Air Force's milestone decisions for the Guardian upgrade allowing entry into full production without milestone decision points.
- Based on testing to date, which was designed to support a LRIP decision, the Air Force's Milestone Decision Authority (MDA) is accepting high risk if Guardian production continues above previously planned LRIP quantities (up to 20 percent of total production) before the Air Force conducts the FY09 LAIRCM Phase II IOT&E.
- DOT&E concurs with the Air Force Operational Test and Evaluation Center's (AFOTEC) OA report that the Next Generation Missile Warning Sensors (NexGen MWS) testing supports the scheduled 2QFY08 LRIP decision, and that demonstrated capabilities are maturing as expected.

### System

- LAIRCM is a defensive system for large transport and rotary wing aircraft that combines the Air Force's newest Missile Warning Sensor (MWS) and infrared laser jammer countermeasure systems.
- LAIRCM Phase I is fielded.
  - It delivers a system of proven and available subsystems.
  - Key components include ultra-violet MWS, countermeasures processor, and infrared laser jammer.
  - The infrared laser jammer is the Small Laser Transmitter Assembly.
  - Platforms with LAIRCM Phase I include C-17, C-130, and MH-53.



- Integration on C-5, CV-22, and C-40 began in FY06-07.
- LAIRCM Phase II is a spiral upgrade in development and incorporates:
  - A new infrared MWS called the NexGen MWS
  - A Miniaturized Laser Jammer Turret Assembly (also known as Guardian)
- The Phase II NexGen MWS is designed to provide higher performance warning compared to Phase I MWS through:
  - Earlier threat warning
  - Improved detection in challenging urban and natural environments
  - Enhanced capability against emerging threats
- Phase II Guardian Laser Jamming Turret Assembly reduces life-cycle costs through:
  - Smaller and lighter packaging
  - Reliability improvements

### Mission

Combatant commanders use LAIRCM to provide automatic protection to crews and large transport or rotary wing aircraft against shoulder-fired, vehicle-launched, and other infrared-guided missiles. Such protection is needed during normal take-off and landing, assault landings, tactical descents, air drops, low-level flight, and aerial refueling.

### Activity

#### LAIRCM Phase I

- The Air Force fielded LAIRCM Phase I in FY05.
- This phase of the LAIRCM system did not undergo significant testing in FY07.

- In FY07, the Navy began plans to test LAIRCM Phase 1 MWS integrated on Marine Corps CH-53E helicopters.

## LAIRCM Phase II

- LAIRCM Phase II is in the System Development and Demonstration phase.
- In FY07, AFOTEC completed OAs for both the Guardian and the NexGen MWS.
- The Air Force's OAs supported the scheduled Guardian LRIP decision in 3QFY07 and a separate NexGen MWS LRIP in 1QFY08.
- USD (AT&L) nominated LAIRCM for transition to Acquisition Category IC in FY07 driven by increased production quantities and a rising research and development budget which supports the incremental upgrades.
- The Air Force changed the Guardian acquisition strategy from development of a new capability to an engineering change proposal in FY07.
- In coordination with DOT&E, the Air Force finalized plans to test the integration of the LAIRCM on the C-5 transport aircraft in early FY08. The LAIRCM system configuration includes the Phase I ultra-violet MWS and the Phase II Guardian.
- DOT&E approved updates to the LAIRCM Test and Evaluation Master Plan (TEMP) in January 2007 for testing through the FY09 IOT&E.
- LAIRCM testing in FY07 was conducted in accordance with the DOT&E-approved TEMP and test plans.
- In FY07, the Navy began plans to test LAIRCM Phase II Guardian integrated on Marine Corps CH-53E.

## Assessment

### LAIRCM Phase I

- The LAIRCM Phase I system is operationally effective at enhancing aircraft survivability, and is much less susceptible to degradation under certain conditions compared to the system initially fielded.

### LAIRCM Phase II

- DOT&E provided a Guardian report to the MDA in support of the scheduled 3QFY07 Guardian LRIP decision. DOT&E

assessed that the OA testing was adequate to support the LRIP decision, and that the demonstrated effectiveness and suitability were at expected maturity levels for this stage of development. Some limitations were identified which should be addressed prior to IOT&E.

- The Air Force's OA testing on the Guardian was adequate for the LRIP decision, but did not fully characterize the system capabilities for a full-rate production decision.
- This new Guardian acquisition strategy eliminated the Air Force's milestone decisions for the Guardian upgrade allowing entry into full production without milestone decision points.
- Based on testing to date, which was designed to support a LRIP decision, the MDA is accepting high risk if Guardian production continues above previously planned LRIP quantities (up to 20 percent of total production) before the Air Force conducts the FY09 LAIRCM Phase II IOT&E.
- Based on the AFOTEC NexGen OA Report, DOT&E anticipates a timely NexGen LRIP decision in 2QFY08. DOT&E concurs with the AFOTEC report that testing is adequate to support a NexGen LRIP decision, and that the system's capabilities are maturing as expected.
- DOT&E plans to provide an Early Fielding Report to Congress early in FY08 that will clarify the risks related to the Air Force fielding Guardian on the C-5 transport aircraft, which is well prior to the planned IOT&E in FY09.

## Recommendations

- Status of Previous Recommendations. The Air Force has addressed all previous DOT&E recommendations.
- FY07 Recommendations.
  1. LAIRCM Phase I: None
  2. LAIRCM Phase II: The Air Force should provide a revised TEMP by October 1, 2008, that incorporates changes to the LAIRCM Acquisition Strategy and clearly defines the Guardian reliability testing to support planning of the FY09 LAIRCM Phase II IOT&E.

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

### Executive Summary

- The Air Force has not yet fully developed a test strategy to adequately evaluate Miniature Air Launched Decoy's (MALD's) capabilities in an operational mission environment.
- The Air Force is conducting an Operational Assessment (OA) to assess MALD progress towards operational mission capabilities in support of a 2QFY08 low-rate initial production (LRIP) decision.
- MALD testing and performance are progressing as expected for a system at this early stage of development.
- The Air Force-approved MALD Test and Evaluation Master Plan (TEMP) is not adequate to support the FY08 LRIP decision or MALD testing after December 31, 2007. The Air Force TEMP is not based on the required Capabilities Development Document because this document has not been developed.

### System

- MALD is a small, low-cost, expendable, air-launched vehicle that replicates what fighter, attack, and bomber aircraft look like to enemy radar operators.
- The MALD is a new Air Force capability that is in the System Development and Demonstration Phase.
- The Air Force plans to procure the first 150 of 1,500 production MALD in 2QFY08 to support testing and an Initial Operational Capability in 2010.
- The MALD-J is a future program spiral that adds the capability to jam specific radars from within the threat's lethal engagement zone.



- The F-16 C/D and B-52 are the lead aircraft to employ MALD and MALD-J. In the future, the Air Force plans to employ both versions of these decoys on F-15C/E, B-1B, A/OA-10, B-2, F-22, and F-35 aircraft.

### Mission

Combatant commanders use the MALD to allow a strike force to accomplish its mission by forcing enemy radars and air defense systems to treat MALD as a viable target. MALD-equipped forces should have improved battle space access for airborne strike forces by deceiving, distracting, or saturating enemy radar operators and Integrated Air Defense Systems. Airborne strike leaders will use MALD-J to degrade or deny threat radar detection of friendly aircraft or munitions.

### Activity

- MALD is in the System Development and Demonstration Phase, with the Initial Operational Capability planned for early FY10.
- The Air Force is conducting an OA to assess MALD's progress towards operational mission capabilities in support of a 2QFY08 LRIP decision.
- The OA uses ground and flight testing to assess MALD's progress, while also conducting mission planning demonstrations, as well as reliability and supportability data collection.
- MALD ground testing is focused on integration on the B-52 and F-16, threat density saturation, radar cross section performance, and suitability.
- Flight testing of MALD in FY07 is concentrated on safe aircraft separation, engine start, MALD vehicle flight,

- navigation, and subsystem performance, as well as decoy effectiveness.
- Air Force MALD ground testing is being conducted at Eglin AFB, Florida, the Naval Air Warfare Center at China Lake, California, in addition to the Army's White Sands Missile Range, New Mexico.
- The flight testing portion of the MALD OA includes off-shore flights near Eglin AFB, Florida, and overland events at the Air Force's Nevada Test and Training Range.
- As a result of MALD being placed on initial operational test oversight in FY07, the Air Force initiated a revised MALD TEMP for initial DOT&E approval. This TEMP includes the core MALD capability in addition to the planned MALD-J increment.

- FY07 testing was conducted in accordance with the DOT&E-approved test plan.

## **Assessment**

- MALD testing and performance are progressing as expected for a system at this early stage of development. Three of five MALD launches to date have experienced moderate to significant anomalies. Two of the three have been corrected and have not reoccurred in subsequent flights. The overall mission-level success rate is three of the five launches to date, since the first anomaly was not mission critical.
- DOT&E observed MALD present a credible small bomber-size target to threat radar operators in a very limited flight test scenario.
- The Air Force's primary open air electronic warfare range, the Nevada Test and Training Range, is extremely limited in overland flight profiles available for MALD, and does not authorize simultaneous flights of multiple MALD. Additionally, the Air Force has not developed a mature modeling and simulation plan or other mitigating ground testing for full MALD assessment. These limitations challenge the Air Force's ability to adequately assess MALD in an operational mission environment.
- Evaluation of MALD reliability and performance in a dense threat environment will rely heavily on modeling and simulation, which will require a proactive and disciplined validation, verification, and accreditation process.
- The Air Force-approved MALD TEMP is not adequate to support the FY08 LRIP decision or MALD testing after December 31, 2007. The Air Force TEMP is not based on the required Capabilities Development Document, because this document has not been developed. Additionally, development of the required Capabilities Production Document to support the FY08 Milestone C/LRIP decision and the draft TEMP for DOT&E approval is well behind schedule.

## **Recommendations**

- Status of Previous Recommendations. There are no previous recommendations as this is the first DOT&E report on MALD.
- FY07 Recommendations. The Air Force should:
  1. Submit and gain DOT&E approval of the revised MALD TEMP prior to January 1, 2008.
  2. Incorporate improved test methodology and range resources that support adequate characterization of MALD in an operational mission environment.

## MQ-9 Reaper Hunter Killer Armed Unmanned Aircraft System (UAS)

### Executive Summary

- The Test and Evaluation Master Plan (TEMP), approved by DOT&E in 2005, has not been executed. The Air Force's decision to deploy MQ-9 prior to IOT&E has altered the 2005 test strategy. A revised TEMP was approved in 2007.
- The Air Force deployed an MQ-9 system to the Central Command's (CENTCOM) area of responsibility (AOR).
- No dedicated operational testing occurred prior to fielding. DOT&E is preparing a report in accordance with Section 231 of the National Defense Authorization Act of 2007 based on data collected by the developer and operational test agency during developmental testing (DT).
- IOT&E for MQ-9 Increment 1 is planned for 2-3QFY08.
- A full-rate production decision for MQ-9 Increment 1 is planned for 2QFY09.

### System

- The MQ-9 is a remotely piloted, armed, unmanned aerial vehicle (UAV) that uses optical, infrared, and radar sensors to attack ground targets.
- This system includes ground stations for launch/recovery and mission control of sensors and weapons.
- This MQ-9 is a medium-sized UAV that has an operating ceiling up to 50,000 feet, an internal sensor payload of 800 pounds, an external payload of 3,000 pounds, an endurance of approximately 14 hours, and stronger landing gear than its predecessor, the MQ-1 Predator.
- The MQ-9 shares command and control characteristics with the MQ-1 Predator.
- The MQ-9 is commanded by ground elements via Ku-band satellite and C-band line-of-sight data links.



- It carries Hellfire II anti-armor missiles (AGM-114) and 500-pound laser-guided or Global Positioning System-guided bombs.

### 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.

### Activity

- An updated MQ-9 TEMP was approved in 1QFY08.
- Government led DT continued through FY07. Significant DT efforts included the completion of DT testing on the operational flight program (OFP), which supports the early fielding configuration and the IOT&E. This OFP includes GBU-12 and basic Hellfire missile capability, expanded flight regimes, and stores management system.
- Expanded takeoff and landing procedures and weapons integration testing was executed by the DT team at China Lake Naval Weapons ranges and Edwards AFB, California.
- A three-mission Integrated System Evaluation (ISE) #1 was completed to assess initial combat capability for the early fielding configuration for the Air Component Commander.
- The Air Force deployed an MQ-9 system to the CENTCOM AOR. DOT&E is preparing a report in accordance with Section 231 of the National Defense Authorization Act of FY07 based on data collected by the developer and operational test agency during developmental testing.
- Two MQ-9 missions flew in support of the Air Force's Weapon System Evaluation Program; Hellfire missiles and 500-pound laser-guided GBU-12s were successfully employed by the DT team.

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## Assessment

- Testing observed to date has had limited operational realism thus affecting the evaluation of operational effectiveness and suitability.
- The MQ-9 demonstrated limited initial combat capability during the observed ISE missions. The lack of operationally realistic testing limited the ability to assess the system's effectiveness and suitability prior to the Air Force's early fielding. The Early Fielding report to be submitted to Congress will detail DOT&E's analysis of the early fielding decision reiterating a limited combat capability. Full operational characterization is forthcoming following completion of the fully scoped DT and operational test in FY08.

## Recommendations

- Status of Previous Recommendations. One of three previous recommendations remains valid:
  - The Air Force should complete ISE-I and ISE-II in order to prepare for IOT&E in FY08.
- FY07 Recommendations. The Air Force should:
  1. Ensure sufficient developmental testing in accordance with the October 18, 2007, approved TEMP.
  2. Plan for and conduct IOT&E in accordance with the approved TEMP and an approved Test Plan.

## NAVSTAR Global Positioning System (GPS)

### Executive Summary

- The Global Positioning System (GPS) Architecture Evolution Plan (AEP) Operational Utility Evaluation (OUE) conducted by the Air Force Operational Test and Evaluation Center (AFOTEC) commenced in 4QFY07 in accordance with the DOT&E-approved Test and Evaluation Master Plan (TEMP).
- The NAVSTAR GPS test community addressed previously identified concerns by including user equipment in operational testing and is working to create a comprehensive, GPS enterprise TEMP.
- The NAVSTAR GPS Modernized System needs to integrate operational end-to-end testing of the space, control, and GPS modernized (Military-code) receivers on representative combat platforms in realistic operational and threat environments.

### System

- The NAVSTAR GPS is an Air Force-managed joint Service precision navigation and timing space program used for DoD and non-DoD operations.
- The NAVSTAR GPS consists of three operational segments:
  - Space Segment: The NAVSTAR GPS spacecraft constellation consists of 24 operational satellites in semi-synchronous orbit.
  - Control Segment: The control segment consists of the GPS master control station, operational system control antennas, a pre-launch compatibility station, and geographically dispersed operational monitoring stations.
  - 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 a Military-code (M-code) enhanced capability to better meet the needs of operational users.



- The Air Force Space Command has launched three blocks of NAVSTAR GPS satellites and has two blocks of spacecraft in development:
  - Block I (1982-1992)
  - Block II/IIA (1990-1997)
  - Block IIR/IIR-M (Modernized) (1997-present)
  - Block IIF development (follow-on spacecraft)
  - 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.

### Activity

- Operational testing of the Operational Control Segment (OCS) AEP commenced in July 2007.
- The Air Force plans to launch the third NAVSTAR GPS Block IIR-M (Modernized) satellite in October 2007 and will conduct early-orbit testing upon successful orbit insertion.
- The Integrated Test Team developed a draft TEMP for the Block IIIA satellites and the Next Generation GPS Control Segment (OCX).
- The 92nd Information Operations Squadron conducted Information Assurance testing during the OUE for the AEP.
- The test planning for GPS Block III and OCX made substantial progress in 2007; specifically, the Air Force

designed a GPS enterprise schedule that identified GPS mission capabilities, control segment upgrades, and user segment requirements.

### Assessment

- To ensure effectiveness for combat, the NAVSTAR GPS Modernized User Equipment (MUE) receivers must be integrated into production representative Military GPS User Equipment (MGUE) hosted on representative platforms (i.e., ships, aircraft, land, and space vehicles) and tested in realistic operational environments that include appropriate electronic warfare and Information Assurance conditions.

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- The third Block IIR-M satellite is planned to launch in 2007; however, prototype NAVSTAR GPS MUE will not be available to conduct basic developmental testing of Block IIR-M unique capabilities until at least 2010. While this problem affects developmental testing, the Air Force should have production representative MUE in place for adequate operational testing scheduled for 2012.
- The synchronization of the development of the space, control, and user segments continues to be a concern; however, progress towards creating MGUE production representative articles has improved the situation. Delays in fielding MGUE preclude operational testing of IIR-M unique capabilities, but the risk to GPS III has been mitigated by the Air Force committing resources and planning to test GPS III capabilities with MGUE on operational platforms.

## Recommendations

- Status of Previous Recommendations. There were no FY06 recommendations. The Air Force has made progress on previous FY05 DOT&E recommendations, yet four out of the five recommendations remain valid. The Air Force should continue to synchronize development of the three NAVSTAR GPS segments and include them in a rigorous end-to-end test with operationally representative platforms. DOT&E continues to advocate the operational testing of new and legacy NAVSTAR GPS receivers as early in the program as possible. The Air Force should test GPS in appropriate electronic warfare environments to ensure M-code capabilities are demonstrated under realistic combat conditions.
- FY07 Recommendations. None.

## Small Diameter Bomb (SDB) Increment I

### Executive Summary

- The Small Diameter Bomb (SDB) system completed its first year of operational service, including combat employment, in FY07. Overall performance was consistent with that observed in FY06 IOT&E. The system remained effective and suitable.
- BRU-61/A carriage reliability shortfalls noted in FY06 impacted operational use in FY07, but improvements were noted with the incorporation of redesigned carriage hardware. Fielded BRU-61/A inventories were modified in FY07, and the full effect of improvements on overall carriage reliability remains to be assessed in FY08.
- Correction of deficiencies in SDB Joint Munitions Effectiveness Manual Weaponing Software (JWS) was ongoing in FY07; the planned FY07 software improvements were deferred by the Air Force until FY08.
- The Air Force follow-on test plan to address shortfalls in SDB lethality data was approved by DOT&E on July 17, 2007. Testing will be conducted in early FY08.



- SDB may be supported by the Accuracy Support Infrastructure (ASI) system, a ground-based, theater-deployable, differential GPS system, designed to increase SDB accuracy. ASI collects GPS satellite positioning error data and broadcasts target location corrections to the SDB through the F-15E data link prior to weapon release.

### System

- The SDB is a 250-pound air launched weapon using deployable wings to achieve standoff range.
- SDB uses a combination of Global Positioning System (GPS) and internal inertial navigation system guidance to achieve precise guidance accuracy.
- SDBs are employed from a four-weapon carriage assembly mounted on F-15E aircraft.
- The SDB warhead is a penetrator design with additional blast and fragmentation capability. Integral fuzing is initiated by warhead impact, with or without a specified function delay, or by reaching a preset height above the intended target.
- SDB provides reduced collateral damage potential while achieving kills across a broad range of target sets by precise accuracy, small warhead design, and focused warhead effects.

### Mission

- Combatant commanders use SDB to attack fixed or relocatable targets that remain stationary from weapon release to impact. Units can engage both soft and hardened targets to include communications facilities, aircraft bunkers, industrial complexes, and lightly armored ground combat systems and vehicles.
- SDB-equipped units can achieve an increased weapons load out per aircraft compared to conventional air-to-ground munitions for employment against offensive counter-air, strategic attack, interdiction, and close air support targets in adverse weather.

### Activity

- Test and evaluation was conducted in accordance with the December 2004 DOT&E-approved Test and Evaluation Master Plan.
- SDB was fielded for combat use by operational F-15E at the end of FY06. Early problems with hardware component failures led the Air Force to take aggressive action to correct deficiencies and repair fielded items. SDB weapons have been employed in support of ongoing combat operations in the Southwest Asia areas of operation.
- The SDB BRU-61/A carriage assembly had not met the Air Force's mean time between failure requirements at the end of FY06. In FY07, the Air Force took action to redesign and

- replace certain carriage components to improve reliability. At the end of FY07, the existing inventories of BRU-61/A carriages had been retrofitted with the improved configuration.
- Upon conclusion of FY06 IOT&E DOT&E determined that additional Live Fire testing was required to validate forthcoming improvements in SDB weaponing software and to provide a more robust set of empirical lethality data to better characterize SDB capabilities and limitations. In FY07, DOT&E approved the Air Force follow-on test plan, and test execution will commence in early FY08.
- Upon conclusion of FY06 IOT&E, DOT&E determined that the currently fielded version of the JWS small warhead

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lethality modeling did not adequately support SDB mission planning. An improved JWS version was expected in FY07, but efforts were not complete and an updated JWS will not be released for operational use until FY08.

- SDB evaluation in other FY06 operational test venues included Force Development Evaluation testing in Air Combat Command's Weapon System Evaluation Program in late FY07.
- Developmental and Live Fire testing of the SDB Focused Lethality Munition continued in FY07. This testing supported an OSD-sponsored Advanced Capabilities Technology Demonstration initiative investigating the utility of SDB munitions, coupled with an enhanced blast-only warhead and an enhanced bomb body composed of composite materials. Operational assessment of this SDB variant is anticipated in FY08.

## Assessment

- Overall SDB performance during its first year of operational fielding, to include combat employment, was consistent with that noted in FY06 IOT&E. Operationally the system remained effective and suitable.
- BRU-61/A carriage reliability problems first noted in IOT&E impacted operational use in FY07. However, overall carriage reliability improvement was noted with the incorporation of improved hardware components. At the end of FY07, all fielded carriage assemblies had been modified. The full effect of the carriage improvements on overall BRU-61/A remains to be assessed in FY08.

- JWS improvements have yet to be realized. While progress was noted in Air Force small warhead lethality modeling, anticipated FY07 JWS updates will not be available for assessment until FY08.
- Follow-on live weapons testing to provide a more robust set of empirical lethality data to better characterize SDB capabilities and limitations remains to be accomplished. Testing in accordance with the DOT&E approved test plan is scheduled to occur in early FY08.

## Recommendations

- Status of Previous Recommendations. Correction of deficiencies in JWS SDB effectiveness to facilitate accurate and effective mission planning remains to be completed. Additionally, follow-on Live Fire testing using impact-fuzed SDBs to validate JWS improvements and to provide a more robust set of empirical data to better characterize the range of SDB capabilities against ground combat system such as field artillery and lightly armored air defense systems has yet to be accomplished (FY06).
- FY07 Recommendation.
  1. The Air Force should continue to monitor BRU-61/A carriage reliability improvements in FY08 to determine overall system reliability in conjunction with hardware improvements incorporated in FY07.

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

### Executive Summary

- Highly Elliptical Orbit (HEO) Satellite 1 is undergoing developmental testing, and planning is ongoing for operational testing and message certification in 2008. Early data indicate better than expected sensor performance; yet, overall system performance may be restricted initially by ground software limitations.
- Deficiencies in the Geosynchronous Orbit (GEO) satellite Flight Software Subsystem (FSS) were identified during GEO-1 developmental testing. The FSS may require redesign to meet spacecraft control and telemetry functionality.
- The ground architecture and operational requirements for subsequent HEO and GEO deliveries, including mobile survivable and enduring elements, need further definition.

### System

- The Space-Based Infrared System (SBIRS) program is being developed to replace the Defense Support Program (DSP) satellites and is being developed in two system increments:
  - Increment 1 uses the SBIRS Control Segment and User Segment, operating with DSP satellites, to provide current military capability. Initial Operational Capability for Increment 1 was attained in December 2001, consolidating the operations of the DSP and Attack and Launch Early Reporting to Theater missions.
  - Increment 2 develops new software and hardware for the Mission Control Segment to conduct integrated SBIRS spacecraft operations. The SBIRS Space Segment consists of two hosted payloads in HEO and four satellites in GEO. The launch of the GEO SBIRS satellites for Increment 2 has not yet started.



### Mission

- Combatant commanders, deployed U.S. military forces, and allies intend to use SBIRS to conduct missions that require improved space sensors and operational launch detection capabilities.
- Commanders will use SBIRS to provide enhanced data quality and more timely reporting to joint combat forces in four key areas:
  - Timely and responsive space-based missile warning and detection
  - Launch detection for missile defense operations
  - Technical intelligence
  - Battlespace awareness

### Activity

- An Acquisition Decision Memorandum (ADM) in July 2007 approved Air Force acquisition of the third SBIRS GEO satellite and sensor payloads for the third and fourth HEO satellites as well as an option for a fourth GEO satellite.
- The contractor conducted thermal-vacuum developmental testing on the GEO-1 spacecraft bus between November 2006 and March 2007.
- The contractor delivered the GEO-1 payload to the integration facility in August 2007 for assimilation and testing with the spacecraft bus.
- The HEO-1 sensor continues developmental testing in preparation for operational testing and certification of the HEO mission in 2008.

- The HEO-2 payload is undergoing ground testing and integration.
- Progress continues toward development of modeling and simulation required to support SBIRS operational testing.

### Assessment

- The SBIRS Increment 1 system, operating with the current DSP satellites, continues to demonstrate improved performance over the earlier DSP system.
- Early HEO-1 on-orbit data indicates better-than-expected sensor performance; however, overall system performance appears to be limited by the capabilities of the current ground software. Evaluation of actual end-to-end operational

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performance should be accomplished during a planned 2008 Operational Utility Evaluation.

- The SBIRS ground architecture and overall system operational requirements need better definition to support development of an integrated test strategy that can meet the program schedule and mission needs. Specifically, the ground architecture for full HEO and GEO message processing, and the survivable and endurable mobile elements, lack sufficient definition.
- Compressed schedules for accredited SBIRS operational test scenarios and simulations increase program risk.
- The contractor identified deficiencies in the GEO FSS following analysis of thermal-vacuum developmental test data on the GEO-1 bus. These deficiencies could impact spacecraft control and telemetry functionality. If FSS redesign is necessary, significant program schedule impacts are likely.

## Recommendations

- Status of Previous Recommendations. There were no FY06 recommendations. The Air Force has made progress on the FY05 DOT&E recommendations. Two of the original four recommendations remain valid as the Air Force continues to refine concepts of operation and operational requirements for each SBIRS increment.
- FY07 Recommendations.
  1. The Program Office should identify modeling and simulation requirements as soon as possible to provide sufficient time for validation and verification of modeling and simulation prior to the program's need date.
  2. The Air Force should conduct integrated operational testing in support of SBIRS GEO message certification.

## Theater Battle Management Core Systems (TBMCS)

### Executive Summary

- Led by the Air Force, the Services conducted Force Development Evaluation (FDE) and Security Test and Evaluation (ST&E) of Theater Battle Management Core Systems (TBMCS) Force-level 1.1.3, software upgrades (Service Packs) during March 2007. Force-level regression testing is ongoing.
- Significant TBMCS Unit-level Operations (UL-Ops) testing occurred during FY07. However, no significant TBMCS unit-level intelligence operational testing occurred.
- TBMCS UL-Ops testing was adequate and revealed improvements in base mapping and unit scheduling functions. Documentation changes were made and regression testing occurred, resulting in a significant reduction of mission downtime during system upgrade. TBMCS UL-Ops remains operationally effective, suitable, survivable, and has been approved for fielding.

### System

- TBMCS is an integrated command and control, intelligence, surveillance, and reconnaissance system, which provides hardware, software, and communications interfaces to support the preparation, modification, and dissemination of the force-level Air Battle Plan (ABP). The ABP includes the Air Tasking Order (ATO) and Airspace Coordination Order (ACO).
- TBMCS incorporate servers, routers, communications links, operator workstations, and software to improve real-time targeting, accuracy of targeting, data handling and dissemination, and interoperability with national intelligence databases.
- Planned TBMCS fielding includes every theater air component, all Navy aircraft carriers and command ships, all Marine Air Wings, and all Air Force flying wings and Air Support Operations Center (ASOC) squadrons. Army Battlefield Coordination Detachments, Army Missile Defense Command will interface with TBMCS through the Army Battle Command System.

### Mission

- The TBMCS force-level system provides intelligence, targeting, and airspace deconfliction applications at the theater



- Joint Force Air Component Commander (JFACC) level, the ASOC, and the Direct Air Support Center to support the coordination of precision engagement fires, safe passage zones, and near real-time warnings of impending air attack.
- TBMCS UL-Ops and unit-level intelligence provide Air Force Wings and Bases the capability to receive the ABP, parse it, and manage wing operations and intelligence to support execution of the ABP.
- The TBMCS air and surface surveillance and weapons coordination engagement options enables synchronized operations and correct weapons employment for each target.
- All TBMCS network participants contributing to improved decision-making by commanders share engagement intentions and results assessments.
- Units equipped with TBMCS are able to:
  - Provide the JFACC and component commanders with decision support tools
  - Support joint air campaign planning and execution
  - Provide computer-supported management of all joint theater airborne assets in the area of responsibility within the Air Operations Center (AOC) construct

### Activity

- FDE and ST&E of TBMCS Force-level 1.1.3, software upgrades were conducted during March 2007, with follow-on regression testing conducted June 2007. TBMCS test participants were:
  - 46th Test Squadron, Eglin AFB, Florida
  - Air Mobility Command (AMC), Scott AFB, Illinois
  - Space and Warfare Systems Center (SPAWAR), San Diego, California

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- Marine Corps laboratory at Idaho National Laboratories, Idaho Falls, Idaho
- Redstone Arsenal, Alabama
- A classified operational military location
- Combined developmental testing and operational testing (DT/OT) and ST&E of TBMCS Force-level 1.1.3, Service Pack testing was conducted at various times in 2007 by the 46th Test Squadron and SPAWAR in lab environments. The Marines led a combined DT/OT of a specific Service Pack at a classified location. The 46th Test Squadron and SPAWAR supported the DT/OT from stateside test labs.
- 605th Test Squadron personnel conducted FDE and ST&E of TBMCS UL-Ops Spiral 9.1 during July 2007.
- There was no significant TBMCS unit-level intelligence operational testing in 2007.

## Assessment

- Operational Service Pack testing provided feedback to the user community and program office on the overall effectiveness and suitability of the enhancements to the TBMCS Force-level program. These enhancements enable TBMCS users to interface directly with AMC's new Global Decision Support System-2 (GDSS2) for command and control of AMC missions.
- TBMCS testing had few significant limitations, which had only minimal effect on test adequacy when testing the interface with GDSS2. Limitations were:
  - The system administrators' ability to detect and react to an Information Assurance system penetration attempt was not evaluated.
  - There were no internal multi-level security protocols available, and TBMCS-GDSS2 interface testing was strictly at the Secret level.
  - During operations, AMC employs an electronic guard when interfacing between the TBMCS Secret information and the GDSS2 Unclassified information. Thus, GDSS2 will require testing to ensure the classification bridge works correctly to keep both Secret and Unclassified databases synchronized.
- Loading TBMCS software requires a minimum of four hours, which exceeds the amount of mission downtime allowed for availability requirements. The program office has worked with operational sites to use a combination of contractor support (to minimize actual load time) and extra hardware (to allow loading to occur with minimal impact to live operations) to satisfactorily address system availability requirements.
- Individual service plans for mitigating TBMCS 1.1.3 Service Pack installation time have been coordinated and deemed

acceptable by the Army, Navy, Marine Corps, and Air Force. During the June 2007 regression testing of Service Packs, the Air Force and Navy were able to close all outstanding critical problem reports. The Marines were unable to complete testing for their Service Packs, and they continue to search for the reasons for failure.

- TBMCS Force-level 1.1.3, with Service Packs, is operationally effective, suitable with exceptions, and survivable. One Service Pack has been approved for limited fielding to select Air Force and Marine Corps sites in order to enable timely Field Training Unit course development, Help Desk training, and risk mitigation prior to general fielding. After fielding to one unit, the Marine Corps will re-evaluate to ensure that Service Packs have no deficiencies. Upon that determination, the Marine Corps will then support a full fielding.
- TBMCS Force-level Service Packs were assessed to be low risk, and operational testing was adequate and successful.
- TBMCS UL-Ops (UL-Ops) testing of Spiral 9.1 upgrades revealed improvements in base mapping and unit scheduling functions. Documentation changes were made and regression tested, resulting in a significant reduction of mission downtime during the system upgrade. TBMCS UL-Ops remains operationally effective, suitable, and survivable, and Spiral 9.1 has been approved for fielding.

## Recommendations

- Status of Previous Recommendations. There are no previous recommendations.
- FY07 Recommendations. The Air Force should:
  1. Continue efforts to instrument the network and TBMCS servers in the AOC during testing. Problems attributable to "unexplained slowdowns" will be more easily diagnosed, reducing time and money spent for contractor debug efforts.
  2. Ensure system administrators and Help Desk personnel attain and maintain a high level of proficiency, enabling them to quickly fix problems. One recommendation is to ensure 24-hour Help Desk manning, and the contractor's facility Tier 2 Help Desk having ready access to the classified Internet [SIPRNET], which would facilitate communication with end users to better identify and address system problems more quickly.
  3. Prepare system installation plans addressing how the system will be upgraded from the legacy version to the new software version early so that operational testing can better examine how software upgrades impact operational readiness and system availability.

## Wideband Global SATCOM (WGS)

### Executive Summary

- The test community is planning activities to support integrated and dedicated Wideband Global Satellite Communications (WGS SATCOM) operational test and evaluation.
- Multi-Service participation of satellite operators, deployed users, and testers is required to satisfy essential test objectives of this program.
- Although deployed users plan to transition to space vehicle 1 in a conditional mode as soon as the satellite reaches its operational orbital slot, the fielding decision should be based on the results of operational test and evaluation.

### System

- WGS is the next generation wideband component in the DoD's future military SATCOM architecture and provides communications in both the X-band and Ka-band frequencies.
- WGS combines vital capabilities onto a single satellite for tactical X-band communications, augments the Global Broadcast Service (GBS) Phase 2 system, and provides new two-way Ka-band service.
- The Military Satellite Communications (MILSATCOM) Joint Program Director is responsible for integrating the WGS and the GBS space and control capabilities.
- The WGS system will be composed of three segments:
  - The Space Segment is being procured in a block of three or more satellites under the Federal Acquisition Regulation Part 12 rules for commercial item acquisition. First launch is projected by the Air Force for FY08 with the second and third launches following at about six-month intervals.
  - The Control Segment equipment and components will be integrated with existing satellite communications control assets to provide an integrated WGS satellite constellation control capability.



- The Terminal Segment consists of both existing and programmed terminal types acquired under Service and agency terminal programs.

### Mission

- Combatant commanders, U.S. joint warfighters, and allied partners will use the capabilities of the WGS space-based communications system for all military operations short of nuclear war.
- Commanders intend for this new service to alleviate the spectrum saturation of X-band, to provide increased single-user data rate availability, and to increase total satellite capacity over current Defense Satellite Communications System III satellites.

### Activity

- The test community focused on contractor and government ground developmental testing in preparation for the launch of the first WGS satellite in early FY08. In addition, the Service components tested new Ka-band terminals for conditional certification to support operational testing for the first WGS satellite.
- The Services maximized the limited time for testing by identifying deployed users to support both the 37-day integrated test period and the 42-day dedicated operational testing period.
- The program successfully completed an end-to-end test involving the space vehicle, the Air Force Satellite Control Network, and respective ground control facilities. The

- program successfully demonstrated command, control, and configuration management of the payload by uniformed satellite controllers.
- DOT&E approved the Air Force Operational Test and Evaluation Center's WGS operational test concept briefing in August 2007.
- The Air Force integrated the WGS-related operating capabilities of the GBS Phase 2 system into the WGS Multi-Service Test and Evaluation Strategy.

### Assessment

Test planning activities are progressing satisfactorily to support integrated testing and dedicated operational test and evaluation.

## Recommendations

- Status of Previous Recommendations. The Air Force and the Combined Test Force made progress on all three FY05 recommendations; however, two of the three remain valid. The Air Force should continue to carefully control WGS program risks associated with frequency reuse, satellite orbital placement, and launch system availability. The Combined Test Force should maximize the application of combined development and operational testing for WGS, but preserve the previously scheduled test periods needed for dedicated operational testing.
- FY07 Recommendations.
  1. Developmental and operational testers must work together to maximize the very limited test window while space vehicle 1 is in its temporary check-out orbit.
  2. Air Force Space Command and Army Forces Strategic Command must actively participate with satellite operators, deployed users, and testers to satisfy all test objectives of this program.
  3. Although deployed users plan to transition to space vehicle 1 in a conditional mode as soon as the satellite reaches its operational orbital slot, Air Force Space Command should base the fielding decision on the results of operational test and evaluation.



# **Ballistic Missile Defense System**



# **Ballistic Missile Defense System**

## Ballistic Missile Defense System (BMDS)



### Executive Summary

- Missile Defense Agency (MDA) testing continues to move from element-centric testing to Ballistic Missile Defense System (BMDS)-centric testing.
- A second attempt by Ground-based Midcourse Defense (GMD) to intercept a live target using an operationally-configured interceptor (with a range safety kit installed), kill vehicle, and primary radar sensor resulted in a no-test due to target failure. The retest in September was successful and met all test objectives.
- Terminal High-Altitude Area Defense (THAAD) and Aegis Ballistic Missile Defense (BMD), theater elements of the BMDS, made good progress with seven successful flight tests this year between them.
- Command, Control, Battle Management, and Communications (C2BMC) continues to rectify display inaccuracies and address issues with situational awareness; battle management capability is still in early development.
- Sensor fusion remains untested during end-to-end live intercept flight tests.
- Target availability, reliability, performance, and cost are becoming issues in BMDS flight testing.

### System

- The current BMDS architecture integrates ballistic missile defense capabilities against all ranges of threats.
- BMDS is a distributed system currently composed of four elements and six sensor systems:

#### Elements

- Aegis BMD

- C2BMC
- GMD
- Patriot Advanced Capability 3 (PAC-3)

#### Sensors

- Aegis BMD SPY-1 Radar
- Cobra Dane Radar
- Upgraded Early Warning Radars (UEWR) – Beale and Fylingdales
- AN/TPY-2 radar (formerly Forward-Based X-band Transportable radar, or FBX-T)
- Space-Based Infrared System (SBIRS) / Defense Support Program (DSP)
- BMDS is employed as part of an integrated strategic defense plan.
- Near-term additions to the BMDS include the Sea-Based X-Band (SBX) Radar and THAAD.
- Far-term additions to the BMDS may include:
  - Airborne Laser (ABL)
  - Kinetic Energy Interceptor (KEI)
  - Multiple Kill Vehicle (MKV)
  - Space Tracking and Surveillance System (STSS)

### Mission

- U.S. Strategic Command is responsible for overall ballistic missile defense and will employ the BMDS to defend the U.S. territory, deployed forces, friends, and allies against ballistic missile threats of all ranges, in all phases of flight. Initial capability will permit defending the U.S. territory against simple ballistic missile threats.

# BALLISTIC MISSILE DEFENSE SYSTEMS

- U.S. Strategic Command and U.S. Pacific Command will maintain situational awareness across the full mission space using the C2BMC system.
- The Army employs PAC-3 to provide theater defense for the deployed forces against short- and medium-range threats. The

Missile Defense Agency (MDA) transitioned PAC-3 to the Army; PAC-3 is reported as an Army program.

## Activity

- In May 2007, GMD attempted intercept flight test, Flight Test Ground-based Interceptor-03 (FTG-03). This resulted in a no-test due to a target vehicle failure. FTG-03a, the retest, successfully completed in September 2007, meeting all test objectives.
- The MDA executed Flight Test Other-2 (FTX-2) in March 2007. The test provided data to assess Block 06 functionality and interoperability. The MDA learned new lessons during radar data collection on the new target that required adjustments to the SBX software and performance parameters for the final Block 06 architecture.
- Aegis BMD attempted Flight Test Standard Missile-11 (FTM-11) in December 2006. This resulted in a no-test due to operator failure. FTM-11 Event 4, a repeat of FTM-11 in April 2007, resulted in a successful intercept. FTM-12, conducted in June 2007, and FTM-13, conducted in November 2007, were also successful intercept tests. Aegis BMD also participated in a live tracking exercise, Glory Trip-193, in February 2007.
- C2BMC conducted developmental and integration testing, and participated in several wargames as well as during Aegis BMD, GMD, and Patriot flight tests.
- Patriot conducted several flight and ground tests, including:
  - Five flight tests between October 2006 and July 2007 with one failure
  - Limited User Test regression testing in January/February 2007
  - Lethality testing in July 2007
- THAAD conducted one non-intercept flight test (FTT-05) in June 2007, one radar characterization test (RDC-1d) in which the target did not function correctly limiting objective accomplishment, and three successful intercept flight tests between January and October 2007: Flight Test THAAD-06 (FTT-06), FTT-07, and FTT-08.
- During FY07, the MDA conducted two system-level ground tests, Ground Test Distributed-01 (GTD-01) in November 2006, and Ground Test Integrated-02 (GTI-02) in September 2007. In addition, the MDA conducted one partial system-level test, Ground Test Other-02a (GTX-02a), in February 2007. The MDA also conducted Performance Assessment-07 (PA-07), in a BMDS-level end-to-end digital simulation, to assess the capability of BMDS architecture expected to be fielded by December 31, 2007. Results will be reported in the FY07 BMDS Report to Congress.
- In FY07, the MDA declared UEWR-Fylingdales as an early capability delivery radar, but not as part of the BMDS operational baseline. The MDA will assess the radar's

suitability for inclusion in the operational baseline after GTD-02 scheduled for November-December 2007.

- The North American Aerospace Defense Command and U.S. Northern Command sponsored the Vigilant Shield 07 wargame in December 2006.
- The U.S. Strategic Command Joint Functional Component Command for Integrated Missile Defense sponsored the Assured Response 07A wargame in June 2007.
- The BMDS was also represented in Pacific Command's Terminal Fury 07 Exercise, December 2006; in U.S. Forces Japan Keen Edge Exercise, February 2007; and in European Command's Juniper Cobra 07 Exercise, May 2007.

## Assessment

- The MDA, in its spiral development process, designates BMDS capability in three categories:
  - Early Capability Delivery (emergency, low confidence capability), which includes C2BMC version 6.2, Ground-based Interceptor, and UEWR-Fylingdales
  - Partial Capability Delivery (medium confidence capability that supports a warfighter partial mission capability decision), which includes Aegis BMD, UEWR-Beale, Cobra Dane, AN/TPY-2, and GMD Fire Control
  - Full Capability Delivery (highest confidence capability that supports a warfighter full mission capability decision) which includes PAC-3 and C2BMC version 6.0
- The elements that comprise the present and future BMDS are all at different levels of maturity.
  - PAC-3 continues to provide the most mature and well-understood capabilities against its theater-level missile threat set. This assessment is based on the number and complexity of test and evaluation events in which PAC-3 has participated (both flight and ground testing) as well as real-world operations. Recent testing uncovered some deficiencies in PAC-3 that are currently being addressed.
  - Aegis BMD promises to provide a robust theater-level missile defense capability against its threat set. However, this assessment is based on considerably less flight and ground testing than PAC-3, and includes few real-world operations. As with PAC-3, Aegis BMD uncovered several issues that are being addressed.
  - THAAD testing indicates that it will provide a significant increase in capability against short- to intermediate-range threats when it is incorporated into the BMDS in FY10.
  - GMD provides the least mature missile defense capability against its strategic threat set. To date, GMD demonstrated

a limited capability against a simple foreign threat. GMD flight testing to date is not sufficient to provide a high level of statistical confidence in its limited capabilities. Ground testing continues to demonstrate increasing GMD integration, but additional flight test data under realistic conditions is necessary to validate models and simulations and to increase confidence in the ability of these models and simulations to accurately assess system capability.

- The inherent BMDS defensive capability against theater threats increased during the last fiscal year. DOT&E anticipates continued increases in this capability. The inherent BMDS defensive capability against strategic threats, however, remains very basic. The addition of limited operational realism to BMDS testing against strategic threats has uncovered unanticipated deficiencies that will require additional development and testing.
- C2BMC continues to add new functionality. Communications and situational awareness have improved, but adding new sensors and shooters continues to create new challenges. To date, C2BMC is not mature enough to provide an integrated, layered defensive capability against any range of threat missile.
- During the past year, the MDA discovered system deficiencies which resulted in redesigns, testing, and modifications that delayed execution or changed content of test events. For example, FTG-03 was scheduled for the third quarter of 2006, roughly three months after FTG-02 was scheduled in the second quarter of 2006. After FTG-02 completed on September 1, 2006, FTG-03 was rescheduled for the second quarter of 2007. It actually occurred on May 25, 2007, roughly eight months later. Among other things, the program needed this additional time to further analyze, test, and fix the tracking anomaly that occurred during FTG-02. Also, data from FTX-02 demonstrated that SBX needed software modifications to improve discrimination performance during tracking scenarios. This forced MDA to put limitations on the test cases for SBX/GFC integration during GTI-02.
- The MDA is the DoD agency responsible for designing, developing, producing, and/or procuring targets for testing

the nation's ballistic missile defense system. These targets must represent the full spectrum of threat missile capabilities (separating and non-separating re-entry vehicles, varying radar cross sections, countermeasures, etc.) and ranges (intercontinental, intermediate, medium, and short). The appropriate targets are engaged by both strategic and tactical missile defense systems developed by the MDA, the Army, and the Navy.

- During the past 18 months, the MDA has suffered a number of target failures that have seriously impacted test schedules and accomplishment of test objectives. In one case, the MDA had to restructure a program due primarily to target non-availability and cost growth. The MDA is developing the Flexible Target Family (FTF) which it hopes will not only reduce cost through production efficiency and modular flexibility, but also improve reliability and timeliness.
- Unfortunately, the FTF is not ready. As a result, the MDA is forced to continue to use targets that are unreliable and/or don't meet performance requirements that programs need to fully demonstrate their systems' capabilities. The MDA is still several years away from a fully-implemented FTF. The cost-saving goal is a long way from reality. In the meantime, the MDA will continue to suffer schedule delays, retests, and follow-up test requirements as the result of unreliable and inadequate targets. Ultimately, some non-MDA users may not be able to afford the targets provided by the FTF.

## Recommendations

- Status of Previous Recommendations. The MDA has addressed all but one of the DOT&E recommendations from previous annual reports. While the MDA is slowly improving reliability, availability, and maintainability data collection for the BMDS, improvement is still needed in this area (FY05).
- FY07 Recommendation.
  1. The MDA should review its current target development and procurement strategy to confirm the strategy will provide targets that meet performance and schedule expectations at costs proportional to their expected use.

# BALLISTIC MISSILE DEFENSE SYSTEMS

## Aegis Ballistic Missile Defense (BMD)

### Executive Summary

- Aegis Ballistic Missile Defense (BMD) intercepted one short-range unitary target and one medium-range separating target during FY07 tests. One planned engagement against a short-range low-exoatmospheric unitary target failed due to improperly entered fire control parameters. To date, the Aegis BMD program has conducted 12 successful flight tests out of 14 attempts.
- Aegis BMD demonstrated simultaneous BMD and ship self-defense capabilities.
- Aegis BMD demonstrated long-range surveillance and track (LRS&T) capability and interoperability with the Ballistic Missile Defense System (BMDS) and the Terminal High-Altitude Area Defense (THAAD) system during multiple exercises in FY07.
- Continuing involvement of operational testers and warfighters in flight tests has proven valuable in planning and conducting operationally-realistic tests and in exposing operational design and training issues.



### System

- Aegis BMD is a highly-mobile, 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.
  - Computer program modifications to the AN/SPY-1 radar allow LRS&T of long-range ballistic missiles.
  - A modified Aegis vertical launcher system stores and fires the new, larger Standard Missile-3 (SM-3) Block IA.
  - The SM-3 Block IA design delivers a maneuverable kinetic warhead to an intercept point in the upper atmosphere or in space.
- Aegis BMD is capable of autonomous missile defense operations and can accept external cues and tracks over tactical data links.

- Aegis BMD can cue other BMDS sensors through tactical data links.

### Mission

The Navy can accomplish three missions using Aegis BMD:

- Provide forward-deployed radar capabilities to enhance defense against long-range ballistic missile threats
- Provide all short- to long-range ballistic missile threat data to the Command, Control, Battle Management, and Communications system for dissemination to U.S. Strategic Command and U.S. Pacific Command to ensure situational awareness
- Defend deployed forces and allies from short- and medium-range theater ballistic missiles

### Activity

- In FY07, the Aegis BMD test program continued to assess engagement and LRS&T capabilities. The program continued the combined Developmental Test/Operational Test (DT/OT) phase of testing that will support the transition of the Aegis BMD Block 04 system to the Navy in FY08.
- The Aegis BMD program completed two successful intercept flight tests, Flight Test Standard Missile-11 (FTM-11) Event 4 (following an unsuccessful FTM-11 Event 3 early in FY07) and FTM-12. In the unsuccessful December 2006 test, the SM-3 Block IA interceptor failed to fire against a low-exoatmospheric unitary target due to incorrectly set fire control parameters. In April 2007, the program conducted

- a re-test of the December event. In that test (FTM-11 Event 4), the Aegis BMD program successfully completed a near-simultaneous engagement of a short-range ballistic missile target with an SM-3 Block IA and an aerial target with an SM-2 Block IIIA interceptor.
- During FTM-12 (June 2007), Aegis BMD successfully intercepted a medium-range, simple separating target using the SM-3 Block IA.
- During FTM-12 (June 2007), Aegis BMD conducted simulated firings against two short-range ballistic missile targets in the air at the same time, demonstrating the capacity to perform a near-simultaneous engagement of two BMD targets.

# BALLISTIC MISSILE DEFENSE SYSTEMS

- During FTM-12 (June 2007), Aegis BMD collected data for the Block 06 BMD signal processor and enhanced discrimination algorithm development.
- Aegis BMD conducted an intercept test of a medium-range target during FTM-11a in August 2007. The mission provided an opportunity to demonstrate the “SM-3 Engage on AN/SPY-1” Engagement Sequence Group using the Aegis BMD 3.6 Weapon System.
- During FTM-13 in November 2007, the program successfully conducted a live near-simultaneous multiple engagement of two short-range unitary targets using an SM-3 Block IA salvo of two missiles.
- In FY07, Aegis BMD participated in several flight and ground tests to assess Aegis BMD functionality and interoperability with and in support of the BMDS.
  - Ground Test Distributed-01 (GTD-01) in November 2006 demonstrated BMDS operational functionality, connectivity, and interoperability. Dockside simulators were used on two Aegis BMD ships, in addition to simulators at two Naval Surface Warfare Center locations.
  - Ground Test Other-02a (GTX-02a) in February 2007 used simulations to test the interaction between Aegis BMD, THAAD, Patriot, and other sensors and command and control interfaces.
  - Flight Test Other-02 (FTX-02) in March 2007 employed two Aegis BMD ships, which tracked a long-range ballistic missile target with countermeasures. Aegis BMD demonstrated key steps of Launch on Tactical Data Information Link (TADIL) functionality in support of FTM-14, which will take place in 3QFY08. Aegis BMD LRS&T data was also used to cue Sea-Based X-band Radar, thus testing aspects of interoperability with the Ground-based Midcourse Defense (GMD) mission.
  - Ground Test Integrated-02 (GTI-02) in September 2007 used hardware-in-the-loop systems to test the interaction between Aegis BMD, GMD, THAAD, Patriot, AN/TPY-2, Space-Based Infrared System, C2BMC nodes, demonstrating BMDS operational functionality, connectivity, and interoperability in the Missile Defense System Exerciser architecture.
  - In March and August 2007, Aegis BMD tracked an intercontinental ballistic missile during two Air Force tests, Glory Trip-193 and -195.
- Aegis BMD demonstrated the multi-warfare version of the Aegis BMD combat system in a live testing event. Though not thoroughly stressing, the test event demonstrated some level of capability for simultaneous ship self-defense and BMD functionality.
- An SM-3 Block IA interceptor equipped with a fully capable divert system on the kinetic warhead was flown for the first time during flight tests in FY07; however, flight tests to date have not yet exercised the full range of divert system pulse modes.
- Test events in FY07 further demonstrated the utility of the unitary version of the Aegis Readiness Assessment Vehicle (ARAV-A) target as an affordable target for tracking and intercept tests for some mission scenarios. Further efforts should be made to collect the necessary data on the simple separating ARAV, the ARAV-B, to determine the viability of its use in operationally realistic scenarios.
- The Aegis BMD program continues to assess its interoperability with and support of the BMDS. In FY07, the Aegis BMD flight test program incorporated other BMDS elements and components. Aegis BMD participation during Glory Trip events in FY07 and past years has provided valuable data toward assessing Aegis BMD LRS&T capability in support of GMD. To date, Aegis BMD has yet to participate in a GMD flight test as a real-time contributor to the development of a GMD weapon task plan.
- The Aegis BMD program continues to include a good degree of operational realism in its flight test program. In FY07, Aegis BMD continued the combined DT/OT test phase, during which the Navy Operational Test Agency will evaluate the operational performance of the Block 04 system to support its transition to the Navy. Aegis BMD benefits from the active participation of the operational test and warfighter communities, as their recommendations are incorporated in system design modifications; tactics, techniques, and procedures; fleet training; and follow-on flight missions.

## Recommendations

- Status of Previous Recommendations. The program addressed four of the five DOT&E recommendations from previous annual reports. The remaining FY05 recommendation for Aegis BMD to provide real-time support to GMD weapons task plan development has been moved to GMD since GMD determines whether Aegis BMD track data is used.
- FY07 Recommendation.
  1. The Aegis BMD should continue to collect test data on reliability, availability, maintainability, and other relevant data to adequately assess the suitability of the system. The adequacy of the Navy’s regular crew manning, training procedures, and fleet material condition to support the BMD mission is of particular importance to Aegis BMD.

## Assessment

- In FY07, Aegis BMD flight testing continued to demonstrate the capability to engage short-range unitary and medium-range simple separating ballistic missile targets. In 14 attempts to date, Aegis BMD successfully intercepted eight of 10 short-range unitary targets, three of three medium-range simple-separating targets, and one of one targets presenting a complex scene. Training and a software change should prevent a repeat of the FTM-11 Event 3 failure in the future.

## Command, Control, Battle Management, and Communications (C2BMC) System

### Executive Summary

- The Command, Control, Battle Management, and Communications (C2BMC) system capabilities and interactions with other elements continued to grow in FY07.
- The Missile Defense Agency (MDA) continues to correct C2BMC display inaccuracies and improve data presentation.
- Although C2BMC is still only used as a situational awareness tool, the MDA is starting to implement planning, battle management, and sensor network tools as well.

### System

- C2MBC is the warfighter's interface to the fully integrated Ballistic Missile Defense System (BMDS).
- Initial configuration includes C2BMC data terminals at the Missile Defense Integration and Operations Center (MDIOC), Schriever Air Force Base, Colorado; Cheyenne Mountain, Colorado; Fort Greely, Alaska; U.S. Strategic, Northern, and Pacific Commands, and the National Command Authority.
- The current C2BMC system provides situational awareness data only. The C2BMC terminals provide warfighters and the National Command Authority with information on missile events, BMDS status, and system coverage. Aegis Ballistic Missile Defense (Aegis BMD) and Ground-based Midcourse Defense (GMD) elements use their own command, control, battle management systems, and mission planning tools.
- The Block 06 C2BMC is intended to provide situational awareness for the Block 06 BMDS, and command and control for the AN/TPY-2 radar.



### Mission

U.S. Strategic, Northern, and Pacific Commands currently use the C2MBC to provide communications necessary to support ballistic missile defense engagements, as follows:

- Deliberate planning
- Collaborative dynamic planning
- Situational awareness
- Consequence management
- Network management

### Activity

- Software Spiral 6.0 became fully operational in June 2007. Meanwhile, the MDA developed Spiral 6.2 and tested it throughout FY07. The MDA expects this software version to be used in a Live Fire test event and a ground test in the fall of 2007, with installation at all the Combatant Commands by December 2007. Spiral 6.2 improves the capabilities of C2BMC in a number of areas, including:
  - AN/TPY-2 radar management and track forwarding functions, which allow the user to task the radar as well as forward selected tracks to Aegis BMD via a new communications architecture
  - A new communications architecture, which provides a two-way satellite interface with Aegis BMD for the exchange of data
  - A Parallel Staging Network to enable fielding of software and hardware upgrades without impacting the operational system
- Most BMDS system-level tests now involve C2BMC participation. During FY07, this included participation in four ground tests (integrated hardware-in-the-loop tests and distributed tests that used operational hardware and software) and seven flight tests. During these flight tests, C2BMC demonstrated the ability to provide situational awareness by receiving and displaying data from a variety of sensors. Additionally, the Space-Based Infrared System (SBIRS) demonstrated its capacity to provide early warning data to the BMDS through C2BMC.
- C2BMC participated in the Vigilant Shield/Terminal Fury 07 wargame in December 2006.
- The MDA used the C2BMC Joint Defense Planner in the U.S. Forces Japan bilateral Keen Edge exercise, in February 2007 and July 2007.
- Ground Test Integrated-02 (GTI-02) in September 2007 used hardware-in-the-loop systems to test the interaction between

Aegis BMD, GMD, Terminal High-Altitude Area Defense, Patriot, and other sensors and command and control interfaces.

## Assessment

- C2BMC is a critical component of the BMDS. Its capabilities and interactions with other elements continued to increase and improve during FY07.
- Although shortcomings in C2BMC situational awareness capabilities continue to exist, the MDA has taken steps to reduce these. Warfighters are experiencing better data accuracy and, based on data from ground and flight tests, have noticed improvements in access and display content.
- C2BMC demonstrated some interoperability with theater assets, but requires more extensive tests in order to support development of tactics, techniques, and procedures.
- C2BMC battle management capability currently only functions with the AN/TPY-2 radar.

## Recommendations

- Status of Previous Recommendations. Two of the three FY06 DOT&E recommendations still remain unfulfilled. The MDA needs to continue multi-radar testing at the theater level in addition to developing appropriate tests at the BMDS level in order to fully assess C2BMC track accuracies and correlations of data received from multiple radar sensors (FY06). The MDA should also include assessments of Information Assurance during BMDS-centric C2BMC testing (FY06).
- FY07 Recommendation.
  1. The MDA should include further ground and/or flight testing to verify C2BMC management of the AN/TPY-2 radar in Shariki, Japan, following the recent move of the radar to its objective site.

## Ground-Based Midcourse Defense (GMD)

### Executive Summary

- The Missile Defense Agency (MDA) intercepted a threat representative target for the second time with an interceptor launched from an operationally-configured silo using data from a deployed radar.
- The MDA increased the operational realism of its flight tests employing both assets and warfighters in a more operationally realistic manner.
- Robust integrated ground testing continues to provide valuable insight into system behavior and capability.
- Available flight test data, consistent with or indicative of system maturity, impedes evaluation of effectiveness, reliability, suitability, and survivability, and is a factor limiting validation of models and simulations.
- Ground test events and digital simulations are critical to performance assessment. Lack of accredited models and simulations continues to be a problem that limits confidence in results from these events.



### System

Ground-based Midcourse Defense (GMD) is the principal element used by the Ballistic Missile Defense System (BMDS) for the homeland defense mission. The current distributed GMD configuration consists of the following systems:

- Cobra Dane Upgrade Radar at Eareckson Air Station (Shemya Island), Alaska
- Upgraded Early Warning Radars (UEWR) at Beale Air Force Base, California, and Fylingdales, United Kingdom
- Ground-based Interceptor (GBI) missiles at Fort Greely, Alaska, and Vandenberg Air Force Base, California
- GMD Fire Control (GFC) / Communications at the Missile Defense Integration and Operations Center, Schriever Air Force Base, Colorado; and Fort Greely, Alaska. The GFC includes In-Flight Interceptor Communications System (IFICS) Data Terminals (IDTs) at Vandenberg Air Force Base, Colorado, Fort Greely, Alaska, and Shemya Island, Alaska.

- External interfaces include Aegis BMD; Cheyenne Mountain Directorate, Colorado; Command, Control, Battle Management, and Communications (C2BMC), Peterson Air Force Base, Colorado; Space-Based Infrared System (SBIRS), Buckley Air Force Base, Colorado; and AN/TPY-2 radar (formerly called the Forward-based X-band Transportable radar, or FBX-T), Shariki Air Base, Japan

### Mission

U.S. Strategic Command operators will use the GMD system to defend U.S. territory, deployed forces, friends, and allies against threat ballistic missiles (intercontinental and intermediate range missiles).

### Activity

- The GMD program is in the development phase. The MDA testing included:
  - Flight Test Other-2 (FTX-02) occurred in March 2007 and was a long-range target launched from Vandenberg Air Force Base, California. The target flew across radar viewing volumes of the Sea-based X-band (SBX) radar and two Aegis BMD SPY-1 radars to characterize radar and BMDS performance.
  - Flight Test Ground-based Interceptor-3 (FTG-03) occurred in May 2007 and was an intercept attempt that was declared a “no-test” when the target failed to reach the defended area. The interceptor was not launched.
  - FTG-03a occurred on September 28, 2007, as a repeat of the FTG-03 “no test” in May 2007. The MDA launched a target from Kodiak Launch Complex, Alaska. Using radar data from the Beale UEWR, the MDA intercepted the target using a GBI launched from Vandenberg Air Force Base.
  - Five GMD-centric and BMDS-centric ground tests and one fully digital end-to-end BMDS simulation to support characterization of GMD performance within the BMDS.

# BALLISTIC MISSILE DEFENSE SYSTEMS

- SBX underwent sea trials and journeyed round trip from Hawaii to the vicinity of the Alaskan Aleutian Island chain.
- The MDA scheduled a new flight test, FTG-03a, to repeat FTG-03. This delayed FTG-04 to FY08. Subsequent to the FTG-03 “no-test,” the MDA delayed ground tests including Ground Test Distributed-02 (GTD-02), which the MDA delayed to FY08.
- The MDA fielded new sensors, more interceptors, and upgraded software into the GMD architecture.
  - Sensors: The MDA fielded the AN/TPY-2 radar at Shariki Air Base in Japan and the UEUR at Fylingdales, United Kingdom.
  - Interceptors: The MDA emplaced 10 additional interceptors at Fort Greely, Alaska, and one additional at Vandenberg Air Force Base, California, bringing the total number of operational interceptors to 24.
  - Software: The MDA upgraded the GFC software from version 4B.1.2.3 to version 6A.1.6 in FY07.
- The MDA delayed fielding of a second AN/TPY-2 and the SBX pending further development and testing. The MDA utilized the SBX for FTX-02 (target only) and FTG-03a though it did not participate in directing the FTG-03a engagement.
- Warfighters participated in MDA flight and ground tests and conducted their own exercises, wargames, demonstrations, and training.

## Assessment

- Ground and flight tests enabled characterization of GMD performance within the BMDS, but limited flight test data and limited accreditation of ground tests and digital simulations prevented performance evaluation. The limited flight test data reflects the current maturity and developmental nature of the system. The limited accreditation reflects the inability of model development and accreditation based on test results to keep pace with development and fielding.
  - FTX-02 demonstrated capable SBX performance and potential, but also uncovered some unanticipated, undesirable performance. The MDA analyzed these test results and is modifying the radar software.
  - FTG-03a demonstrated an end-to-end test of the system for a single engagement sequence group, target hit, and warfighter execution within a limited threat representative scenario. Several aspects of the engagement were representative of an unsophisticated threat, such as lacking specific target suite dynamic features and intercept geometry. Several other aspects were realistic of a particular engagement, but relatively unchallenging, such as closing velocity and fly out range.
  - As a result of the target failure during FTG-03, the MDA executed only one of two planned intercept flight tests indicative of the complexity of developing and testing the GMD. The slow pace of intercept flight testing impeded

verification and validation of ground test models and digital simulations.

- Ground tests demonstrated system behavior and supported warfighter exercise of tactics, techniques, and procedures. These tests also uncovered unanticipated, undesirable system performance features that the MDA addressed, is addressing, or plans to address.
- Ground tests supported system characterization, but not performance evaluation due to limited validation, lack of transparency into model accreditations, and absence of accreditation by an independent agency.
- Effectiveness and suitability were limited consistent with the maturity of the fielded system. The MDA fielded capability continually, component-by-component and software build-by-software build, commensurate with the MDA spiral development plan.
- Intercept tests FTG-03 and FTG-03a incorporated operational realism consistent with the maturity of the fielded system:
  - Used production GBI and production kill vehicle
  - Used deployed sensors for engagement planning and execution.
  - Exercised a single engagement sequence group in end-to-end system test with multiple sensors providing the GFC with tracks of the threat
  - Warfighters operated the GFC, all other command and control nodes, and the Beale UEUR, the primary intercept sensor
- Warfighters demonstrated increased control and facility with the system through participation in MDA flight and ground tests, and warfighter exercises, wargames, demonstrations, and training.

## Recommendations

- Status of Previous Recommendations. There were no recommendations in FY06. Two of the seven FY05 DOT&E recommendations remain unfulfilled. The MDA has begun to put processes into place and develop an evaluation-based test strategy (FY05). Through contract modifications and user forums, the MDA continues to work to maximize data collection to determine the GMD systems operational reliability, availability, and maintainability, but needs to develop and implement systematic data collection, analysis, and reporting procedures for all BMDS elements (FY05).
- FY07 Recommendations.
  1. Model and simulation development needs to keep pace with the developmental program so that verification, validation, and accreditation occur prior to ground test events or digital simulation events that are intended to support performance assessment.
  2. The GMD-specific lethality simulation needs to be re-examined in light of test data emerging from MDA target lethality testing since its last accreditation for Initial Defensive Operations in FY04.

## Sensors

### Executive Summary

- In May 2007, the Missile Defense Agency (MDA) attempted the FTG-03 intercept flight test that would have used the Upgraded Early Warning Radar-Beale (UEWR-Beale) to provide a weapon task plan. However, the target vehicle failed prior to acquisition by the UEWR-Beale. Using the UEWR-Beale, FTG-03a (the retest) successfully completed in September 2007, meeting all test objectives.
- In FTX-02, the MDA launched a target from Vandenberg Air Force Base, primarily to allow the Sea-based X-band (SBX) Radar and Aegis Ballistic Missile Defense (Aegis BMD) to collect data to generate weapon task plans for simulated intercepts. SBX exhibited some anomalous behavior. The MDA adjusted software and performance parameters and used SBX to successfully collect test data during FTG-03a.
- No BMDS sensors have high fidelity performance models and simulations validated and accredited for use by the Joint Operational Test Agency.



Cobra Dane



SBX



UEWR

### System

The BMDS sensors are:

- Cobra Dane radar: an L-band single-face (120 degree azimuth field of view), phased array radar located at Shemya, Alaska.
- SBX radar: an X-band single-face, phased array radar on a movable mount, positioned on a fifth generation twin-hulled, semi-submersible, self-propelled ocean-going platform, home-ported at Adak, Alaska.
- UEWRs: Ultra High Frequency fixed site, fixed orientation, phased array radars located at Beale Air Force Base, California

(2 faces, 240 degree azimuth field of view), and Fylingdales, England (3 faces, 360 degree azimuth field of view).

- AN/TPY-2 (FBM) for Forward-Based Mission (formally called Forward-based X-band-Transportable (FBX-T) Radar): a Terminal High-Altitude Area Defense high resolution, X-band, phased array radar with modified software to provide acquisition and tracking of ballistic missiles of all ranges in the boost phase and transition to midcourse phase of flight. The radar is operationally deployed at Shariki, Japan.
- Aegis BMD radars: Aegis AN/SPY-1 radars modified to provide surveillance and tracking of long-range ballistic missiles.
- Space-Based Infrared System (SBIRS): an infrared satellite constellation and ground station that provides the BMDS with the initial notification of a ballistic missile launch and defended area determination.



AN/TPY-2



Aegis BMD



SBIRS/DSP

### Mission

U.S. Strategic Command warfighters will use the BMDS sensors to:

- Detect, track, and classify ballistic missile threats targeting the United States, its allies, and its friends
- Provide situational awareness data to the BMDS C2BMC element
- Generate weapon task plans for ballistic missile defensive systems such as Aegis BMD and GMD

### Activity

- Cobra Dane: Due to its location and field-of-view, Cobra Dane cannot participate in BMDS intercept flight test events. During the past year, it participated in several ground test events.

- SBX: SBX participated in the FTX-02 flight test. During this test, SBX exhibited some anomalous behavior. The MDA adjusted software and performance parameters and used SBX to collect test data during FTG-03a.

- UEWrs: The BMDS will use several UEWrs for radar detection, tracking, and classification. The MDA planned to use UEW-Beale during FTG-03. However, the ballistic missile target for this event failed prior to entering the coverage volume of the radar, precluding the collection of any radar data. Using the UEW-Beale, FTG-03a (the retest) successfully completed in September 2007, meeting all test objectives. The MDA successfully demonstrated UEW-Fylingdales performance during GTI-02.
  - AN/TPY-2 (FBM): The MDA moved the first AN/TPY-2 to its objective deployed location in Shariki, Japan, where it has undergone electromagnetic radiation surveys and executes daily performance monitoring and calibration. Before the move, the radar participated in GTD-01 with operational communications from the interim deployed location in Shariki, Japan. The second AN/TPY-2 is at Vandenberg Air Force Base, where it completed basic integration and testing. The MDA has installed the anti-tamper technology at the Vandenberg AFB radar and plans to complete verification by end of CY07. The MDA is preparing the radar to move to Juneau, Alaska, for FTG-04. It participated in three flight tests: Glory Trip-193, FTX-02, and FTG-03a (as an interceptor radar range sensor and was not part of the BMDS system under test.) The hardware-in-the-loop facility participated in the GTX-02a and GTI-02 system ground tests with more threat representative scenarios than in the GTD-01 campaign. The hardware-in-the-loop facility also participated in a few BMDS-level ground tests. In support of the FTG-04 flight test in FY08, the MDA negotiated and built a dedicated test site at Juneau, Alaska, which allows the AN/TPY-2 (FBM) radar to participate as a forward-based sensor and pass track data on a target launched from Kodiak, Alaska.
  - Aegis BMD: Aegis BMD participated in multiple live tracking exercises, ground tests, and real-world operations during FY06. These events exercised the long-range surveillance and track capability of the Aegis BMD radar and demonstrated interoperability with the BMDS.
  - SBIRS: During FY07, SBIRS participated in four ground tests and seven flight tests. These tests exercised the SBIRS-C2BMC active interface. This interface, which the Air Force declared operational in February 2007, enables C2BMC to receive early warning data directly from SBIRS instead of going through a GMD communications network. The software baseline release 7-1 underwent an operational trial period and may be declared the new operational baseline in late FY07.
- parameters prior to FTG-03a. Subsequently, SBX performed well in a data collection mode during FTG-03a. The MDA must complete its analysis of SBX performance before finalizing the SBX role in the BMDS.
- UEWrs: The UEW-Beale successfully tracked the target during FTG-03a. It provided the data required to generate the weapon task plan for the interceptor launched from Vandenberg Air Force Base. In FY07, the MDA declared UEW-Fylingdales as an early capability delivery radar, but not as part of the BMDS operational baseline. The MDA will assess the radar's suitability for inclusion in the BMDS after GTD-02.
  - AN/TPY-2 (FBM): The first AN/TPY-2 was primarily occupied with set-up at the objective site. Glory Trip-193, FTX-02, and FTG-03a allowed the second AN/TPY-2 to demonstrate some new capabilities and more advanced tasking from both C2BMC and the External Sensors Laboratory, although these tests did not represent operational test geometries. Additionally, in July 2007, U.S. Pacific Command used results from a warfighter capability demonstration of the AN/TPY-2, positioned in its operational location at Shariki, Japan, to declare the radar Partially Mission Capable. AN/TPY-2 and C2BMC are both preparing for major software upgrades starting next year. The MDA will need to accomplish additional testing to demonstrate the new capabilities.
  - Aegis BMD: Aegis BMD continues to evaluate its interoperability with the BMDS, and continues to support BMDS testing and real world activities. Aegis BMD collected valuable BMDS mission support performance data during long-range surveillance and track exercises and real-world events. Aegis BMD has yet to participate in a BMDS flight test that uses AN/SPY-1 radar data in real-time to develop a GMD weapon task plan.
  - SBIRS: SBIRS has demonstrated the ability to support the BMDS with timely and accurate launch and predictive impact data.
  - OVERALL: As each sensor finishes upgrades or development, it is demonstrating the ability to provide accurate and timely data to support successful intercepts for the BMDS.

## Assessment

- Cobra Dane: Performance estimates for Cobra Dane are limited to the ground test results and the targets of opportunity. These estimates rely on models and simulations that are not yet validated and accredited for use in operational evaluations. This will require the MDA to fly another target through the Cobra Dane field of view.
- SBX: SBX has yet to support a live intercept as the primary sensor. The MDA adjusted software and performance

## Recommendations

- Status of Previous Recommendations. Three of the six FY06 DOT&E recommendations remain valid. The MDA does not plan to fly another target through the Cobra Dane radar field of view to verify the software fixes that resulted from FT 04-5 before FY10 (FY06). The MDA has not yet used SBX or Aegis BMD as the primary sensor to provide the radar intercept data during a flight test that culminated in an actual target intercept using a GMD interceptor (FY06). Before deploying the second AN/TPY-2 radar, the MDA should use it as the primary sensor generating the radar intercept data during a flight test that culminates in an actual target intercept using a GMD interceptor (FY06).
- FY07 Recommendations. None.

## Technology Programs

### Executive Summary

- The MDA made progress this past year on its four major technology programs.
- The Airborne Laser (ABL) completed the Low Power System Integration (LPSI) flight test series in August, which was one of the 2007 knowledge points, and is on track to complete its second 2007 knowledge point. Integration of the High Energy Laser modules began in September. The MDA moved the first lethal demonstration against a threat-representative ballistic missile to August 2009 from December 2008.
- In FY07, the MDA moved the launch of two Space Tracking and Surveillance System (STSS) satellites from December 2007 to April 2008 due to delays in the flight readiness certification.
- In FY07, the MDA restructured the Kinetic Energy Interceptor (KEI) concept from a boost phase missile defense system (including a launcher, missile, and fire control unit) to a high-speed developmental booster. In FY07, the program completed two first-stage static fire tests and a series of wind tunnel tests.
- The Multiple Kill Vehicle (MKV) program is refining system concepts in preparation for the System Requirements Review scheduled in FY08. In FY07, MKV completed a static hot fire test of the carrier vehicle divert and attitude control system.

### Systems

Airborne Laser (ABL) is a prototype missile defense weapon system consisting 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



ABL

Space Tracking and Surveillance System (STSS) is a research and development system that will consist of:

- Two flight test satellites in low-earth orbit
- The Missile Defense Space Experimentation Center, Colorado Springs, Colorado (the primary control center)



STSS

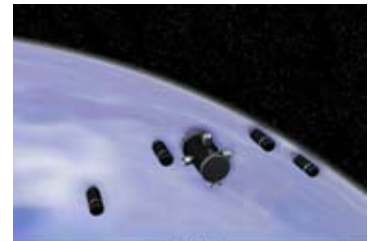
- The Low Satellite Operations Center, Redondo Beach, California (the backup control center)

Kinetic Energy Interceptor (KEI) is planned as a land-based, air-transportable battery with the following components:

- Transportable erector launcher
  - High acceleration and high burnout-velocity booster rocket
  - High divert velocity kill vehicle that can identify the threat re-entry vehicle in the presence of a bright plume during boost phase and among countermeasures during midcourse phase
  - KEI fire-control/communications (KFC/C) ground suite and a KEI Interceptor Communications System
- Multiple Kill Vehicle (MKV) plans for many small kinetic kill vehicles to be carried aboard a Carrier Vehicle. Key features of the Carrier Vehicle include:
- Kill vehicle restraints and dispense mechanisms
  - Communications with kill vehicles and endgame management
  - Command and control of the kill vehicles, especially assignment of targets and prevention of fratricide
  - Infrared and visible sensors



KEI



MKV

### Missions

Airborne Laser (ABL) - Combatant commanders will use the ABL to destroy threat ballistic missiles in the boost phase before they have an opportunity to deploy re-entry vehicles, submunitions, or countermeasures. Commanders will use ABL to:

- Autonomously acquire and track threat ballistic missiles using its passive infrared sensors
- Establish precise track on the missile nose and an aim point on the propellant tank using its illuminator lasers
- Destroy the missile by placing laser thermal energy on the tank or motor case to weaken the casing, allowing internal pressure to rupture the tank

Space Tracking and Surveillance System (STSS) - U.S. Strategic Command will use the STSS, a space-based sensor element of the Ballistic Missile Defense System (BMDS) to:

- Acquire, track, assess, and report ballistic missile and intercept events from lift-off to re-entry
- Provide a space node to support data fusion, over-the-horizon radar/sensor cueing, interceptor handover, and fire control

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Kinetic Energy Interceptor (KEI) - U.S. Strategic Command will use the KEI as a primary intercept missile in the BMDS to:

- Intercept threats in boost, ascent, and midcourse phases of flight
- Intercept medium-, intermediate-, and long-range- ballistic missiles
- Independently exercise command, control, battle management, and communications at the battery level, access sensor data, and communicate with the kill vehicle

- Boost alternate kill vehicles toward the interception point
- Multiple Kill Vehicle (MKV) – The U.S. Strategic Command will use the MKV as the primary kill mechanism for the interceptors deployed in the BMDS to:
- Intercept long-range ballistic missiles and countermeasures in the midcourse phase of flight
  - Mitigate the target discrimination problem by destroying all major objects in the field of view using many small kill vehicles

## Knowledge Point Progress

For the technology programs, the MDA uses knowledge points to measure development progress by focusing on the set of critical activities that define each program's risk. This approach allows the MDA to make informed decisions on advancement of a development activity.

### ABL

- Knowledge Point #2 (held over from 2006): First in-flight atmospheric compensation with the Tracking Illuminator Laser and an illuminator laser beacon on a diagnostics-equipped aircraft. The MDA completed this knowledge point in July 2007.
- Knowledge Point #4: Completion of the Low Power System Integration-Active flight test series. The MDA completed this knowledge point in August 2007.
- Knowledge Point #5: Aircraft and support systems ready for High Power System Integration. The MDA expects to complete this knowledge point on time in December 2007.
- Transition Knowledge Point: The MDA moved the first lethality demonstration against a threat-representative ballistic missile to August 2009 from December 2008.

### STSS

- Knowledge Point #1: Ground Acceptance Test. In FY07, the MDA delayed the flight readiness certification, which is the demonstration of the ground segment's readiness to control the satellites, to December 2007.
- Knowledge Point #2: Environmental testing of Space Vehicle (SV) 1 has been completed. SV-2 is undergoing satellite integration and environmental testing, which commenced in mid-August 2007. It has not yet been determined whether the SVs will be launched in a dual or single configuration.
- Transition Knowledge Point: After the launch of the two STSS satellites (planned for April 2008), the MDA will conduct four major flight tests to characterize sensor performance. The flight tests will serve as a risk reduction for the eventual fielding of an operational constellation of satellites.

### KEI

- Knowledge Point #1: Demonstrate Overhead Non-imaging Infrared Accuracy for Boost Phase Fire Control (completed April 2006 – not relevant to current booster-only development)
- Knowledge Point #2: Demonstrate High Acceleration Booster (In FY07, the program made progress toward a booster demonstration with the completion of two first-stage static fire tests.)

### MKV

- There are no knowledge points scheduled for MKV in the near term. MKV is refining concepts in preparation for the System Requirements Review in FY08. The MKV program completed a static hot fire test of the carrier vehicle divert and attitude control system in August 2007.
- MKV Knowledge Point # 1: Demonstrate Volume Kill Capability (2QFY11). The MDA will conduct component hover testing (4QFY08), seeker captive carry testing (1QFY10), engagement management demonstrations in real-time digital simulation with hardware in-the-loop testing (3QFY10), and lethality enhancement testing (2QFY11) leading up to Knowledge Point #1.
- MKV Knowledge Point # 2: Determine Affordability of Volume Kill Capability (2QFY13). The MDA will establish production cost commitments (1QFY10); verify and validate production cost commitments (2QFY13); and achieve engineering manufacturing readiness level 2 on the production line (2QFY13) leading up to Knowledge Point #2.
- MKV Knowledge Point # 3: Demonstrate MKV Integrated System Capability from Mid-Course Interceptor (3QFY15). The MDA will conduct hardware-in-the-loop ground testing with a flight configured payload (2QFY12) and integrated, intercept flight testing (3QFY15) leading up to Knowledge Point #3.
- The Director's MKV Knowledge Point #2, being executed by STSS for MKV, was partially accomplished through the Launch of the Near Field Infrared Experiment 2a (FIRE 2a) mission. This knowledge point, in support of the Plume-to-Hardbody Handover effort for Terrestrial and Space basing, included the launch of the NFIRE satellite, successful tracking of the target, and acquisition of substantial infrared tracking data of the stages 1 & 2 of the target missile. NFIRE 2b is to launch in FY08 to acquire near field infrared data.

## Recommendations

- Status of Previous Recommendations. The one FY06 DOT&E recommendation for the technology programs pertained to KEI. The recommendation is no longer applicable because of the program restructure.
- FY07 Recommendations. None.

## Terminal High-Altitude Area Defense (THAAD)

### Executive Summary

- The Terminal High-Altitude Area Defense (THAAD) system intercepted three short-range targets under varying intercept geometries in FY07 flight tests.
- THAAD began planning and execution of the Government Ground Test Program which is a critical component of the Army Materiel Readiness Release Process.
- THAAD executed five high-speed sled tests to characterize lethality against three different threat payloads in FY07.
- THAAD began initial integration testing into the Ballistic Missile Defense System (BMDS) in FY07 with Aegis Ballistic Missile Defense (BMD), Patriot, and the Command, Control, Battle Management, and Communications (C2BMC) system.
- Consolidating test objectives into fewer test events increased risk in the flight test program. The MDA intends to transition the first two fire units to the Army in FY10 and FY11.

### System

- The THAAD ballistic missile defense system consists of five major components:
  - Missiles
  - Launchers
  - Radars designated AN/TPY-2 (TM) for Terminal Mode
  - THAAD Fire Control and Communications (TFCC)
  - Unique THAAD support equipment
- THAAD can accept target cues from the Aegis BMD, satellites, and other external theater sensors and command and control systems.



- 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 the full-range of theater ballistic missile threats to troops, military assets, and allied territories using hit-to-kill technology. Commanders can use the THAAD Kill Vehicle to intercept an incoming threat ballistic missile in the high endoatmosphere or exoatmosphere, minimizing the effects of weapons of mass destruction on battlefield troops and civilian populations.

### Activity

- The program continued planning, testing, and qualifying THAAD ground and flight test components:
  - Flight Test THAAD-06 (FTT-06) took place in January 2007. THAAD successfully intercepted a threat-representative short-range unitary target in the high endoatmosphere. This was the first flight test at the Pacific Missile Range Facility in Hawaii.
  - FTT-07 occurred in April 2007. This test also resulted in a successful intercept of a threat-representative short-range unitary target, in the mid-endoatmosphere. This was the first THAAD flight test with BMDS integration. THAAD transmitted messages to the BMDS C2BMC system and an Aegis BMD hardware-in-the-loop facility.
  - FTT-05 was a missile characterization flight (no planned target), which took place in June 2007. This test demonstrated booster and kill vehicle performance in the high dynamic pressure environment of the low endoatmosphere.
  - FTT-08 occurred on October 26, 2007. This test was an intercept of a threat-representative short-range unitary target in the exoatmosphere. The missile was “heat conditioned” before the test to simulate operations in a hot environment. It was the third successful flight test at the Pacific Missile Range Facility.
  - Two radar data collection tests took place in March and July 2007, Radar Data Collection-1c (RDC-1c) and RDC-1d. In these tests, the MDA flew targets with characteristics of interest for radar observation in support of advanced discrimination algorithm development. Both targets had anomalies. RDC-1c deployed the re-entry vehicle at the wrong aspect angle due to reverse thrust motor failure, and

RDC-1d failed to achieve any desired target dynamics due to separation failure.

- Ground Test Other-02a (GTX-02a) in February 2007 used simulations to test the interaction between Aegis BMD, Ground-based Midcourse Defense (GMD), THAAD, Patriot, and other sensors and command and control interfaces.
  - Ground Test Integrated-02 (GTI-02) in September 2007 used hardware-in-the-loop systems to test the interaction between Aegis BMD, GMD, THAAD, Patriot, and other sensors and command and control interfaces.
  - Six high-speed sled tests using a lethality surrogate THAAD sled vehicle were conducted from December 2006 to October 2007. The THAAD program is using the test data to assess the lethality of THAAD against a variety of targets and to support the development and validation of simulation tools.
  - Combined contractor/government electromagnetic environmental effects ground qualification testing began for the missile and launcher in July 2007. The MDA accomplished detailed planning for the rest of the government ground test qualification program, which begins in FY08.
  - In June 2007, THAAD participated in Aegis BMD Flight Test Standard Missile-12 (FTM-12), exercising two-way communication and track exchange with an Aegis BMD cruiser (non-firing ship) during the test.
- THAAD began basic integration into BMDS-level testing, exercising one-way communication during FTT-07 and two-way communication during FTM-12. The program has demonstrated sending cues to both Aegis BMD and Patriot, but not for use in a live engagement. An opportunity is scheduled during FTT-10 in September 2008. THAAD also demonstrated the ability to provide the warfighter with a live common operating picture during FTT-08 by providing a Link-16 picture to the Pacific Command Joint Operations Center, the Pacific Air Operations Center, and the 94th Air and Missile Defense Command (AAMDC), as well as engagement status voice reporting to the 94th AAMDC.
  - The MDA removed three flight tests from the flight test matrix during FY07 because of target development and production delays. The resulting flight test matrix can still exercise the majority of the THAAD battlespace and support the MDA's planned transition of two fire units to the Army in FY10 and FY11. Some redundancy and gradualness have been lost, introducing more risk to the program. The MDA must re-accomplish any subsequent flight test failure, which will delay the program.
  - THAAD added two sled tests against a new target for FY08 in lieu of several lower-priority light-gas-gun tests.
  - The MDA currently has no flight test program planned after 2009 even though THAAD capabilities will continue to evolve through spiral development.

## Assessment

- In FY07, THAAD made significant progress, with three successful intercept tests of threat-representative short-range targets under various intercept geometries and intercept altitudes. Flight tests against medium-range and more sophisticated short-range targets are scheduled for FY08 and FY09.
- The program expanded operational realism during THAAD flight tests by continuing to use warfighters to operate the THAAD radar, launcher, and fire control, and denying the soldiers detailed knowledge of launch times.

## Recommendations

- Status of Previous Recommendations. The DOT&E FY06 recommendation is still valid. Although the MDA restructured the THAAD flight test program to align with target delivery dates, offering additional target types, and improving the visibility of the targets requirements process, it has yet to confirm availability and prioritize timely delivery of targets with the necessary characteristics for the final two planned THAAD flight tests.
- FY07 Recommendations. None.



# **Information Assurance**



**Information  
Assurance**

# Information Assurance (IA) and Interoperability (IOP) Evaluations

## Summary

- The threats to military information networks continue to grow. DoD awareness and activities in response to these threats have grown dramatically this fiscal year, but a significant gap between the threat and our defensive capabilities remains. Failure to close this gap, or inadequate preparation to detect and respond to attacks, may result in degraded mission effectiveness and/or loss of confidence in critical command and control capabilities at inopportune times.
- Most vulnerabilities found during assessment events are basic in nature, and can be remedied by local personnel who possess adequate skills. The fact that many organizations lack a full complement of trained personnel is a root cause of most problems that are exploited by exercise Red Teams.
- The full assessment cycle employed by the Operational Test Agencies (OTAs) continues to contribute to improved warfighter skills and awareness of best practices, identification and resolution of problems, and methods and metrics for measuring operational IA/IOP performance.
- Assessments were performed for 23 Combatant Command (COCOM) and Service exercises this fiscal year.
- Assessment and remediation efforts in support of units deploying to Iraq and Afghanistan were conducted during six exercises; three such assessments are planned for FY08.
- IOP assessment methods and metrics were enhanced and applied to all appropriate exercises this fiscal year.
- More realistic portrayal of threats, and stressing of network Continuity of Operations Plans (COOP) have been emphasized in assessment planning this fiscal year. Several FY08 COCOM exercises are expected to have opposition forces controlling multiple Red Teams that portray nation-state threat capabilities.
- DOT&E issued a new IA Policy for OT&E of acquisition programs in November of 2006. This policy is being implemented by Service OTAs for all programs on the DOT&E oversight list, as well as for many non-oversight programs.

## Background

The FY03 Appropriations bill directed that:

- Operational evaluations of interoperability and information assurance be conducted during COCOM and Service exercises
- The OTAs, the Service Information Warfare Centers (IWCs), and the National Security Agency (NSA) assist in the planning, conduct, and evaluation of these exercises
- DOT&E oversees these efforts, and provides annual updates on DoD's progress based on results of the exercise evaluations and OT&E of acquisition programs

Fiscal year 2007 assessment funds were principally distributed to the OTAs to support the assembly and maintenance of expert teams which perform the IA and IOP assessments, and assist the COCOMs and Services in designing the exercises in which the assessments take place. These teams plan and execute events, assemble and analyze the resulting data, and report the results to the Exercise Authority and DOT&E. This information is collated and analyzed by DOT&E to provide feedback to DoD agencies engaged in IA and IOP solutions, developments, and policies.

The primary elements of the IA/IOP assessment process include:

- Blue Teams – Perform technical network scans and non-technical assessments of networks, network personnel, and network policies and practices.
- Green Teams – Provide assistance to the Exercise Authority in interpreting the results of an assessment, and directly addressing any shortfalls that arise. They coordinate remediation and training, as required.
- Red Teams – Perform live network assessments via penetration testing and other activities based on a comprehensive scenario as part of the exercise scenario and in support of the exercise opposition force. During some assessments, the Red Teams also deploy units to test the physical security of protected facilities. These combined events are seen to provide a more realistic depiction of a multiple-vector threat environment in which the IA posture of a unit may be measured.
- IOP Teams – Perform live network assessments via mission-thread evaluation as part of the exercise scenario to examine information flow in support of stated missions.

OTAs develop assessment plans, quick-look reports, and final reports for each assessment performed. In conjunction with each assessment report, OTAs develop a Vulnerability and Shortfall Matrix (VSM) that consolidates all identified IA vulnerabilities and IOP shortfalls, with proposed priorities and remedies, and a section to track their resolution.

DOT&E remains partnered with the Joint Staff and the Assistant Secretary of Defense for Networks, Information, and Integration (ASD[NII]) in the oversight and execution of the IA/IOP assessment program. The OTA teams that lead the IA/IOP assessments have developed strong relationships with their assigned COCOMs and Services as well as other partner organizations, including the Service IWCs, NSA, the Defense Intelligence Agency (DIA), the Defense Information Systems Agency (DISA), the Joint Task Force – Global Network Operations (JTF-GNO), U. S. Strategic Command, and other elements within DoD.

# INFORMATION ASSURANCE

As many issues identified during the IA/IOP assessment process are not merely local, but represent enterprise-wide issues across multiple theaters, DOT&E provides trend information to a number of cognizant agencies, including the Joint Staff (JCSJ6), the DoD Chief Information Officer (CIO) – Defense Information Assurance Program (DIAP), the NSA Global Information Grid IA Portfolio Manager (GIAP), the Service CIOs, and specific program offices where appropriate. Most of these agencies are additionally addressed via standing bodies, including the IA Senior Leadership group (IASL) and the Enterprise Solutions Steering Group (ESSG) for IA, and the Military Communications & Electronics Board MCEB, which includes both the IA and IOP

panels. These groups address policy issues as well as the rapid fielding of DoD Enterprise tools.

## FY07 Assessment Activities

In FY07, the OTAs performed: (23 events total)

- IA/IOP assessments in conjunction with 14 COCOM and seven Service exercises (Table 1)
- Full Blue, Green, and Red Team events for 15 exercises
- Six exercise assessments for units preparing to deploy to Iraq and Afghanistan

**Table 1 – Information Assurance and Interoperability Exercise Events in FY07**

Exercise Authority	Exercise / Event	Lead OTA	Support OTA
Joint Staff	Bulwark Defender 07	JITC	AFOTEC, ATEC
CENTCOM	Lucky Warrior 07	ATEC	
EUCOM	Coalition Warrior Interoperability Demonstration 07	JITC	MCOTEA
	Sharp Focus 07	ATEC	
	Able Warrior 07-2	ATEC	JITC
JFCOM	Unified Endeavor 07-1*	JITC	ATEC
	1 <sup>st</sup> Armored Division Mission Rehearsal Exercise 07 (Unified Endeavor 07-2)*	ATEC	JITC
NORTHCOM	Vigilant Shield 07	AFOTEC	
	Northern Edge 07	AFOTEC	JITC
PACOM	Terminal Fury 07	ATEC	COTF, AFOTEC
	Talisman Sabre 07	COTF	
	Valiant Shield 07	COTF	
SOUTHCOM	Blue Advance 07	ATEC	
	Panamax 07	ATEC	COTF
	Peace Keeping Operations 07	ATEC	
STRATCOM	Global Lightning 07	JITC	
USFK	Reception, Staging, Onward-movement, and Integration 07	ATEC	
Army	3 <sup>rd</sup> Infantry Division Mission Rehearsal Exercise 07 (Unified Endeavor 07-2)*	ATEC	
	4 <sup>th</sup> Infantry Division Mission Rehearsal Exercise 07 (Unified Endeavor 07-2)*	ATEC	JITC
	101 <sup>st</sup> Airborne Division Mission Rehearsal Exercise 07 (Unified Endeavor 08-1)*	ATEC	JITC
	Combined Arms Center (Fort Leavenworth)	ATEC	
Marine Corps	Federation of Systems 07	MCOTEA	
	1 <sup>st</sup> Marine Expeditionary Force Exercise*	MCOTEA	

\*Pre-deployment assessment events in FY07

AFOTEC – Air Force Operational Test and Evaluation Center  
 ATEC – Army Test and Evaluation Command  
 CENTCOM – Central Command  
 COTF – Commander Operational Test and Evaluation Force  
 EUCOM – European Command  
 JFCOM – Joint Forces Command  
 JITC – Joint Interoperability Test Command

MCOTEA – Marine Corps Operational Test and Evaluation Activity  
 NORTHCOM – Northern Command  
 PACOM – Pacific Command  
 SOUTHCOM – Southern Command  
 STRATCOM – Strategic Command  
 TRANSCOM – Transportation Command  
 USFK – U.S. Forces, Korea

The IA/IOP Assessment Program made improvements to the planning, assessment, and reporting methods employed during this fiscal year:

- Established a common methodology for technical and non-technical Blue Team assessments
- Initiated development of a Green Team Guidebook and linkage of Green Team assistance efforts to formal program support via ASD(NII) and DISA
- Formally adopted a common set of Core Control Measures derived from the Department of Defense Instruction (DoDI) 8500.2 IA Requirements
- Participated in ongoing efforts with NSA, the DIAP, the GIAP, and DISA to establish a common set of IA metrics for DoD assessments
- Established an Interoperability Working Group to develop common metrics for IOP
- Established an online capability for storing, updating, and analyzing assessment data
- Developed a prototype online collaboration and reporting tool for data collection and analysis, to improve timeliness, consistency, and accuracy of data collection
- Conducted a three-year trend analysis of IA/IOP assessments to identify positive and negative performance trends

The Vulnerability and Shortfall Matrix (VSM), used by OTAs to document assessment results, is the subject of significant multi-agency collaborations in IA and IOP. DOT&E is participating with NSA, the Service IWCs, DISA, and JTF-GNO to create standardized sharing protocols that will allow each agency to make full use of the data collected by another agency, potentially improving the depth and validity of analyses across multiple organizations.

DOT&E issued an updated IA policy for OT&E of acquisition programs, and conducted training for DOT&E Action Officers to ensure uniform implementation of the new six-step policy. DOT&E also identified a number of acquisition programs for in-depth IA evaluation. Red Team assessments, using the methodologies and collection techniques developed in the IA/IOP assessment process, were conducted under DOT&E oversight for the:

- Global Broadcasting Service (GBS)
- Patriot (PAC-3) Build 6
- Business Systems Modernization (BSM)
- Global Positioning System (GPS)
- Combat Information Transport System (CITS)

Additional programs such as the Joint Strike Fighter (JSF/F-35) and Ship Self-Defense System (SSDS) are proceeding towards similar IA assessments in the future. In the case of the Net-Enabled Command Capability (NECC) program, DOT&E is actively involved with the Program Office to develop IA test concepts to ensure adequate IA assessments through the Integrated Test Team.

## Assessment

Although emphasis on IA continues to improve at all assessed commands, the threats to military information networks continue to grow. DoD awareness and activities in response to these threats have grown dramatically this fiscal year, but a significant gap between the threat and our defensive capabilities remains. Failure to close this gap, or inadequate preparation to detect and respond to attacks, may result in degraded mission effectiveness and/or loss of confidence in critical command and control capabilities at inopportune times.

Boundary defenses for most DoD networks are improving, making network penetration more difficult for Red Teams than in FY06, but generally not difficult enough. More realistic portrayal of real-world threats and stressing of network COOP are needed to prepare network defenders and warfighters to effectively perform protect, detect, react, and restore missions in the face of network intrusions.

Many of the vulnerabilities found during assessments are basic, with known solutions, and can be remedied by local personnel. In most cases, the lack of adherence to best practices and known solutions is directly traced to the lack of manpower (or sufficiently trained manpower) to carry out the many manpower-intensive tasks necessary to protect information networks. Resource support for conducting these basic tasks is needed. Working with DISA, the DIAP, and the ESSG, DOT&E has been active in identifying areas in which improved automated tools can make more efficient use of the limited manpower available.

General assessments trends include the following:

- Personnel and Training
  - Standard manning templates for IA personnel that account for network complexity and mission do not exist; this forces a reliance on inadequately trained or undesignated personnel for network management.
  - Training and exercise of defensive tactics, techniques, and procedures (TTP) remains low across all assessed commands, giving a distinct advantage to network attackers.
  - Network COOPs are generally in need of improvement and not routinely exercised.
  - Many intrusions could be detected by forensic analysis of logs and audit records. As these activities are manpower intensive, automated log analysis and correlation tools are needed.
- Configuration management and Interoperability
  - Positive configuration control is increasing, but new technologies continue to complicate enforcement of standards. Users implement untested or “work-around” interoperability solutions that can result in vulnerabilities.

# INFORMATION ASSURANCE

- System version information collected during IOP assessments indicate that roughly one-quarter of all assessed systems have an interoperability certification as required by DoD regulation.
- Policy Compliance
  - Most commands do not possess complete network documentation and policies for existing networks.
  - Classified networks frequently do not employ intrusion detection software.
  - Standard tools for internal traffic monitoring and anomaly detection are not available.
- Physical security
  - Opposition forces frequently acquire sensitive information that assists in both physical and network penetration.
  - Use of basic precautions, such as screen-locks and time-outs, is inconsistent, allowing intruders unblocked access to systems.
  - Positive physical control over critical network components is improving, but many network devices such as switches and routers are not secured.

**Table 2 – Planned IA & Interoperability Exercise Events for FY08**

Exercise Authority	Exercise / Event	Lead OTA	Support OTA
Joint Staff	Coalition Warrior Interoperability Demonstration-08	JITC	MCOTEA
CENTCOM	Bright Star 08	ATEC	MCOTEA
EUCOM	Austere Challenge 08	ATEC	AFOTEC, JITC
JFCOM	Combined Joint Task Force/Horn of Africa 08	JITC	
	United Endeavor 08-1*	ATEC	JITC
NORTHCOM	Ardent Sentry 08	AFOTEC	MCOTEA, JITC
	Vigilant Shield 08	AFOTEC	JITC
PACOM	Terminal Fury 08	COTF	ATEC, AFOTEC
	Key Resolve 08	COTF	AFOTEC
SOUTHCOM	Blue Advance 08	ATEC	COTF, MCOTEA
STRATCOM	Global Lightning 08	JITC	MCOTEA
	Bulwark Defender 08	JITC	ATEC, AFOTEC
	Global Storm 08	JITC	MCOTEA
	Global Thunder 08	JITC	
TRANSCOM	Turbo Distribution 08	JITC	MCOTEA
Army	3 <sup>rd</sup> Army	ATEC	
Navy	Joint Task Force Exercise 08-4	COTF	
Marine Corps	1 <sup>st</sup> Marine Expeditionary Force Exercise*	MCOTEA	
	2 <sup>nd</sup> Marine Expeditionary Force Exercise*	MCOTEA	

\*Pre-deployment assessment events in FY08

AFOTEC – Air Force Operational Test and Evaluation Center  
 ATEC – Army Test and Evaluation Command  
 CENTCOM – Central Command  
 COTF – Commander Operational Test and Evaluation Force  
 EUCOM – European Command  
 JFCOM – Joint Forces Command  
 JITC – Joint Interoperability Test Command  
 MCOTEA – Marine Corps Operational Test and Evaluation Activity

NORTHCOM – Northern Command  
 PACOM – Pacific Command  
 SOUTHCOM – Southern Command  
 STRATCOM – Strategic Command  
 TRANSCOM – Transportation Command  
 USFK – U.S. Forces, Korea

## FY08 Goals and Planned Assessment Activities

The Combatant Commands and Services continue to respond positively to the exercise assessment process, and to support deeper and more comprehensive evaluations of readiness.

Assessment plans for FY08 include approximately 20 exercises (See Table 2). The FY08 goals for the IA/IOP Assessment Program include improved:

- Consistency in the collection, analyses, and reporting of performance data to assess network readiness and operational IA and IOP postures
- Portrayal of Red Team and Opposition Force operations to more realistically depict real-world threats
- Emphasis on the exercise and assessment of intrusion detection COOPs, data/system recovery, and restoration
- Operational metrics to better quantify the effectiveness of network defenses under attack
- IOP standards through the use of a mission-thread based approach using COCOM-defined mission processes, tasks, and linkages
- Collaboration, reporting, and analysis tools

Acquisition program IA assessment support will continue to expand in FY08, and DOT&E will continue integrating IA and IOP issues identified during OT&E of acquisition programs into the IA/IOP Assessment Program planning process. COCOM and Service exercises provide an excellent opportunity to track issues identified during OT&E of acquisition programs to ensure they are resolved, and that solutions and upgrades provided after system fielding do not introduce further IOP problems or IA vulnerabilities. In coordination with the Joint Staff and ASD(NII), DOT&E will continue data-sharing and integration efforts with DISA and NSA to create a common foundation for analysis and deficiency tracking.

## Recommendations

- Status of Previous Recommendations. Action has been taken on the DOT&E FY06 recommendations, but more action is needed.
- Limitations continue to be imposed by exercise authorities that prevent more realistic Red Team emulation of adversary capabilities. Some commands permit long-term, sustained Red Teaming, a much more threat-representative approach to IA assessments that should be implemented in all theaters.
- On May 29, 2007, the Joint Staff J6 transmitted a message to COCOM counterparts urging more accurate portrayal of real-world threats during exercises, sufficient command priority to embed rigorous IA scenarios into the exercises, closer ties between the Red Team and the Opposition Force, and greater emphasis on operational impacts.
- COCOMs remain reliant on simulation in many aspects of exercise play, but are increasing the amount of live-system functionality and staff activity.
- Interoperability remediation and assessment findings have been incorporated into the Military Communications and Electronics Board Interoperability Panel.
- FY07 Recommendations.
  - Exercise authorities should permit more realistic network attacks to exercise detection capabilities, and network COOPs and recovery plans; a Joint Staff recommendation to high-level COCOM and Service authorities would be helpful.
  - The Joint Staff and/or USSTRATCOM should undertake the development of standard network manning and training templates based on network function, complexity, and required maintenance.





# **Joint Test & Evaluation**



## **Joint Test & Evaluation**

## Joint Test and Evaluation Program

The Joint Test and Evaluation (JT&E) Program provides non-materiel solutions to critical warfighting issues. It charters operational test projects that improve joint warfighting capabilities with existing equipment. The program develops solutions to joint operational problems and measures the associated improvements through enhanced tactics, techniques, and procedures (TTP). It also measures improvements brought about by enhanced testing methodologies. The JT&E Program's objective is to provide rapid solutions to issues identified by the joint military community.

The JT&E Program exists to conduct OT&E that cuts across Service lines. The interactions among Services become extremely important during combat where the success of joint military operations transcend Service-centric boundaries and responsibilities. A lack of joint OT&E makes detecting certain deficiencies in those interactions very difficult. The JT&E Program provides quantitative information for analysis of existing joint military capabilities that result in recommendations for increasing joint military effectiveness through process improvements. The program is complimentary to, but not part of, the weapons acquisition process. JT&E products include the development or refinement of joint or multi-Service TTP; inputs to improve joint and Service training programs; new operational and technical testing methods; new test and training range procedures; and joint and multi-Service operations analysis tools.

The JT&E Program manages Joint Test projects that focus on the emergent needs of today's warfighter engaged in the War on Terror. The JT&E Program had 10 active Joint Tests continuing through FY07:

- Joint Command and Control for War on Terror Activities (JC2WTA)

- Joint Fires Coordination Measures (JFCM)
- Joint Mobile Network Operations (JMNO)
- Joint Test and Evaluation Methodology (JTEM)
- Joint Integrated Command and Control for Maritime Homeland Defense (JICM)
- Joint Airspace Command and Control (JACC)
- Joint Command and Control of Net Enabled Weapons (JC2NEW)
- Joint Air Defense Operations-Homeland (JADO-H)
- Joint Electronic Protection for Air Combat (JEPAC)
- Joint Non-Kinetic Effects Integration (JNKEI)

The JT&E Program instituted a Quick Reaction Test (QRT) capability in 2004 to respond to pressing warfighter needs identified by the combatant commands, the Services, the Joint Staff, or national agency sponsors. A QRT is completed within a year without giving up the rigors of test and evaluation. A QRT is led by a designated Service operational test agency. The five active QRTs during FY07 were:

- Joint Contingency Operations Base Force Protection (JCOB)
- Joint Theater Ballistic Missile Early Warning (JTBMEW)
- Joint Tactical Tomahawk Targeting (JHAWK)
- Joint Integration of Nationally-Derived Information (JINDI)
- Joint Logistics Global Combat Support System (JLGCSS)

Four JT&E Joint Tests and QRTs completed this year:

- Joint Space Control Operations - Negation (JSCO-N) Joint Test
- Joint Counter Remote-Control Improvised Explosive Device Warfare (JCREW) QRT
- Joint Interoperability for Maritime Interdiction (JIMI) QRT
- Joint Shipboard Ammunition and Ammunition Boards (JSAABR) QRT

### ACTIVE JOINT TESTS

#### JOINT COMMAND AND CONTROL FOR WAR ON TERROR ACTIVITIES (JC2WTA)

##### Test Description

The Navy sponsored JC2WTA in February 2006 to develop, test, and evaluate joint TTP that enable the joint force commander (JFC) to conduct distributed command and control of joint forces. This will allow the JFC to rapidly plan and execute War on Terror missions. The two principal test issues are:

- To what extent do TTP enable the JFC to command and control assigned forces from a clandestine, forward location?

- To what extent do TTP enable intelligence in support of operations for War on Terror missions assigned to the JFC operating from a clandestine, forward location?

##### Test Activity

JC2WTA's risk reduction event conducted in December 2006 assessed the communications bandwidth required to support a forward-based joint operations center, while providing sufficient support to command and control systems and associated intelligence processes. The three primary areas evaluated were:

1) bandwidth requirements to effectively support a clandestine, forward command center, 2) the applicability of the draft TTP under simulated field conditions, and 3) the overall success using a wargame as a risk reduction event. The risk reduction event achieved all three primary objectives.

JC2WTA conducted Field Test 1 with the Special Operations Command, Pacific at the Talisman Saber exercise in June 2007. This test exercised the planning staff of a combined joint special operations task force, forcing them to work together closely in developing a plan to deploy a distributed, forward command center.

### Benefits to the Warfighter

The JC2WTA-developed TTP (interim TTP distributed in August 2007, final version expected in June 2008) will support the JFC to conduct distributed command and control of warfighters engaged in the War on Terror from a small, forward-deployed platform using limited communications bandwidth.

### JOINT FIRES COORDINATION MEASURES (JFCM)

#### Test Description

The Air Force sponsored JFCM in February 2005 to improve the effectiveness of joint fires areas (JFAs) by establishing standardized TTP. JFCM's two principal test issues are:

- To what extent do JFCM developed-TTP enable the JFC to plan and establish a JFA?
- To what extent do the current or near-term communications systems and command and control systems enable the JFC to plan and establish a JFA with JFCM-developed TTP?

#### Test Activity

The third phase of JFCM's four phase test plan was completed during FY07 as JFCM analyzed data from two mini-tests and issued test event reports for both of these events. JFCM began Phase IV, which consists of a risk-reduction event, a live field test, and final product transition. Phase IV's objective is to determine whether the refined JFA TTP and supporting communication systems and command and control processes will meet warfighter needs in a realistic, joint combat environment. The test team conducted the risk reduction event in March 2007 and the field test in August 2007. Initial review of the data from the test demonstrated that the JFCM-developed JFA TTP and supporting communication systems and command and control architecture can be used to effectively establish JFAs for both joint and combined forces. JFCM began detailed planning for JFA TTP transition into appropriate doctrinal publications. JFCM is scheduled to close on December 31, 2007.

### Benefits to the Warfighter

JFCM provides TTP that enables the JFC to integrate fires in support of a campaign plan and provides sea, land, and air component courses of action without further coordination with the establishing authority. The JFA TTP standardizes a fire support coordination measure that not only integrates fires, but also integrates components. JFA TTP, published in December

2007, enables the components to use existing communication systems and command and control processes to more effectively and efficiently integrate fires with maneuver elements, while reducing the risk of fratricide.

### JOINT MOBILE NETWORK OPERATIONS (JMNO)

#### Test Description

The Marine Corps sponsored JMNO in February 2006 to identify, test, and recommend network operations procedures that enhance interoperability of mobile networks employed in joint operations. JMNO will develop joint TTP to improve the joint forces' ability to access information and network services when crossing from one network to another. The two test issues are:

- What is the level of network interoperability achieved between different Services at the tactical level?
- To what extent do JMNO-developed mobile network operations TTP enable a tactical user to access information resources and network services via a different Service's network?

#### Test Activity

JMNO completed its research of each Service's mobile network operations and developed an initial, mobile network operations TTP. JMNO also conducted a Joint User Interoperable Communications mini-test to determine the TTP's acceptability to meet the JMNO test issues.

### Benefits to the Warfighter

JMNO will validate mobile network operations TTP that will:

- Integrate tactical and Service component networks
- Improve mobile network access and maintain current performance
- Enhance user connectivity to the user's information resources while maneuvering through the battlespace
- Enable interoperability and information assurance between different Services' networks
- Provide input to future concepts employing mobile network operations on the asymmetric battlefield
- Maintain quality of service across network boundaries

### JOINT TEST AND EVALUATION METHODOLOGY (JTEM)

#### Test Description

DOT&E sponsored JTEM in February 2006 to develop processes and test methods for operational testing in a joint environment. Specifically, JTEM is developing and evaluating methods and processes for defining and using a distributed live, virtual, constructive joint test environment to evaluate system performance and joint mission effectiveness. The three principal test issues are:

- How effective are the proposed methods and processes for designing and executing tests of a system-of-systems in the joint mission environment?
- How suitable are the proposed methods and processes for designing and executing tests of a system-of-systems in the joint mission environment?

- How effective are the proposed methods and processes for assessing performance as it pertains to capabilities supporting joint missions?

## Test Activity

JTEM conducted two major test events in 2007. The first test was a gap analysis event conducted with the Net Enabled Command Capability Program within the Defense Information Systems Agency to determine if the procedures set by JTEM and the Net Enabled Command Capability Program documented all the necessary steps to conduct testing in a joint environment. Following the gap analysis, JTEM conducted its first full-scale field test in August 2007. The test evaluated JTEM methods and processes when used by typical test organizations under realistic conditions in order to evaluate the suitability of the methods and processes for testing in a joint mission environment. JTEM is scheduled to close on April 30, 2009.

## Benefits to the Warfighter

JTEM will deliver processes and test methodologies that institutionalize testing in a joint mission environment. JTEM's Capability Test Methodology v.2 is expected to be published in February 2008, with the final version ready for release in March 2009. Additionally, JTEM test products will include method and process templates, handbooks for the testing and acquisition communities, recommended changes to the acquisition instructions, and directives that will facilitate testing in a joint environment.

## JOINT INTEGRATED COMMAND AND CONTROL FOR MARITIME HOMELAND DEFENSE (JICM)

### Test Description

The Northern Command (NORTHCOM) sponsored JICM in March 2006 to evaluate command and control (C2) processes to execute NORTHCOM maritime homeland defense missions. The test is focused on maritime C2 TTP, for both DoD and non-DoD agencies, from the strategic to the operational level. The principal test issue is:

- To what extent does the JICM Maritime Homeland Defense Command & Control Handbook support maritime threat response C2 within the NORTHCOM area of responsibility?

### Test Activity

The team conducted Field Test 1 during Vigilant Shield 2007 to assess the "as is" maritime homeland defense C2 processes to create a baseline for future test comparisons. Field Test 2 encompassed Ardent Sentry/Northern Edge 2007 and Frontier Sentinel 2007. During these exercises, the team assessed the impact of the JICM test article on C2 processes in response to maritime threats and collected data on Canadian maritime responses. JICM is scheduled to close in September 2008.

## Benefits to the Warfighter

JICM will provide recommendations to improve DoD and intergovernmental C2 interoperability, maritime concept of

operations, and joint and integrated TTP for responding to a maritime threat. The JICM test products include the Maritime C2 Handbook, Maritime Threat Response Checklist, Maritime Threat Response C2 Business Rules, and the Maritime Threat Response Portal. JICM is working within NORTHCOM to develop a joint mission essential task for maritime C2 processes.

## JOINT AIRSPACE COMMAND AND CONTROL (JACC)

### Test Description

The Army sponsored JACC in August 2006 to provide more lethal access to joint airspace for surface and airborne sensors, weapons, and C2 systems to carry out missions generated in support of forward operating bases (FOB) and maneuver elements. The principal test issues are:

- To what extent are the joint airspace C2 processes effective in supporting immediate missions generated in support of FOBs and maneuvering elements?
- To what extent are the joint airspace C2 processes acceptable to support immediate missions generated in support of FOBs and maneuvering elements?

### Test Activity

JACC will conduct its testing at Joint Forces Command's Unified Endeavor exercise and the Joint Readiness Training Center. JACC will conduct a risk reduction event in FY08 to assess and validate its data collection plan.

## Benefits to the Warfighter

JACC plans to deliver airspace C2 process enhancements to the warfighter that will improve execution of missions needing access to the joint airspace. JACC will deliver an interim product after Field Test 1 that will describe and clarify current joint airspace C2 procedures. The second version of the handbook will contain enhanced C2 procedures that will be tested in Field Test 2. The final version of the handbook will be distributed after JACC assesses the results of Field Test 2.

## JOINT COMMAND AND CONTROL FOR NET ENABLED WEAPONS (JC2NEW)

### Test Description

The Air Force sponsored JC2NEW in August 2006 to address the concept of operations (CONOPS), processes, and procedures for employment of net enabled weapons (NEW) in the net-centric battlespace. The objective of NEW is to improve the JFC's capabilities in precision engagement, particularly for targets that require immediate attention. The ability of intelligence, surveillance, reconnaissance systems and command and control processes to support net-centric weapons employment has not been determined, which severely degrades the JFC's ability to effectively use this capability. The principal test issues are:

- To what extent do JC2NEW-developed CONOPS and TTP support command and control of NEW employment against dynamic targets in maritime operations?

- To what extent do JC2NEW-developed CONOPS and TTP support command and control of NEW employment against dynamic targets in ground operations?

## Test Activity

JC2NEW participated in Valiant Shield 2007 focusing on the integration of the Combined Air Operations Center Performance Assessment System, an analysis tool, into the Bong Air Operations Center at Hickam AFB, Hawaii. This test activity provides the baseline for JC2NEW's first field test in Northern Edge 2008.

## Benefits to the Warfighter

JC2NEW will have an interim TTP ready by August 2008. The final version is expected to be ready in August 2009. Other expected benefit includes the ability to:

- Precisely engage moving and stationary surface targets in all anticipated operational scenarios while minimizing risks to operators, friendly ground forces, and noncombatants
- Provide the JFC with the responsiveness and flexibility to dynamically respond to time-sensitive targets and changing priorities
- Increase attack confidence, thereby minimizing a friendly force's exposure to threats and to help reduce resource expenditures

## JOINT AIR DEFENSE OPERATIONS-HOMELAND (JADO-H)

### Test Description

The Army's Space and Missile Defense Command / Army Forces Strategic Command, NORAD, and NORTHCOM sponsored JADO-H in August 2007 to test and evaluate deployable homeland air and cruise missile defense (D-HACMD) TTP to improve the planning process. JADO-H will collect, collate, and analyze D-HACMD planning TTP and refine processes and procedures to formalize the TTP. The principal test issues are:

- To what extent do formalized D-HACMD planning TTP enable effective use of combined force air and cruise missile defense capabilities to support defeating asymmetric aerial threats directed against a defended asset?
- To what extent do formalized D-HACMD planning TTP enable effective use of interagency air and cruise missile defense capabilities to support defeating asymmetric aerial threats directed against a defended asset?

### Test Activity

The test team began work in September 2007 by forming combined and interagency working groups. JADO-H will conduct a risk reduction event and a mini-test in FY08.

### Benefits to the Warfighter

JADO-H will provide a set of collaborative tools that will standardize interagency planning. The collaborative tools will include D-HACMD process modeling, operational architecture enhancements, an exercise planning guide, a commander's planning handbook, and joint TTP.

## JOINT ELECTRONIC PROTECTION FOR AIR COMBAT (JEPAC)

### Test Description

The Air Force sponsored JEPAC in August 2007 to develop joint TTP to improve combat effectiveness through the use of electronic protection via timely integration of specific target track generating capabilities with tactical shooters during combat employment. The principal test issues are:

- To what extent does the JEPAC-developed TTP enable the warfighter to recognize he is operating in the presence of advanced electronic attack (EA) waveforms?
- To what extent does the JEPAC-developed TTP enable the warfighter's ability to rebuild key targeting data in the presence of advanced EA waveforms?
- To what extent does the JEPAC-developed TTP enable the warfighter's ability to prosecute the primary threat in the presence of advanced EA waveforms?

### Test Activity

JEPAC formed its test team in September 2007, convened a joint warfighter advisory group, and held tabletop exercises. The first field test is scheduled in mid-FY08 during Northern Edge 2008.

### Benefits to the Warfighter

During the course of its testing, JEPAC will deliver interim products to the warfighter that will protect him from advanced EA. These interim products are expected to be new advanced EA joint TTP for publication in July 2008 and a revised version in July 2009; recommendations to update Service and joint advanced EA training; recommendations to improve data link system architectures in support of advanced EA missions; and inputs to support U.S. Pacific Command (PACOM) contingency and operations plans. The final EA joint TTP is expected to be published in mid-2010. Final products will also include recommended changes to Service and joint doctrinal publications.

## JOINT NON-KINETIC EFFECTS INTEGRATION (JNKEI)

### Test Description

The Strategic Command (STRATCOM) sponsored JNKEI in August 2007 to focus on offensive non-kinetic information operations capabilities that include EA, computer network attack (CNA), and space control-negation (SC-N) to affect adversary systems through manipulation of the electromagnetic spectrum. The principal test issue is:

- To what extent does JNKEI-developed TTP enable the JFC to integrate EA, CNA, and SC-N capabilities within crisis action planning?

### Test Activity

JNKEI formed its test team in September 2007. The team will host a joint warfighter meeting to develop a draft TTP and conduct tabletop exercises in early FY08 to be used during JNKEI's first mini-test.

## Benefits to the Warfighter

JNKEI will develop planning interim TTP that integrate EA, CNA, and SC-N operations into the JFC's planning process expected to be published in December 2008. Specifically, JKNEI will develop joint and Service training packages that support non-kinetic integration planning; publish the Commander's

Handbook for Non-Kinetic Integration Planning; and the Intelligence Support to Non-Kinetic Integration Handbook. JNKEI will also recommended changes to Service and joint doctrinal publications. These final products and a final version of the TTP are expected to be published in May 2010.

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## ACTIVE QUICK REACTION TESTS

### JOINT CONTINGENCY OPERATIONS BASE (JCOB)

#### Test Description

The Army sponsored JCOB in August 2006 to develop joint TTP to improve the set up of U.S. camps housing security, stability, transition, and reconstruction operations. This TTP enhances security, streamlines camp set-up, and allows military units to focus on their assigned mission. The Army's Test and Evaluation Command leads this effort.

#### Test Activity

Testing occurred from April-June 2007. Testing included anti-terrorist and force protection measures such as vehicle inspections, interior and exterior protection barriers, and small observation and fighting positions. In August 2007, the JCOB test team observed and conducted research at counter-rocket, -artillery, and -mortar exercises. Additionally, the test team reviewed best practices of units in theater and input from the JCOB subject matter expert working group. The project closed in October 2007.

#### Benefits to the Warfighter

JCOB produced a handbook for defense of contingency operations bases that gives guidance on: site selection, perimeter security, standoff, dispersion, compartmentalization, sidewall protection, and overhead cover against the threat of improvised explosive devices (IEDs), rockets, artillery, mortars, and vehicle-borne IEDs in Iraq and Afghanistan. JCOB recommended changes to joint publications for contingency operations base defense. It also published a final report that identifies the gaps in current base defenses. The Army distributed the handbook to units presently in Iraq and Afghanistan and to training units in the United States in November 2007.

### JOINT THEATER BALLISTIC MISSILE EARLY WARNING (JTBMEW)

#### Test Description

The Army sponsored JTBMEW in August 2006 to develop joint TTP that enhances precise theater ballistic missile early warning to the Combined Forces Command. This test will examine the Korean theater of operations' ballistic missile early warning architecture to determine weaknesses involving all platforms and current methods of information collection, processing, and dissemination. The Army's Test and Evaluation Command leads this effort.

#### Test Activity

The test team collected the data needed for analysis of the early warning system in March 2007. The next phase of the test produced a report on the analysis of the data and a draft early warning system operator's handbook. The handbook was evaluated during Ulchi Focus Lens 2008 in August 2007 and a final handbook will be published after the revisions are incorporated. The project closed in October 2007.

#### Benefits to the Warfighter

The JTBMEW operator's handbook, published in October 2007, standardizes the use of the complex early warning system to increase confidence and accuracy in warnings. The JTBMEW project will provide full documentation of the existing tactical ballistic missile early warning system architecture (all platforms and reporting methods) and will add radio frequency data sources. This will result in increased accuracy of launch and impact predictions.

### JOINT TACTICAL TOMAHAWK TARGETING (JHAWK)

#### Test Description

The Special Operations Command and the Commander, Second Fleet co-sponsored JHAWK in April 2007 to evaluate and recommend multi-Service TTP for employment of the Tactical Tomahawk Weapon System by special operations and other expeditionary forces. The Navy's Commander, Operational Test and Evaluation Force is the lead operational test agency. The principal test issues are:

- Determine the in-place C2 structure and systems used in the approval of short response strikes
- Determine the optimal C2 structure necessary to satisfy all theater targeting and engagement approval requirements
- Determine courses of action to alternative C2 structures and procedures to reduce timelines in support of meeting mission objectives
- Develop and document recommended procedures for early assessment and operational trial

#### Test Activity

JHAWK's prime data collection opportunities are Tomahawk missile operations during the Greyhound Express series of exercises. Greyhound Express 07-1 (June 2007) served as a risk reduction event that allowed test planners to rehearse their

data collection, storage, and manipulation activities. Greyhound Express 08-1, tentatively scheduled for fall 2007, will be the primary data collection opportunity for JHAWK. The draft TTP will be validated during this event. Any modifications determined to be needed will be incorporated in the final version of the TTP. The project is scheduled to close in April 2008.

## Benefits to the Warfighter

JHAWK's interim TTP were distributed in June 2007. JHAWK will deliver a final, executable TTP in February 2008 for the tactical use of the Tomahawk Land Attack Missile in striking time-sensitive targets associated with the War on Terror. The JHAWK TTP will formalize Tomahawk third-party targeting for units such as special operations teams.

## JOINT INTEGRATION OF NATIONALLY-DERIVED INFORMATION (JINDI)

### Test Description

The Air Force Warfare Center sponsored JINDI, with support from PACOM, to evaluate and recommend improvements to current methods used to provide nationally-derived information from regional cryptologic centers to front-line forces. The Air Force Joint T&E Program Office leads this effort. The principal test issues are:

- Can dependable Link 16 (a data link) architectures be developed to provide a beyond line-of-sight capability to provide timely information to distant front-line forces?
- Can this dependable Link 16 architecture be used to provide the cryptologic centers with real-time tactical information to enable more focused support of a tactical situation?
- Can the JINDI-developed TTP provide timely information to the tactical users to support command and control, tactical deconfliction, and targeting?

### Test Activity

JINDI's initial test was during Valiant Shield 2007 in August 2007. JINDI established tactical data link connectivity between a regional cryptologic center and tactical assets participating in the exercise. Using JINDI-developed TTP, exercise participants within the regional cryptologic centers were able to view the tactical picture from front-line forces and inject nationally-derived data into the exercise data link to directly support tactical forces. Further tests will utilize regional cryptologic centers daily operations to further validate and refine the JINDI capability and associated TTP. The project is scheduled to close in April 2008.

## Benefits to the Warfighter

JINDI will test and validate TTP designed to increase situational awareness for the warfighter by incorporating unique, actionable, and sanitized intelligence into the Link 16, a common tactical data link. The TTP will also benefit the national intelligence community by providing methodologies for the receipt of near real-time tactical information for more focused collection strategies and priorities. An interim TTP was published in August 2007; the final version is expected to be published in March 2008.

## JOINT LOGISTICS GLOBAL COMBAT SUPPORT SYSTEM (JLGCSS)

### Test Description

The Joint Staff J4 sponsored JLGCSS in April 2007 to develop Global Combat Support System (GCSS) TTP to enable the joint warfighter to fully leverage GCSS capabilities to enhance joint force reception processes and workflows; make GCSS capability improvement recommendations; and develop a GCSS training strategy. This QRT will better enable the JFC to leverage GCSS capabilities to sustain joint logistics readiness. The Army's Test and Evaluation Command leads this effort.

### Test Activity

The test team began the review and analysis of joint force reception doctrinal publications in May 2007. From July to September 2007, force reception processes and workflows were documented at PACOM, Central Command, Southern Command, and U.S. Forces Korea to establish a valid representation across combatant commands. The test includes a risk reduction event in which the TTPs will be reviewed by experts, followed by a field test in which PACOM and U.S. Forces Korea test the TTPs in a realistic environment. The project is scheduled to close in April 2008.

## Benefits to the Warfighter

Updated, standardized TTP will improve a warfighter's use of GCSS capabilities in support of personnel and materiel arriving into, moving through, or leaving an area of operation. The QRT will also report gaps in GCSS v6.1 capabilities to the GCSS-J Program Manager for inclusion in future upgrades to GCSS software. Finally, the QRT will develop a training strategy that provides an overview of GCSS capabilities to leaders, as well as more detailed operator-level training. These products are expected to be delivered in March 2008.

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## JOINT TESTS COMPLETED IN FISCAL YEAR 2007

### JOINT SPACE CONTROL OPERATIONS-NEGATION (JSCO-N)

#### Test Description

The Air Force sponsored JSCO-N in February 2004 to evaluate improvements to command and control processes and joint

TTP associated with the space control-negation (SC-N) mission area. It primarily focused on integrating the SC-N targeting and intelligence support functions into the joint targeting cycle at the joint task force component level. The principal test issues were:

- To what extent do alternative JSCO-N processes improve mission planning?
- To what extent do alternative JSCO-N processes improve mission assessment processes?

## Test Activity

During FY07, JSCO-N conducted analysis and final reporting following its third field test during European Command's Austere Challenge 2006 exercise. JSCO-N closed in March 2007.

## Benefits to the Warfighter

JSCO-N:

- Provided improvements to Contingency Plan 8035-06, Space Control Operations that provides guidance to the space control operational elements reporting to STRATCOM. Additionally, recommendations were provided to improve Joint Publication 3-14, Joint Doctrine for Space Operations, and STRATCOM's Strategic Directive 504-3

- Published an exercise planning guide to enhance realistic training for the SC-N mission and to improve its integration with other warfighting capabilities
- Provided input to the Information Operations (IO) Joint Munitions Effectiveness Manual Working Group on associated command and control processes, TTPs, and proof of concept software models used to evaluate IO target-weapon pairings in support of the joint targeting cycle
- Assisted Joint Forces Command and STRATCOM in conducting a series of workshops on collaborative command and control processes involving IO
- Provided feedback and organized a series of workshops to better organize and enhance intelligence support to the SC-N mission
- Improved individual training by providing curriculum inputs to Air Force National Security Space Institute and Army Functional Area-40 courses

## QUICK REACTION TESTS COMPLETED IN FISCAL YEAR 2007

### JOINT COUNTER REMOTE-CONTROL IMPROVISED EXPLOSIVE DEVICE ELECTRONIC WARFARE (JCREW)

#### Test Description

The Army sponsored JCREW in March 2006 to consolidate training and training material for radio frequency jammers used to counter command-detonated IEDs using radio frequencies. The Army's Test and Evaluation Command led this effort.

#### Test Activity

JCREW developed an electronic warfare training handbook to counter remote-controlled IEDs with input from subject matter experts across DoD. The JCREW web portal, containing an online version of the handbook, plus other training materials that help address warfighter needs for current information, was launched in March 2007. The web portal is hosted by Joint Forces Command. The project closed in June 2007.

#### Benefits to the Warfighter

Standardized training information regarding IED employment increased warfighter combat capability and improved counter remote-controlled IED performance, resulting in fewer lives lost to IEDs, the primary cause of fatalities in Operation Iraqi Freedom. In February 2007, over 48,000 copies were printed and distributed. Plans are underway to print 32,000 additional copies.

### JOINT INTEROPERABILITY FOR MARITIME INTERDICTION (JIMI)

#### Test Description

PACOM sponsored JIMI to address Link 16 (a data link) interoperability shortfalls while conducting maritime interdiction against hostile surface targets. The Navy's Commander, Operational Test and Evaluation Force led this effort.

#### Test Activity

JIMI's primary data collection event was during Valiant Shield 2006. JIMI developed TTP for E-2C, F/A-18, F-15E, and F-16CJ aircraft for this test. JIMI conducted an additional test event in September 2006 and validated TTP refinements. JIMI closed in December 2006.

#### Benefits to the Warfighter

JIMI provided a joint concept of operations to support maritime interdiction with a Link 16 messaging standard. JIMI developed solutions to counter the Link 16 interoperability shortfalls between the E-2C, F/A-18, F-15E, and F-16CJ airborne platforms and enhance the dissemination of actionable information to these platforms in support of maritime interdiction missions.

### JOINT SHIPBOARD AMMUNITION AND AMMUNITION BOARD (JSAABR)

#### Test Description

The Special Operations Command (SOCOM) sponsored JSAABR to evaluate and recommend how the Services and SOCOM can safely use non-naval ordnance when deploying from Navy ships. The Navy's Commander, Operational Test and Evaluation Force led this effort.

#### Test Activity

Two mini-tests (May to November 2006) focused on evaluating ordnance with special operations weapon systems to validate the process developed for joint approval. JSAABR closed in March 2007.

## Benefits to the Warfighter

### JSAABR:

- Updated the Ammunition and Explosive Safety Afloat Ordnance Pamphlet (OP 4), which now addresses shipboard operations for non-naval ordnance
- Developed capabilities for shipboard ordnance personnel to access safety information and storage requirements for all SOCOM ordnance that is cataloged in the Navy's Ordnance Information System, prior to its arrival onboard, and also receive notice of ammunition reclassification for these munitions
- Enabled the 160th Special Operations Air Regiment to conduct contingency operations using the vast majority of their weapons, without the need for first obtaining a waiver; they can also conduct training operations with selected ordnance aboard ships
- Established an efficient process for Service safety reviews of ordnance designated for use in the joint environment
- Updated checklists for SOCOM Army aviation assets and helped designate the 160th Special Operations Air Regiment as the responsible command
- Developed procedures which are now in place for cataloging existing non-naval ordnance into the Navy's Ordnance Information System



# **Live Fire Test & Evaluation**



## **Live Fire Test & Evaluation**

# Live Fire Test and Evaluation Program

## EXECUTIVE SUMMARY

U.S. Code Title 10, Section 2366, requires realistic survivability testing of major conventional air, land, and sea platforms and realistic lethality testing of major munitions and missile systems. Title 10, Section 139, states that the Director, Operational Test and Evaluation (DOT&E) shall monitor and review the Live Fire testing activities of the DoD provided for in Section 2366, and requires DOT&E to prepare an annual report summarizing the operational test and evaluation activities (including Live Fire testing activities) of the DoD during the preceding fiscal year. This section of the DOT&E Annual Report to Congress satisfies the requirement for an annual LFT&E report.

In FY07, DOT&E executed oversight of 108 LFT&E survivability and/or lethality acquisition programs. Of the 108 programs, 18 programs were operating under the waiver provision. LFT&E published the UH-60M, the CH-47F Block II, and the Small Diameter Bomb combined Beyond Low-Rate Initial Production and LFT&E reports. DOT&E also supported quick-reaction efforts in FY07, including congressional inquiries, and managed several survivability and lethality technology investment programs.

In recent years, Congress has expressed an increased focus on, and sensitivity to, personnel injury. Changes to U.S. Code Title 10 contained within the FY05 and FY07 Defense Authorization bills reflect this increased focus. In the former, Congress added language requiring an assessment of warfighter survivability and system suitability against asymmetric threats<sup>1</sup>. The language in the FY07 Defense bill<sup>2</sup> requires DOT&E to provide guidance to and consult with DoD officials regarding the operational test and evaluation or survivability testing of force protection equipment, including non-lethal weapons. Pursuant to the FY07 force protection legislation, DOT&E provided a memorandum to the Service Secretaries, the Joint Staff, the Assistant Secretary of Defense for Networks and Information Integration, and the Directors of Defense Agencies requesting identification of their force protection and non-lethal weapons programs<sup>3</sup>. The tasked agencies have responded and DOT&E is developing guidance for the Services based upon their responses, as well as policy for how DOT&E will interact with these programs.

<sup>1</sup> Public Law 108-375, Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005, Subtitle E, Section 141, Development of Deployable Systems to Include Consideration of Force Protection in Asymmetric Threat Environments.

<sup>2</sup> Public Law 109-364, John Warner National Defense Authorization Act for Fiscal Year 2007, Subtitle D, Section 231(f), Clarification of Duties with Respect to Force Protection Equipment (amending Section 139(d) of Title 10 U.S. Code).

<sup>3</sup> Director, Operational Test and Evaluation Memorandum dated April 9, 2007, Subject: Force Protection Equipment and Non-Lethal Weapons.

In addition to satisfying acquisition program oversight requirements (Section 2366 of Title 10), the LFT&E program funds and exercises technical oversight of investment programs that develop joint munitions effectiveness data; develops advanced technologies and analytical methods to increase aircraft survivability; conducts vulnerability test and evaluation of fielded air, land, and sea platforms; and, conducts munitions lethality testing. LFT&E investment programs also support quick-reaction efforts aimed at addressing emerging warfighter needs. Specifically, LFT&E investment programs enabled DOT&E to respond to these warfighter needs in FY07:

- **Joint Technical Coordinating Group for Munitions Effectiveness (JTTCG/ME).** This group publishes weapon effectiveness manuals and produces collateral damage estimation tables that enable the warfighter's weaponeering and mission planning processes. DOT&E oversight of the JTTCG/ME and its connection to acquisition programs ensures that weapons effectiveness data are available to warfighters when the Services field new weapons.
  - In support of the Department's increasing focus on mitigating collateral damage, the JTTCG/ME incorporated updated effective miss-distance tables<sup>4</sup> into Chairman of Joint Chiefs of Staff Manual 3160.01b – Collateral Damage Estimation. The JTTCG/ME had a significant role in the development of this Collateral Damage Estimation Manual, which has significantly improved the ability of field commanders to make independent targeting decisions without the need to elevate most decisions. This Manual has been instrumental in mission planning in both Operations Enduring Freedom (OEF) and Iraqi Freedom (OIF).
- **Joint Aircraft Survivability Program (JASP).** The JASP serves as the DoD's focal point for aircraft survivability, establishing survivability as a design discipline and furthering the advancement of aircraft survivability by investing in development and implementation of new technologies.
  - The Joint Combat Assessment Team (JCAT) of the JASP continued its deployment to OIF in support of Combined Forces Aviation. JCAT continued operations from bases in Al Asad and Balad and established a senior uniformed presence with Multi-National Corps-Iraq C3 Air at Camp Victory. JCAT uses data gathered from combat, threat exploitation, and Live Fire testing to provide combat commanders information to influence mission planning and tactics.

<sup>4</sup> Effective miss-distance tables relate collateral damage as a function of distance from a weapon's point of impact, i.e., "How far away from the school should this weapon impact to not cause damage to the school?"

- **Joint Live Fire (JLF).** The Office of the Secretary of Defense established the JLF program in 1984. JLF is a formal program to test and evaluate fielded U.S. systems against realistic threats. The program places emphasis on addressing urgent needs of deployed forces, testing against emerging threats, and assisting acquisition programs by testing legacy systems and identifying areas for improvement. DOT&E funds, establishes goals and priorities, and oversees the efforts of the JLF program.
  - During FY07, JLF continued its support to, and partnership with, the Joint Improvised Explosive Device Defeat Organization (JIEDDO), and to deployed forces through extensive characterization of improvised explosive munitions. JLF testing incorporates enemy tactics and procedures as reported and continuously updated

by the intelligence community. Test results provide combat commanders immediate feedback regarding their vulnerabilities and aids in the development of survivability mitigation techniques, both in materiel and in tactics, techniques, and procedures.

The JTCG/ME, JASP, and JLF programs described above are formal programs funded by DOT&E. In addition to these programs and in addition to DOT&E's statutory oversight responsibilities, DOT&E participates in several focused initiatives that directly support warfighters deployed to OEF/OIF, and/or address issues of significant importance to the Congress. These efforts are described in the Quick Reaction section below.

**Personnel Armor System for Ground Troops (PASGT) Helmet Survivability.** In a memorandum dated July 13, 2007, Deputy Under Secretary of Defense for Logistics and Materiel

## QUICK REACTION

Readiness, Honorable Jack Bell, requested DOT&E direct a test and assessment of PASGT helmets. This request was in response to a Department of Justice (DOJ) letter that indicated the DOJ was conducting a criminal investigation into a manufacturer of material used in PASGT helmet



production. The DOJ letter alleged that the manufacturer was using substandard Kevlar cloth and that therefore, there was a risk that the ballistic protection afforded by the PASGT helmet was below specification. DOT&E coordinated with the Army Test and Evaluation Command (ATEC) and the Army Research Laboratory (ARL) to design and execute a test and analysis program to determine if the helmets in question did or did not meet the ballistic performance specification. Test teams from the Aberdeen Test Center, Maryland, and the Army Research Laboratory's Survivability/Lethality Analysis Directorate (ARL/SLAD) completed a 456-shot test program in less than four days beginning July 17, 2007. The Army Evaluation Center (AEC)/ATEC and ARL/SLAD completed data reduction and performance analysis, providing a report to DOT&E on July 23, 2007. DOT&E reported to the Secretary of Defense on that same day that the helmets tested did meet the ballistic protection requirement.

**Personnel Body Armor.** In a May 21, 2007, letter to Secretary Gates, recognizing ongoing controversy regarding the capabilities of personnel body armor, Senators John McCain and Carl Levin advised that the DoD "must definitively and officially determine the facts regarding the protective qualities of the body armor we are currently providing our troops and that of any other commercially available comparable and competing system." In a full committee meeting on June 6, 2007, the House Armed Services Committee voiced these same concerns. To alleviate

concerns within the DoD, and because of congressional inquiry, the Secretary directed DOT&E to oversee ATEC testing of respondents to a full and open Army solicitation for personnel body armor. The solicitation<sup>5</sup> was open prior to the hearing, but was modified subsequently by Program Executive Office (PEO) - Soldier to ensure that any prospective materiel vendor would not be excluded from submitting proposals. Extensive coordination and planning between DOT&E, ATEC, PEO - Soldier (Army materiel developer), other DoD agencies, and the Government Accountability Office occurred during 3QFY07, resulting in DOT&E approval on September



19, 2007, of Army test plans for the body armor test program. The test program consists of two phases. Phase 1 is ballistic testing in accordance with the Army solicitation that will result in an ATEC evaluation of ballistic performance for each of the solicitation respondents. ATEC anticipates that Phase 1 testing and analysis will continue into 3QFY08. PEO - Soldier will use that evaluation, with other data as required by the solicitation, to complete a source selection process. PEO - Soldier will award contracts to the vendors that pass source selection. ATEC will use material received from those contracts to complete Phase 2 of the test program. Phase 2 consists of additional ballistic testing to increase the confidence in and scope of the Phase 1 ballistic testing, and consists of suitability testing to evaluate parameters such as form, fit, and function. The length and duration of Phase 2 of the test program is dependent upon the number of vendors that pass source selection. The Army solicitation is

<sup>5</sup> Army Research, Development, and Engineering Command Acquisition Center Solicitation W91CRB-07-R-0041, first posted on May 25, 2007.

scheduled to close on February 7, 2008, and ATEC testing will begin thereafter.

As noted in prior DOT&E Annual Reports, between late FY05 and FY07, DOT&E, the Army, and the Marine Corps co-sponsored a series of body armor tests to identify and select the most appropriate testing methodology for soft body armor. Analysis of those data concluded in 1QFY07 and the integrated product team consisting of representatives from DOT&E, the Army, the Air Force, and the Marines Corps agreed to a methodology. That methodology has been codified into a new test operations procedure (TOP), denoted TOP 10-2-208, V50 Ballistic Limit Testing of Fabric Body Armor, Using Clay Backing.

**Blunt Impact Testing of Fielded Combat Helmets.** As reported last year, on June 20, 2006, the House Armed Services Committee requested the DoD conduct testing on the currently fielded Marine Lightweight Helmet and the Army's Advanced Combat Helmet. The Committee was concerned about the blunt impact protection afforded Service members by each of the helmets, and specifically the difference in blunt impact protection between the suspension systems within each of the helmets. The Marine Lightweight Helmet utilizes a sling suspension system, whereas the Army helmet uses a pad system, similar to that of commercial bike and sport helmets. USD(AT&L) and DOT&E partnered with the Army and the Marine Corps to plan, fund, and execute a test program to provide the data necessary to address the Committee's concerns. The U.S. Army's Aeromedical Research Laboratory completed testing in September 2006. DOT&E and the USD(AT&L) completed an assessment of the results and provided that assessment to Congress under a letter from Under Secretary Krieg on February 22, 2007. As a result of this effort, the Marine Corps adopted a pad system and has completed retrofitting its helmets with the new system.

**Joint Improvised Explosive Device Defeat Organization (JIEDDO).** DOT&E continued to support the JIEDDO through participation on the Joint Test Board and its funding of Improvised Explosive Device (IED) and military operations in urban terrain (MOUT) Joint Live Fire test programs. The Joint Test Board coordinates and synchronizes IED test and evaluation events across the Services to maximize utility and reduce redundancy. The Joint Live Fire IED test program supporting JIEDDO is characterizing evolving IED threats and identifying vulnerability mitigation techniques that deployed commanders can employ, and that materiel developers can design into future systems. The JLF MOUT program is characterizing weapons effects and behind wall debris<sup>6</sup> against structures common to the current area of operations. This information assists commanders in deciding weapons employment and helps in developing tactics, techniques, and procedures.

**Tactical Ground Vehicle Up-Armoring.** DOT&E continues to monitor and support tactical vehicle up-armoring programs within the Army and the Marine Corps. This critical effort

addresses urgent armoring needs of deployed forces and new acquisition programs through aggressive testing of potential tactical ground vehicle armor solutions. Materiel developers are focusing their long term armoring efforts on increasing crew and occupant protection. The intent of these programs is to develop an add-on armor package, known as a B-kit that will provide vehicle protection to meet the threat environment into which armed forces are deployed. The High-Mobility Artillery Rocket System – Increased Crew Protection, Long-Term Armoring Strategy (LTAS) – Family of Medium Tactical Vehicles, LTAS - Heavy Expanded Mobility Tactical Truck, and, Logistics Vehicle System Replacement are examples of programs currently undergoing aggressive testing of potential tactical ground vehicle armor solutions.



Each of these armor programs is in a different phase of testing and development. As materiel developers integrate armor onto systems, or design them for mounting of add-on armor once deployed, the automotive performance of those systems must be tested and evaluated in an operational environment to ensure that the integrity of the system and its performance are not degraded. As noted in last year's report, test infrastructure limitations at Aberdeen Proving Ground restrict the Army's ability to conduct realistic operational testing of up-armored vehicles. Specifically, the Army and DoD lack a high-speed vehicle test track to demonstrate the safety, compatibility, reliability, durability, and maintainability of up-armored wheeled and tracked vehicles when operated at sustained high speeds. This capability is necessary to assure consistency with current OEF/OIF tactics, techniques, and procedures for programs such as Mine Resistant – Ambush Protected and Joint Lightweight Tactical Vehicle. Since last year, the U.S. Army Corps of Engineers (USACE) completed the design for the first phase of the test track. The Automotive Technology Evaluation Facility (ATEF) has site approval from the Army Garrison at Aberdeen Proving Ground for construction, appropriate wetlands permits from the state and federal governments, an aeronautical services waiver, and an approved safety site plan. DOT&E continues to support the Army's effort to develop this much-needed high-speed test track to compliment the Live Fire and Roadway Simulator test capabilities at Aberdeen Proving Ground.

<sup>6</sup> Behind wall debris is the material that is ejected from the backside of a wall following a ballistic impact to the front of the wall.

**Small Caliber Rifle Cartridge Lethality.** DOT&E continued its participation in an ongoing joint investigation of the wounding potential of small caliber, off-the-shelf cartridges. The investigation team is seeking an increase in lethality over

the currently fielded M855 cartridge against the lightly clothed enemy that deployed forces are encountering. The joint team completed the first phase of testing in FY06 and published a report documenting the test results in June 2007.

## JOINT TECHNICAL COORDINATING GROUP FOR MUNITIONS EFFECTIVENESS (JTTCG/ME)

The Joint Logistics Commanders chartered the JTTCG/ME in 1968 to ensure development of consistent, credible effectiveness estimates for conventional munitions across the DoD. The primary application is weaponeering, the detailed technical planning of a weapon strike that occurs at multiple levels in the operational chain of command before actual combat application. The JTTCG/ME produces, distributes, and regularly updates Joint Munitions Effectiveness Manuals (JMEMs). JMEMs provide the warfighter with computerized operational tools and data for rapid evaluation of alternative weapons and their delivery against specific targets. JMEMs help the warfighter effectively accomplish mission objectives, while considering collateral damage, and are critical enablers to the warfighter's weaponeering process.

The JTTCG/ME prioritizes its efforts based on annual Joint Staff J-8 data calls, the Munitions Requirements Process, the Military Targeting Committee, and Operational User's Working Groups. This process ensures focus on the highest priority data for current and future operations.

In response to Joint Staff, mission planners, and weaponeers throughout the combatant commands, the JTTCG/ME is actively transitioning to a target-centric weaponeering approach. In support of increasing combined and coalition operations, the JTTCG/ME developed and released JMEM Weaponeering System (JWS) DVD v1.2 (1,250 copies to 800 accounts) that provides air-to-surface and surface-to-surface weaponeering tools. This DVD included new/updated warhead data, delivery

accuracy updates, approximately 280 new targets/surrogates with associated effectiveness data, and an updated Building Analysis Module (i.e., included Small Diameter Bomb (SDB), Guided Multiple Launch Rocket System (GMLRS), and additional building types and enhanced output to meet Central Command urgent requirements). The JTTCG/ME also released the Joint Anti-Air Combat Effectiveness Air Superiority CD-ROM v3.2.1 (250 copies to 210 accounts). The update included an interface to F-22 aero performance data, and new threat air-to-air and surface-to-air missile performance models. This JMEM supports the community of fighter pilots concerned with the air superiority mission and Strategic Command global strike mission planning.

JTTCG/ME initiated efforts to support Information Operations with JMEM applications for communications electronic attack and computer network operations. These efforts are developing the Computer Network Attack Risk and Effectiveness Analyzer (C-REA), Radar Electronic Attack/Planning Effectiveness Reference (REAPER), and Communications Electronic Attack/Planning Effectiveness Reference (CREAPER).

In support of current operations, the JTTCG/ME updated the Effective Miss Distance tables of the Chairman of the Joint Chiefs of Staff Manual 3160.01b - Collateral Damage Estimation, developed a SDB weaponeering guide, updated J-FIRE (FM 90-20 - Multi-Service Procedures for the Joint Application of Firepower) risk estimates, and provided surrogate target information to coalition weapons for multinational mission planning.

## JOINT AIRCRAFT SURVIVABILITY PROGRAM (JASP)

The mission of the Joint Aircraft Survivability Program (JASP) is to increase the economy, readiness, and effectiveness of DoD aircraft through the joint coordination and development of survivability (susceptibility and vulnerability reduction) technology and assessment methodology. The JASP coordinates the inter-Service exchange of information to increase the survivability of aeronautical systems in a combat threat environment. Working with joint and Service staffs, other government agencies, and industry the JASP identifies new capabilities that require aircraft survivability research, development, test, and evaluation (RDT&E) and ensures capabilities are conceived and developed in a joint warfighting context.

The JASP funds projects, complementary to Service survivability programs, to develop and test survivability technologies and assessment methodology. The JASP is sponsored and funded by DOT&E and chartered by the Naval Air Systems Command, Army Aviation and Missile Command, and Air Force Aeronautical Systems Center. DOT&E establishes objectives

and priorities for the JASP as well as exercising oversight of the program.

In FY07, the JASP worked with the defense acquisition community, the Department of Homeland Security, the Federal Aviation Administration, the Transportation Security Administration, and the National Aeronautics and Space Administration to identify critical issues regarding aircraft survivability. Accordingly, JASP funded 54 multi-year survivability projects for \$9.5 Million and delivered 35 reports in FY07. The following summaries illustrate current JASP efforts in susceptibility reduction, vulnerability reduction, survivability assessment methodology, and combat damage assessment.

### Susceptibility Reduction:

The JASP continues to maintain its position at the forefront of susceptibility (the degree to which a weapon system is open to effective attack due to one or more inherent weaknesses) reduction technology efforts through relevant projects and coordination of technology development. With the ultimate goal

of transitioning to or impacting fielded systems, JASP funded efforts are making an impact now and showing promise for the future.

- In partnership with the Army's Aviation Applied Technology Directorate (AATD), a Reactive Infrared Suppressor was successfully flight tested on an AH-64 Apache helicopter. The uniqueness of this infrared suppressor system lies in its capability to provide a significantly reduced infrared signature while minimizing, or eliminating, engine performance penalties. It does this by swiveling the duct for optimization to the current flight and threat condition. The Army's Active/Passive Aircraft Survivability (APAS) program is scheduled to incorporate this technology.



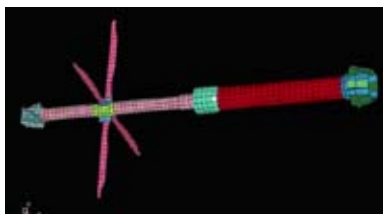
- The JASP continues work at the forefront of advanced infrared missile countermeasure development. Adding to the improved expendable countermeasures project reported last year, efforts to understand the phenomenology of defeating imaging Focal Plane Array (FPA) seekers and technologies to support Directed Energy Infrared Countermeasures (DIRCM) were a focus of the FY07 effort. Significant highlights include a joint Army/Navy project quantifying the laser parameters needed to defeat representative threat seeker FPAs; reducing flight test risks for the Air Force's Affordable Laser IRCM Survivability System (ALISS); and, continued development of high power mid-infrared glass fibers for use in advanced DIRCM systems.

### Vulnerability Reduction:

- **Rocket Propelled Grenade (RPG) Characterization and Damage Modeling.** The Army Research Laboratory's Survivability/Lethality Analysis Directorate conducted tests to collect previously unavailable data to support development of finite element (LS-Dyna) RPG threat models for application to high-fidelity dynamic modeling of threat and aircraft structure interaction.



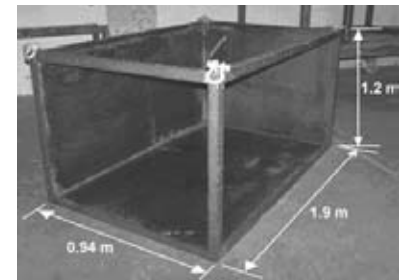
ATEC, together with Boeing, developed a finite element model for RPG-7M damage effects, including blast, fragmentation, copper jet, and rocket body energy. ATEC assessed the accuracy of the model through correlation with an RPG test on an AH-1F Cobra tailboom conducted via the JLF program.



- **Transparent Armor Development.** AATD began work to demonstrate transparent armor concepts for rotorcraft that may yield a 30 percent weight reduction over current systems while lowering manufacturing costs and substantially improving multiple hit performance.



- **Fuel Tank Ullage Vulnerability.** The Air Force's 780th Test Squadron is providing data on the maximum oxygen concentration allowed for safe JP-8 fuel tank inerting under realistic fuel tank conditions for projectile incendiary and tracer ignition sources. A motion simulator at Wright-Patterson AFB reproduces the sloshing environment that exists during flight.



### Survivability Assessment:

- The JASP completed a practical demonstration of the Integrated Survivability Assessment (ISA) process in conjunction with the Multi-mission Maritime Aircraft (MMA) program. JASP developed the ISA process at the request of DOT&E for assessment of the relative effectiveness of susceptibility and vulnerability reduction features on overall system survivability. The JASP effort provided infrastructure to pass consistent data to and from the models and databases used in the ISA process. This infrastructure was embodied in a Common Shared Database (CSD). MMA Program analysts can then perform analyses, using a suite of JASP supported models and the CSD, to identify the most effective mix of susceptibility and vulnerability reduction technologies to optimize MMA survivability. These analyses are ongoing and JASP will document the results in an Integrated Survivability Report for the MMA Program.
- The JASP is funding the development of a library of Damage Effects Models that combines threat effects, primarily blast and penetration, with hydro-code structural response models through the LS-DYNA architecture. The project has generated threat models for two high-explosive projectiles (23 mm and 30 mm) and two man-portable air defense systems (MANPADS) (SA-7 and SA-16/18) to date. FY08 plans call for the development of an SA-24 MANPADS model, enhancing a rocket-propelled grenade (RPG-7) model, and developing an air-to-surface missile (S-5) if sufficient data are available. This library of damage effects models supports aircraft designers, improves vulnerability/lethality analyses, and extends the knowledge gained from Live Fire test.

## JOINT COMBAT ASSESSMENT TEAM (JCAT)

In FY07, the Joint Combat Assessment Team continued deployment to Operation Iraqi Freedom in support of Combined Forces Aviation. The JCAT continued operations from Al Asad and Balad and established a senior uniformed presence with Multi-National Corp - Iraq C3 AIR at Camp Victory. In 2007, the JCAT will complete 2,154 person-days in Iraq and is likely to assess more than 100 aircraft combat damage incidents. The JCAT accomplishes this by inspecting damaged or destroyed aircraft, acquiring available maintenance documentation, and conducting interviews with aircrew and intelligence personnel. The JCAT provides consultation to weapons, tactics, and logistics personnel and provides comprehensive briefings to commanders in charge of daily air operations. These efforts provide valuable information to commanders allowing them to adjust their tactics, techniques, and procedures based on accurate threats assessments.

In 2007, the JCAT and the Survivability/Vulnerability Information Analysis Center (SURVIAC) established the Combat Damage Incident Reporting System (CIDRS) on classified network. JCAT uses this repository to enter assessment reports and SURVIAC provides access to these assessments to the warfighter and acquisition communities.

A second but equally important mission for JCAT is hands-on combat assessment training of the maintenance personnel that work on battle damaged aircraft. This multiplies the JCAT's effectiveness by enlisting the maintainer's help in documenting battle damage when the team is unable to reach an incident site before mechanics initiate repairs.

## JOINT LIVE FIRE (JLF)

The Joint Live Fire (JLF) program consists of three groups: Aircraft Systems (JLF/AS), Armor/Anti-Armor (JLF/A/AA), and Sea Systems (JLF/SS). Following are examples of projects funded by JLF or completed in FY07.

### Aircraft Systems Program

JLF/AS FY07 projects provided survivability data on currently fielded U.S. aircraft in order to obtain a better understanding of their vulnerability and identified ways to reduce that vulnerability. These efforts provided information to aid in combat mission planning, increased aircraft and aircrew combat survival and effectiveness, and provided battle-damage assessment repair training and design recommendations to reduce the ballistic vulnerability of current and future U.S. aircraft.

**CH-53E Super Stallion.** JLF/AS completed the final year of a multi-year investigation into the vulnerability of the CH-53E platform. In FY07, JLF/AS conducted ballistic tests against the CH-53E tail rotor drive and main flight control systems under flight representative dynamic loads. These efforts contribute to the Navy's efforts to reduce the vulnerability of the fielded CH-53E, as well as improving the survivability of the new CH-53K.



both an AH-1Z fuselage dry bay and a replica A-10 wing leading edge dry bay. Of 16 tests conducted, eight on each article, no sustained fires occurred. Threats ranged from 12.7 mm armor piercing incendiary projectiles to a successful 23 mm high explosive incendiary projectile test. JLF/AS testing was the culmination of developmental ballistic testing for this technology in the protection of aircraft dry bays adjacent to fuel tanks. Both the JASP and JLF/AS organizations are assisting aircraft developers with the integration of this technology.

**Rocket-Propelled Grenades (RPGs).** The JLF/AS continues to investigate the vulnerability of front-line rotorcraft to this threat with goals of understanding the damage mechanisms of this threat and identifying survivability enhancements to mitigate it. JLF/AS completed a four-phase evaluation program in December 2006. The final phase of the program investigated the damage mechanisms of a free-flight RPG impacting both unprotected and inert fuel cells of AH-1 Cobra aircraft. Materiel developers and survivability engineers have used the results from the four phases of the program to update threat weapons effects and platform vulnerability databases for use in designing future aircraft.



**Enhanced Powder Panel Validation.** The JASP began investing in powder panel development in the early 2000s with the goal of developing an advanced passive fire extinguishing technology. Enhanced Powder Panels (EPPs) offer significant improvement in passive fire extinguishing and provide a reliable and low-maintenance means of fire mitigation for aircraft dry bays. JLF/AS completed full-scale EPP validation testing in

**Man-Portable Air Defense System (MANPADS).** JLF/AS continued their multi-phase effort to assess large aircraft vulnerability to MANPADS by performing a quick-look assessment of MANPADS damage effects on a large turbofan engine. Test engineers at Wright-Patterson AFB performed live and inert missile tests on a non-operating TF39 engine (common to the C-5 aircraft). Damage proved to correlate well with pretest

predictions generated by General Electric using a missile model supplied by RHAMM Technologies, LLC. This test series marked 1) the first-ever coupling of missile and large turbofan engine models to generate high-fidelity predictions of damage, 2) strong correlation between turbofan engine test results and JASP-funded engine predictions of damage, and 3) validation of the JASP-funded engine-MANPADS modeling procedure.

**Foreign Unguided Rocket Lethality.** This program provided basic warhead characterization data and lethality estimates (versus helicopters) for a single foreign unguided rocket warhead. Survivability engineers and aircraft system trainers are using these data for aircrew training, threat identification, tactics refinement, aircraft vulnerability reduction, and battle damage assessment and repair (BDAR). Survivability engineers will also use these data to better understand the vulnerabilities of deployed aircraft to unguided rockets.



### Armor/Anti-Armor Program

**U.S. Small Arms Effectiveness Against Threat Body Armors.** U.S. troops are currently engaging hostile forces employing body armors (BA) produced by foreign nations. To provide U.S. troops with a situational advantage, the Army Research Laboratory (ARL) conducted test and analysis of U.S. small arms effectiveness against threat BA. ARL selected three potential threat ceramic plates and conducted testing with commonly used U.S. small arms ball and armor piercing (AP) munitions at various velocities to simulate different ranges of engagement. X-rays were taken of the targets before and after each shot to assess damage to the material, and ballistic gelatin blocks were placed behind the targets to assess lethality. ARL used modeling to assess personnel incapacitation. The methodology and modeling used to conduct personnel incapacitation estimation was developed within the small caliber rifle cartridge lethality project that is reported in the Quick Reaction section of this report. This is an excellent example of DOT&E's efforts to standardize test and evaluation methodologies within and across the Services.

**Full Vehicle External Blast.** JLF conducted a systematic series of experiments to assess the vulnerability of a BM-21 multiple rocket launcher and a URAL-375 cargo truck to external air blast loads. ARL detonated bare explosive spheres at various positions relative to these truck-based targets, and assessed the resulting blast damage. ARL applied instrumentation to the targets to characterize the applied air blast load to the target, and to a limited extent, air blast intrusion into the cab of the truck for assessment of crew casualty. ARL analyzed those data to develop contours of lethal miss distances with respect to mobility, firepower, and catastrophic target kills. The JTCG/ME currently uses simple models and database look-ups to estimate air blast effectiveness of a weapon-target pair, and after coupling with

fragment effectiveness, guide the weaponeer in weapon selection and mission planning. Results from this program will provide ground truth data for this important class of targets, and serve as a benchmark for the development of methods utilizing three-dimensional contours of kill level for materiel targets.



### Non-Destructive Evaluation Automated Inspection System (NDE-AIS) Body Armor.

Program Executive Office (PEO) - Soldier developed the NDE-AIS to evaluate hard armor inserts and identify armor plates that had cracks, which make them ballistically degraded and unserviceable. Over the course of a year, the NDE-AIS has been constructed and tested to verify its capability and reliability. Starting in early January 2007, the system was field-evaluated to quantify the rate at which the system could evaluate hard armor plates, its reliability of finding cracks, and the effectiveness of evaluating several hard armor plate designs. The first field evaluation was successful and demonstrated that the system could evaluate 260 plates per hour.

The system was 97 percent successful at identifying cracked plates. Work continued to reduce the amount of false accepts (plates that were accepted but had a crack). Statistical work also continued to help identify which parameters of the crack were causing more ballistic failures. PEO - Soldier conducted another field evaluation on a control sample of enhanced small arms protective inserts at the end of July 2007. This test was very successful and verified that the system is capable of identifying 99.8 percent of unserviceable plates. The NDE-AIS was also able to identify unserviceable plates that the current evaluation process (torque test) did not detect. The system is able to query data using the Unique Identifying (UID) labels used for materials research analysis as well as logistical concerns.

**MOUT Secondary Debris Characterization.** ARL conducted testing of direct fire munitions against walls constructed of materials based on information gained from in-theater



reports. These wall types included infill and load bearing walls. The FY07 tests utilized the expanded arena and test fixture that ARL implemented in FY06 and the data collected continues to populate an initial debris characteristics database. The work specifically benefits the DoD joint target community, Central Command, the personnel vulnerability community, operational tests, the Joint Army/Air Force Modular Effectiveness/Vulnerability Assessment simulation, and the JTCG/ME's ongoing collateral damage estimation efforts. ARL is also using the data collected to increase the fidelity of personnel vulnerability models such as the Operational Requirements-based Casualty Assessment model. The Air Force Research Laboratory (AFRL) conducted testing of bare-charges against triple-brick walls to baseline the wall debris generated during internal and external detonation events. AFRL conducted four tests using Comp-B and a multi-phase blast explosive (MBX) currently being utilized as part of a low-collateral damage warhead. AFRL will combine the data collected with the direct-fire debris data to expand the domain of the debris characteristics database. The tests demonstrated the significant difference in debris characteristics due to the presence of quasi-static gas pressures (internal shots) compared with "free-air" detonations. AFRL will also incorporate this data into their weapon effects computer tools to improve predictive capabilities of structural debris and the collateral hazards for structural and personnel components.

**IED Characterization.** During FY07, JLF continued its support to JIEDDO and to forward deployed forces through high-resolution characterization of explosive ordnance. JLF extended beyond traditional characterization methodology by altering the threat item in a manner reflective of how the intelligence community has determined the current or future anti-Coalition forces to fight in order to gain a more holistic, comprehensive, and reflective characterization of the modern battlefield. The database of information from threat characterization is a fundamental step in designing countermeasures such as improved armor, effective early detection, and enhanced disarming technologies.

### Sea Systems Program

JLF/SS, initiated by DOT&E in 2005, made significant progress toward assessing the survivability of submarines and surface ships, addressing the interests of the Navy, Army, and Marine Corps. JLF/SS has made particular progress by leveraging

major Navy programs. Examples of these and other efforts are discussed below.

**Ship Shock Trial Alternatives.** This project is helping to develop and validate key components of an alternative to the traditional Full-Ship Shock Trial (FSST). The FSST involves underwater explosion testing of new acquisition ships. The goal is an integrated testing and simulation process in which the testing is more environmentally friendly and less expensive; and the simulation is capable of predicting mission degradation resulting from expected threat encounters. This JLF/SS task leverages the Navy FSST Alternative Enterprise program, and is coordinated with several major acquisition programs – notably Littoral Combat Ship, LPD 17, LHA 6, DDG 1000, and CVN 78. The non-explosive testing technology (i.e., air guns) development efforts are addressed in a separate task, below.



**Test Alternatives to Underwater Explosion (UNDEX).** This project is evaluating a less expensive and more environmentally acceptable alternative to UNDEX shock testing. The technical objective is to implement a cost-effective operational ship trial that provides significant data to advance the validity of advanced modeling and simulation used for Navy shock qualification purposes as well as for ship survivability assessments to expected conventional and asymmetric threats. This project leverages a Navy Small Business Innovative Research program to demonstrate the utility of a seismic air-gun array as the non-explosive loading source. The U.S. is collaborating with the UK Ministry of Defence to assess an air-gun array's potential as a surrogate for the traditional full-ship shock trial. In May 2007, test engineers used the circular air-gun array to generate underwater explosion-like loads on a Navy scaled submersible in a quarry. Efforts are quickly ramping up to demonstrate and employ larger arrays against operational Navy warships.





## **Test & Evaluation Resources**



**Test &  
Evaluation  
Resources**

## Test and Evaluation Resources

Title 10, U.S. Code requires the Director to assess the adequacy of the planning for, and execution of, operational testing and evaluation of systems under oversight. The test workforce, ranges, and test facilities, as well as assets used in threat representation, are important elements in assessing the adequacy of operational testing. One key aspect of assessing adequacy is through oversight of DoD and Service-level strategic plans, investment programs, and key budget decisions. DOT&E also conducts studies of resource needs and alternative solutions to key T&E resource needs through its Threat Systems program.

### Summary

The DoD saw progress in long-standing concerns for ranges and some target projects while other critical target and instrumentation developments made only incremental improvements. Of concern are Real-Time Casualty Assessment capabilities, a future Air-Superiority Target, Anti-Ship Cruise Missile (ASCM) target fidelity and resource shortfalls, and Missile Defense targets resource shortfalls. The challenges to test resources, such as increasing sensor and weapon capabilities, remain consistent with our previous reports, while new threats to include Improvised Explosive Devices (IEDs), Computer Network Attack, and Urban and Littoral warfare place additional demands upon Service and DoD resource strategic planning.

Service investment in T&E resources is, in most cases, just meeting specific program near-term needs, while common use resources, such as aerial targets, continue to require intervention. Services increasingly look to OSD-funded programs, such as the Central T&E Investment Program (CTEIP) and DOT&E's Threat Systems program to initiate innovative T&E resources solutions that will be pursued by the Services. DOT&E, either on its own or in coordination with the Test Resource Management Center (TRMC), sponsored studies and projects to prototype modifications to targets and their control systems as well as upgrade threat systems to evaluate weapons, sensors, and counter-IED systems.

DOT&E continues to stress adequate resources for operational testing and accurate estimates in program Test and Evaluation Master Plans, especially those with fast-track strategies, to support adequate OT&E planning, and help control program cost and risk.

### Focus Areas

The following 13 areas are critical to adequate future OT&E and describe the relevant issues and our involvement where applicable:

#### Health of the Operational Test Agencies

New acquisition approaches, joint experimentation, and short notice testing in support of wartime needs, require greater

Operational Test Agency (OTA) involvement. Yet, continued staffing and budget pressure coupled with deployment of test agency military personnel compounds a shrinking pool of experienced testers. Of specific interest, the Army Test and Evaluation Command continues to cope with shortages in civilian staffing and mid-grade officers available for operational test assignments. It may face additional challenges as civil service employees who may choose not to relocate to Aberdeen Proving Ground, Maryland, as a result of Base Realignment and Closure Commission action. Of additional concern is the transfer of operational evaluators to a development test environment. Additionally, an Air Force Operational Test and Evaluation Center military manning drawdown and projected reductions in operations funding may adversely affect its operational capability as the Air Force continues to reduce infrastructure expenses while shifting funding to higher priority programs.

DOT&E will continue to monitor the health of the OTAs and their ability to meet DoD's operational test and evaluation requirements, advocating increased resources when needed to ensure adequate operational testing and evaluation.

#### Aerial Targets (Full-Scale Aerial Targets and Unmanned Aerial Systems)

The DoD's FY05 Strategic Plan for Test Resources established Full-Scale Aerial Targets (FSATs) as one of four Critical Interest items. This year, DOT&E encouraged the Air Force to fund, develop, and field a QF-4 replacement. Due to a depleting QF-4 inventory, the Air Force reached a critical decision point in FY07 and initiated a program to drone F-16 aircraft. While the droning of F-16s will provide an inventory of 4th Generation FSATs, DOT&E remains concerned about the ability to test against emerging 5th Generation fighter threats. This year, DOT&E and USD (AT&L) are co-chairing a combined tri-Service study to determine the future 5th Generation test requirements and examine affordable target designs. Nevertheless, at this point there is no funding to adequately support development of a next generation target.

There was, however, considerable progress made this year for other unmanned air vehicle targets supporting naval ship defense testing. Leveraging a series of DOT&E technical exchange sessions with the Navy and an FY06 DOT&E study of available government and commercial alternatives, the Navy selected a commercial drone vehicle to fulfill the unmanned aerial vehicle target requirement. This was a significant first step toward addressing operationally realistic testing against the emerging threat.

#### Anti-Ship Cruise Missile (ASCM) Targets

Subsonic Targets. Development of the ASCM threat target (BQM-34SH drone with ASCM seeker) required for

ship-launched electronic decoy operational testing and the associated data analysis software have been troubled. There are not enough backup targets to ensure the test can be executed. Furthermore, the target was only recently flight tested, delaying completion of the data analysis software. As a result, scheduled testing for assessing the LPD-17-Class ship's radar signature reduction capability and launching electronic decoys to protect the ship against anti-ship cruise missiles will be delayed at least six months.

**Threat D Target.** The Navy stated that they will fund development of the Threat D target (also referred to as the Multi-Stage Supersonic Target (MSST)). While the initiation of the MSST development is a positive step, it appears to be coming at the expense of reductions in procurement of other target types, as well as test range investments and other facility investments within the Navy. This will adversely affect out of date equipment replacement projects and other target programs. Additionally, the delays in resolving the requirement for a target representing Threat D will result in a target no earlier than FY14, according to Navy projections, missing testing of the Standard Missile-6, Rolling Airframe Missile Block 2, and the LHA-6 Ship Self-Defense System in FY10/11. This situation directly impacts the adequacy of the IOT&E of these critical systems. Although an expectation for program initiation is for full funding, it appears that only development – not procurement – is covered at this time.

**High Diver.** To satisfy other near-term ship self-defense testing requirements, the AQM-37 drone will perform supersonic high-diver threat profiles. However, the AQM-37 inventory is aging and is difficult to support. Efforts to procure other supersonic high diver vehicles via foreign sources failed, so the Navy indicated that a study would be conducted to examine feasibility of modifying the GQM-163A supersonic sea-skimming target to fly the high diver profile.

**Supersonic Sea-Skimming Target.** Introduction of the GQM-163 “Coyote” target to support operational testing has been challenging. For example, the first demonstration of the capability to fly a dual target presentation is scheduled to occur at the same time that ship self-defense systems (the systems being operationally tested) are on the test range to demonstrate capability against threats in that quantity. In addition, procurement of sufficient quantities of these targets may be affected by the need to fund Threat D target development and procurement.

### **Ballistic Missile Defense Targets**

The Missile Defense Agency procures targets for testing the nation's ballistic missile defense system. In the past 18 months, there were a number of target failures that impacted test schedules and objectives. See the Ballistic Missile Defense section in this report for further details.

### **Real-Time Casualty Assessment and Instrumentation**

The continued lack of a reliable high fidelity Real-Time Casualty Assessment (RTCA) system to support current and near-term operational testing and evaluating unit combat effectiveness

is a major concern. The Army does not currently have a sufficiently high fidelity RTCA system for operational testing of large force-on-force engagements. Consequently, the Army is currently relying on a collection of existing low fidelity training systems to support the Mobile Gun System and Future Combat System (FCS) Spin-Out 1 tests in FY08 that will likely not meet expectations. This condition will exist until the fielding of an adequate high-fidelity system, which promises greater data fidelity at a lower life-cycle cost for test and training. While this replacement program has progressed sufficiently this year to support a full field demonstration in late FY08, there is no procurement programmed beyond FY09.

DOT&E has long supported compatible test instrumentation throughout the DoD's ranges. This year, CTEIP initiated the Common Range Integrated Instrumentation System to support land, naval, and air testing needs. While still in early development, there have been requirements changes that will probably affect budget and schedule. This program will be closely monitored, since operational testing will continue to rely on existing range capabilities, with their limitations and sporadic upgrades, until this new system comes online after FY12.

### **Urban Environment Test Capabilities**

Over 40 percent of new programs have a requirement to operate in an urban environment. The Services are currently relying on new and existing training facilities to meet T&E needs that often lack key features such as densely arranged multi-story structures or can only support testing on a limited basis. While there were a number of Service studies this year to determine the most urgent requirements coupled with modest Army investments to accommodate testing in FY08, progress has been slow. We believe the need for urban test facilities will be even greater as more advanced technologies intended to enhance U.S. capabilities to operate in this environment enter development. We will work with the Services and the TRMC to emphasize urban test capabilities in the next Strategic Plan.

### **Land Targets for Precision Systems and Munitions**

The DoD is developing precision weapon systems for dynamic and urgent task targets with reduced collateral damage. To adequately test these systems, affordable targets with appropriate signatures, speed, and maneuverability are needed. DOT&E, using OT&E and CTEIP resources, continued to lead a multi-Service Multi-spectral Mobile Ground Target initiative to prototype a family of surrogate unmanned threat land vehicles with realistic signatures and an advanced target control system. Once prototyped, the Services will continue the effort into production. The vehicle performance results to date are promising with subsequent efforts planned to improve signature quality and demonstrate multiple target vehicle control from a single command station.

### **Countermeasure and Counter Weapon Test Capabilities**

Adequate operational testing of integrated defensive systems requires robust threat-representative hardware, validated models, simulations and test environments, to include jamming by threat forces. This year, DOT&E, along with CTEIP, supported

prototyping capabilities to test the effects of jamming to our weapon systems. To increase joint use of the DoD's threat simulators, DOT&E and the TRMC also initiated efforts to integrate two threat missile models with tri-Service simulators. DOT&E also sponsored initial efforts to integrate threat surface-to-air missiles at test facilities, as well as initiated a four-year effort to upgrade the Services' inventory of threat missile simulators with standard, validated fly-out models. With these efforts, the DoD will move closer to interoperable missile fly-out models.

## **Naval Platform Signature Measurement Facilities**

T&E infrastructure upgrades have difficulty keeping pace with new naval platform signature reduction efforts. A DOT&E sponsored CTEIP project, upgraded the Norfolk, Virginia, degaussing facility to provide a limited test capability to evaluate the Advanced Degaussing System on new classes of ships (LPD-17, T-AKE, DDG-1000, CVN-21, and Littoral Combat Ship). The Navy fully supported this effort and will further improve this initial capability next year along with upgrades at other facilities. In addition, the Navy initiated new Radar and Acoustic signature measurement developments for low signature ships such as the DDG 1000, though no long-term support has been identified. DOT&E will continue to monitor these measurement system upgrades as their capability is critical to assessing ship vulnerability.

## **Joint Test Environments, Information Assurance and Operations**

The continuing transformation to joint and networked operations presents a significant challenge to operational testing of "system-of-systems" and assessing mission effectiveness. We continue to support DoD's Testing in a Joint Environment Roadmap with our Joint T&E Methodology project examining methods and processes to conduct testing in joint mission environments.

Together with CTEIP, Air Force, and Army, four prototype efforts were initiated to provide capabilities to assess network performance, communications jamming and integrate Army Information Operations into the joint network to support operational testing. The Services also successfully integrated DOT&E and CTEIP Information Operations prototypes into a coordinated joint range program to support FCS Spin Out 1 testing. DOT&E also sponsored a study of threats to Global Positioning System (GPS) and demonstrated a flexible prototype field asset for open-air jamming, recording data for force-on-force and mission modeling efforts.

Testing offensive and defensive aspects of computer network operations poses significant challenges for the T&E community. DOT&E advocates a ready, available team and facilities to conduct assessments of computer network attack tools for the Combatant Commanders, as this testing is not done by the OTAs. Assessing the defensive posture of both fielded systems and systems under development requires both specialized facilities and trained personnel. The demand for personnel with the requisite skills and experience for offensive and defensive

assessments outstrips availability. DOT&E is studying this issue with other members of the information operations community in order to develop a coherent community approach.

## **Undersea and Littoral Warfare Test Resources**

Despite continued need, the Navy's approach to testing in the littorals remains fragmented. Training Range investments, suitable for T&E on the East Coast are mired in environmental litigation with a Record of Decision expected in early CY08. Further delays will likely require more non-operationally realistic alternatives or force more of this testing to the West Coast sites. To satisfy demands for testing at more sites and in the open ocean, DOT&E sponsored a CTEIP program for a portable undersea tracking system to support minefield avoidance testing that was successfully demonstrated in 2007.

## **Frequency Spectrum Management**

Modern complex weapons systems require increased frequency spectrum for their testing. The F-22 flight testing required data rate transfers 100 times that required to adequately test its predecessor fighter, the F-15. Yet the DoD has lost access to nearly 30 percent of the frequency spectrum used for T&E since the time the F-15 was being tested. The DoD has undertaken aggressive research for more efficient spectrum use for weapon system testing and the World Radiocommunication Conference (WRC) recently authorized aeronautical flight testing in additional radio bands. DOT&E, together with the Service OTAs and the TRMC, will assess the likely increased funding requirement for test instrumentation necessary to operate in the additional WRC bandwidth allocations.

## **Test Range Sustainability**

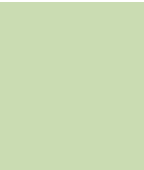
DOT&E supports Sustainable Ranges initiatives and this year the DoD signed a cooperative Memorandum of Understanding with the Departments of Energy and Interior to address energy issues, mitigating encroachment and energy corridor impacts to our test and training ranges. DOT&E's continuing support of outreach efforts to the civil and private sectors in cooperation with the Land Trust Alliance has improved public understanding of DoD's efforts to ensure compatibility of testing and training with the preservation of the nation's open spaces and natural habitat. DOT&E was a co-sponsor of the 2007 Sustaining Military Readiness Conference, which supported training workshops and an opportunity for the exchange of information.

## **Conclusions**

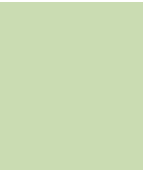
The DoD-wide state of T&E resources remains mixed. The Operational Testing environment continues to change as a result of increased weapon and sensor capability and new threats. As a result, T&E resources are lagging in the ability to support threat representation required for adequate OT&E. While there have been notable successes in 2007 with the introduction of some target and sensor measurement capabilities, significant issues with major target, instrumentation, frequency management and threat models remain. DOT&E will continue to encourage the DoD to address these issues. Based on recent trends, we anticipate that the Services' reliance on OSD-led initiatives

## TEST AND EVALUATION RESOURCES

to mitigate test resources shortfalls, such as DOT&E's Threat Systems program, will continue to grow. Finally, we have worked during this year to ensure OT&E needs are adequately accommodated in Service and Department-level Strategic Planning.



## **Annexes**



## **Annexes**

## Manpower Study Results

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United States Code Title 10, Section 139 (10 USC 139), specifies that “the Director shall have sufficient professional staff of military and civilian personnel to enable the Director to carry out the duties and responsibilities of the Director prescribed by law.” The Director has determined that he does not have sufficient professional staff to carry out the duties and responsibilities prescribed by statute or to support several Department initiatives. The number of Action Officers on the Director, Operational Test and Evaluation’s staff has remained essentially the same since the organization stood up in 1983 while a progression of statutory changes and acquisition initiatives detailed below have nearly doubled the workload. The Director requests an increase in his manpower authorization of one senior executive, three military, and 18 civilian billets. The request for additional military billets is to ensure the warfighter’s current operational perspective continues in support of the Director’s 10 USC 139 responsibilities. However, if the on-going wartime operations do not permit assignment of additional military officers, the need for additional manpower outweighs the requirement for a current warfighter perspective and experienced civilian equivalents with operational command backgrounds could be substituted for the three military billets.

This additional manpower will be utilized in six areas, which are currently understaffed:

- A. A senior executive to serve as the Deputy Director for Net-Centric and Space Systems.
- B. Additional Action Officers (two military and seven civilians) to support oversight of operational and live fire test and evaluation programs.
- C. A civilian employee to serve as the special access program control officer to free up an existing military Action Officer who is performing this growing function as a collateral duty in addition to oversight of operational test and evaluation programs.
- D. Additional Action Officers (four civilians) to support the Joint Capabilities Integration and Development System as well as Department acquisition process initiatives.
- E. Two Action Officers (one military and one civilian) to support Information Assurance and Interoperability evaluations of fielded systems.
- F. Five program management specialists (civilians) to manage the Joint Test and Evaluation Program.

# ANNEX A - MANPOWER STUDY

## Congressional Reports Overview

DOT&E prepared eight Beyond Low-Rate Initial Production (BLRIP) reports for the Secretary of Defense and Congress in FY07. Seven of the summaries from these reports are included in this section. One is not included due to classification issues. It is the APG-79 Active Electronically Scanned Array (AESA) Radar System.

Section 231 of the National Defense Authorization Act 2007, modifying Section 2399 of Title 10, United States Code, requires DOT&E to submit a report to the Secretary of Defense and Congress if a decision is made within DoD to proceed to operational use of a major defense acquisition program (MDAP), or make procurement funds available for that program, before a formal decision is made to proceed to beyond low-rate initial production. DOT&E prepared three Early Fielding Reports. One of the summary letters is included in this section. Two are not included due to classification issues. These are the Stryker Mobile Gun System (MGS) and the Common Broadband Advanced Sonar System (CBASS) Torpedo.

DOT&E prepared one annual assessment of the Ballistic Missile Defense System (BMDS) in FY07. The summary of the report is not included in this section due to classification issues.

### REPORTS TO CONGRESS

Program	Report Type	Date
Small Diameter Bomb Increment One (SDB)	Combined OT&E / LFT&E BLRIP Report	October 2006
Global Broadcast Service (GBS) System	OT&E BLRIP Report	December 2006
Small Unmanned Aerial System (SUAS)	OT&E BLRIP Report	December 2006
FY06 Assessment of the Ballistic Missile Defense System (BMDS) <i>(Summary is not included)</i>	Annual Report	February 2007
Land Warrior System	Early Fielding Report	April 2007
APG-79 Active Electronically Scanned Array (AESA) Radar System <i>(Summary is not included)</i>	OT&E BLRIP Report	April 2007
UH-60M Black Hawk Utility Helicopter	Combined OT&E / LFT&E BLRIP Report	May 2007
Stryker Mobile Gun System (MGS) <i>(Summary is not included)</i>	Early Fielding Report	June 2007
Common Broadband Advanced Sonar System (CBASS) Torpedo <i>(Summary is not included)</i>	Early Fielding Report	June 2007
Common Submarine Radio Room	OT&E BLRIP Report	June 2007
CH-47F Block II Improved Cargo Helicopter	Combined OT&E / LFT&E BLRIP Report	June 2007
UH-72A Lakota Light Utility Helicopter	OT&E BLRIP Report	July 2007

ANNEX B - CONGRESSIONAL REPORTS

## Small Diameter Bomb Increment One (SDB)

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The Small Diameter Bomb Increment One (SDB) is operationally effective, and it is operationally suitable with some limitations.

### System Overview

SDB weapons system consists of the GBU-39/B 250-pound class air-launched glide bomb and the BRU-61/A carriage assembly. SDB is the first Air Force Miniature Munition weapon system and is designed to increase the number of weapons carried per aircraft for employment in offensive counter-air, strategic attack, interdiction, and close air support missions. Combatant commanders use SDB to attack fixed or relocatable targets that remain stationary throughout the weapon time of flight in all weather conditions. The initial SDB-capable aircraft is the F-15E, and follow-on aircraft include the F-22A, F-35, F-16, B-1, B-2, B-52, and MQ-9.

SDB uses a combination of Global Positioning System (GPS) and internal inertial navigation system guidance to achieve kills across a broad range of target sets through the combination of precise accuracy and warhead effects. It is supported by the Accuracy Support Infrastructure (ASI) system, a ground-based, theater-deployable differential GPS system, designed to increase SDB accuracy. ASI collects GPS satellite positioning error data and broadcasts target location data corrections to the SDB through the F-15E data link prior to weapon release.

### Test Adequacy

The operational testing of SDB adequately supported an evaluation of the system's operational effectiveness and operational suitability.

Air Force Operational Test Command conducted the SDB initial operational test (IOT) from November 2005 through July 2006. Operational test aircrews and maintainers planned, flew, and maintained missions. Test phases and events included mission planning exercises, ASI deployment and operations, logistics activities and demonstrations, and flight test missions carrying and delivering both live and inert SDBs. Air Force Operational Test Command conducted testing using production-representative weapons and carriage assemblies. IOT evaluated 51 SDBs in operationally representative free flight test missions to include testing in a GPS jamming environment.

### Operational Effectiveness

SDB is operationally effective and lethal when the optimum fuzing mode is correctly selected. Weapon guidance accuracy combined with appropriate fuze selection will achieve kills across the full spectrum of user-defined target sets. SDB proved lethal against the targets engaged in IOT, and is likely to be lethal against the required targets that were not attacked in testing. SDB demonstrated effective employment and target engagement using both preflight mission planning and airborne targeting using the F-15E onboard sensors to designate and engage targets.

The weapon was not able to perforate all hardened targets with a single SDB, likely requiring two weapons against the same aim point in order to achieve the user's required level of damage for these targets. SDB lethality against relocatable soft surface targets and lightly armored ground combat systems proved heavily dependent upon the fuzing option selected (height of burst or impact) based on actual target location error.

Although limitations in the currently fielded weapons planning software do not support a definitive assessment of the user's requirement of 17 weapons to kill 14 targets, SDB can be expected to perform near its required capability and kill 14 targets with 18 weapons. Additional limitations in the SDB effectiveness modeling resident in this software also lead to inappropriate fuzing solutions for some targets with small target location error.

The ASI system provided incremental guidance accuracy improvements, but did not enhance nor detract from overall effectiveness or lethality.

SDB effectiveness in the presence of GPS jamming is presented in the Classified Annex to this report.

### Operational Suitability

SDB is operationally suitable with some limitations. SDB met user needs for maintainability and reliability with one exception: the BRU-61/A carriage assembly did not meet the user's mean time between failure requirements during IOT. Additionally, the currently fielded SDB mission planning software leads the aircrew to a fuzing option selection that will not achieve the user's required target damage criteria in some target scenarios. Finally, the ASI system required continuous

## ANNEX B - CONGRESSIONAL REPORTS

monitoring and troubleshooting to maintain availability to support SDB missions. This was deemed not to be significant as ASI did not enhance nor detract from effectiveness or lethality observed in IOT.

### **Recommendations**

SDB is an effective system and is suitable for combat operations with some limitations. To address these limitations, the Air Force should:

1. Improve BRU-61/A bomb rack reliability to meet the user-defined mean time between failure requirements.
2. Improve weapons planning software SDB effectiveness modeling. Improvements are necessary to accurately plan for effective SDB employment using both height of burst and impact fuzing. Follow-on live warhead flight testing against relocatable targets (particularly lightly armored ground combat systems) is required to validate the accuracy of software improvements and provide a more robust set of empirical data to better characterize the range of SDB capabilities and limitations.
3. Reconsider the value added in fielding the ASI system given that it did not fully support the user's concept of employment and did not contribute to nor detract from SDB effectiveness.
4. Take measures to ensure that all SDB weapons procured retain the minimum capabilities in a GPS jamming environment as discussed in the Classified Annex to this report.

## Global Broadcast Service (GBS) System

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The Global Broadcast Service (GBS) system transmits secure, high-speed, one-way, classified and unclassified imagery, video, and other military information over military and government leased satellites to forces in theater, in transit, and in garrison.

The operational testing of the GBS system conducted in late 2005 was adequate to confirm:

1. The GBS space and transmit segments are operationally effective and suitable.
2. The GBS receive segment is operationally effective when personnel are available to man the receive suite terminals; the intended operating concept was for unattended use.
3. The GBS receive suite of the receive segment is not operationally suitable.

The GBS receive suite terminals were operationally effective, but did not deliver the level of user service and dependability required. Receive suites did not demonstrate the capability required while operated in the “unattended” mode, unless system personnel were available to man them. Sustained operator involvement was required to prevent outages and delays in data reception. The GBS receive suites have proven to be valuable in delivering data and real-time military information during recent sustained combat operations and contingency relief missions.

The GBS receive suite terminals were not operationally suitable. This is because of difficulties experienced with user receive suite reliability, technical order deficiencies, information assurance security changes, system logistics shortfalls, and the need for more comprehensive system training. It was found during testing that the Army modified their receive suites after receiving them from the factory, but this configuration was not integrated into the final program baseline or the technical order system. The integrated system logistics and technical order data for the GBS must be changed to accommodate receive suite terminals modified by the Army. Additionally, common GBS technical data, operational training materials, and logistics must provide operators and maintainers with the tools and guidance they need to accomplish their respective missions. Improved operational suitability will be needed for effective deployment, employment, and sustainment of GBS in the field.

To meet the requirements of operational users, the Air Force should:

1. Correct and retest system performance shortfalls and reliability deficiencies, including the receive suite unattended mode.
2. Standardize and validate the Army-modified transportable ground receive suite equipment configurations, training materials, and technical orders.
3. Complete the updated Interactive Electronic Technical Manual (IETM) for current full-rate production equipment configurations and standards.
4. Complete GBS system security and information assurance corrective measures and actions to meet the established standards of the system certifying authorities.
5. Provide current system documentation, training, and technical order data so that GBS operators and maintainers can properly accomplish their duties.
6. Complete the review and release of the Joint Integrated Logistics Plan to sustain integrated GBS operations and fielding of the system.
7. Conduct scheduled Multi-Service Operational Test and Evaluation to confirm corrective actions for current and emerging features of the GBS full-rate production program baseline.

## ANNEX B - CONGRESSIONAL REPORTS

## Small Unmanned Aerial System (SUAS)

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The Small Unmanned Aerial System (SUAS) is operationally effective and not operationally suitable.

### System Overview

The SUAS is a rucksack-portable, lightweight, tactical unmanned air vehicle system. The Army intends to employ the SUAS as a company-level asset to provide over-the-hill and around-the-corner reconnaissance for light and mechanized infantry, as well as small units within the Special Operating Forces (SOF). SUAS, when issued to an infantry company, consists of five components:

- 3 aerial vehicles (AVs)
- 2 modular cameras
- 1 ground control station (GCS)
- 1 remote video terminal (RVT)
- 1 field repair kit

A single AV, plus the GCS and RVT, weighs 15.8 pounds. SUAS is designed to be carried, launched, controlled, and recovered by one operator. The Army Acquisition Objective is 2,166 systems and the United States Special Operations Command (SOCOM) Acquisition Objective is 558 systems.

There are no additional soldiers assigned to the infantry company to transport and operate the SUAS. Soldiers operate the SUAS in addition to regular duties in the company. During light infantry missions, soldiers distribute SUAS components among one to three soldiers to transport the load.

The operator prepares the SUAS for operation in less than five minutes. This includes assembling a mission-capable AV, completing preflight preparations, setting up the GCS and RVT, and launching the AV. The AV is hand-launched by a single operator “running and throwing” the AV.

### Test Adequacy

DOT&E approved the SUAS Initial Operational Test (IOT) Plan in May 2006. The operational test plan for the SUAS, conducted from May 23, 2006, to June 15, 2006, at Fort Bliss, Texas, was adequate to support an assessment of the system’s operational effectiveness and suitability, as well as to examine survivability. Due to program schedule delays, the test unit and test location was changed 60 days prior to the SUAS Initial Operational Test and Evaluation. This decreased the efficiency of the test execution.

### Operational Effectiveness

The SUAS is operationally effective. An infantry company equipped with SUAS benefits from enhanced situational awareness, more operational options to choose for planning and executing missions, and increased force protection. The SUAS provided a positive contribution to the commander’s and unit’s situational awareness and understanding.

During missions when employing the SUAS, the infantry company enjoyed enhanced situational awareness through real-time information provided by the SUAS. The information confirmed or discovered avenues of approach, obstacles, and targets. An infantry company employed the SUAS during mission planning stages. The SUAS presented the company with more options to maneuver forces to points of positional advantage in order to conduct raids on specific buildings in urban areas or engage enemy vehicles. In all missions with the SUAS, the infantry increased force protection by employing the SUAS in place of manned reconnaissance and surveillance missions.

The SUAS sensors can recognize man-sized objects and can distinguish tracked from wheeled vehicles, but the sensors could not identify armed versus unarmed personnel or find improvised explosive devices.

Launch requirements for SUAS demand that the AV be hand-launched, or launched by some other means (from a moving vehicle) that will not require an airfield. The launch success rate was 65 percent in the IOT. Flight variables such as winds, temperature, and pilot technique can influence launch as well as battery life and endurance. Although not demonstrated in the IOT, pilots with more experience have been able to use altitude adjustments and glide and power management to increase successful launch rates and extend endurance.

The enemy’s ability to attack the AV was not tested in the IOT. The SUAS is susceptible to acoustic and visual detection, thus it can be engaged. The AV did not meet the acoustic signature requirement of being inaudible at a steady cruise speed at

a maximum of 400 feet above ground level. The AV can be visually detected during the day, permitting observers to track the AV on its return leg to the recovery site.

### **Operational Suitability**

SUAS is not operationally suitable because an SUAS-equipped unit cannot sustain itself in prolonged combat and the AV is not reliable. The primary measures for operational suitability are reliability, availability, and maintainability. The test did not dictate that the unit sustain 24-hour combat operations, and the forward repair area was artificially co-located with the infantry unit. These test artificialities provided an overly optimistic estimate for operational availability.

The system consumed parts, especially vehicle fuselages, at a rate in excess of current parts allocation. Although the operators were able to adequately perform and complete most required repairs within five to six minutes, these repairs had varied impact on mission performance, from delay in launch time to system aborts.

The AV did not meet reliability requirements, averaging one essential function failure during each mission. Operators had to replace some part of the AV every time they wanted to fly it. The demonstrated AV reliability was 5.6 hours Mean Time Between System Abort versus a requirement of 12 hours Mean Time Between System Abort. In certain types of units, the Army should consider adding additional AVs until the poor reliability is corrected. The proximity of the forward repair area to the unit during the IOT and the usage of spare parts beyond those normally allocated to a brigade contributed to artificially high operational availability rates. Had the forward repair area been located at a doctrinal representative distance, logistics delay times would increase and the operational availability would potentially be reduced.

### **Recommendations**

The Army should consider:

1. Improving the reliability of the AV by increasing the number of parts in the spares package and re-examining the allocation of spares between operators and depot maintenance.
2. Adding more aerial vehicles until the reliability of the aerial vehicles increases, consistent with the mission or type unit.
3. Exploiting the full potential of the SUAS by developing and refining tactics, techniques, and procedures for dismounted and mechanized infantry to fully utilize the SUAS, to include airspace de-confliction procedures.

## Land Warrior System

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This report provides my assessment of Land Warrior demonstrated performance in testing, in accordance with the provisions of Section 231 of the 2007 National Defense Authorization Act (modifying Title 10, United States Code, Section 2399).

In this assessment, I find the following key points:

- Performance suggests that deploying the Land Warrior to Operation Iraqi Freedom with the 4th Battalion, 9th Infantry should provide a force multiplier by improving situational awareness and facilitating command and control.
- Land Warrior testing was adequate to support the planned Milestone C Low-Rate Initial Production Decision.
- Land Warrior system performance is on track to be operationally effective.
- Land Warrior system performance is on track to be operationally suitable.
- Operational survivability has not yet been thoroughly evaluated. Performance to date indicates that the Land Warrior-equipped soldier has the same operational survivability as the non-Land Warrior-equipped soldier.

Before deploying the system to combat, the Army should resolve the following issues:

- Obtain Communications Security certification from the National Security Administration and system-level accreditation under the DoD Information Technology Security Certification and Accreditation process because of known Information Assurance vulnerabilities in theater.
- Develop “quick release” procedures for the Land Warrior battery so that soldiers will be able to immediately remove the Land Warrior system should it catch fire.

## ANNEX B - CONGRESSIONAL REPORTS

## UH-60M Black Hawk Utility Helicopter

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The UH-60M Black Hawk utility helicopter is operationally effective, suitable, and survivable. The Initial Operational Test and Evaluation (IOT&E) and live fire testing were adequate and executed in accordance with the Director, Operational Test and Evaluation (DOT&E)-approved test plan.

The UH-60M is operationally effective. The UH-60M successfully accomplished 41 of 45 (91 percent) of assigned combat support missions. Internal and external lift missions were successfully executed day and night in simulated stressful combat environments. The aircraft exceeds performance requirements for internal lift, external lift, and self deployment. The digital moving map and other cockpit displays reduce pilot workload and improve crew situational awareness, although some improvements in subsystem integration are necessary.

The UH-60M is operationally suitable. In operational testing, the UH-60M was reliable and required infrequent repairs. The UH-60M is more reliable than the current UH-60L, which is the basis for requirement thresholds. In the 261.6-hour IOT&E, in which six mission aborts would have been acceptable, the UH-60M had three mission aborts. When the aircraft did fail, it was repaired quickly by unit maintainers. Aircraft were available for mission execution over 95 percent of the time.

Operational and live fire testing demonstrated that the UH-60M is survivable in expected threat environments and that the overall susceptibility to surface-to-air threats is lower when compared to the legacy UH-60A/L aircraft. Susceptibility improvements are largely the result of the integration of the Common Missile Warning System (CMWS) on the UH-60M. During integration testing on the UH-60M, the CMWS demonstrated timely detection, declaration, and flare dispenses in response to simulated infrared threat signatures. Testing and analyses showed that the UH-60M is no more vulnerable to projected ballistic threats than the UH-60L. Combat data indicate that the UH-60 can survive some hits from rocket propelled grenades (RPGs), and improvements in the UH-60M safety and crashworthiness features enhance crew survivability in the event of a threat encounter or crash.

### System Overview

The UH-60M Black Hawk is a single rotor, medium-lift helicopter that provides utility and assault lift capability in support of combat and peacetime missions. The Black Hawk is the primary helicopter for air assault, air mobility, logistics support, and aero medical evacuation. The Black Hawk can be configured to perform command and control or mine-laying missions. Army aviation lift units will have ten UH-60M Black Hawks per company with three companies in various multi-function aviation battalions. The UH-60M crew includes two pilots who are assisted by two crew chiefs in the rear cabin. Aircraft and their crews are employed individually, in multi-ship formations, or by company as required by each mission.

The UH-60M will replace the aging UH-60A/L Black Hawks. The Army's strategy is a blocked approach, as depicted below, to develop and modernize the UH-60 fleet. This report covers the UH-60M Block I version of this aircraft.

## UH-60M Acquisition Strategy



### UH-60M Developmental Block Approach

#### Test Adequacy

The Army conducted the initial operational test in accordance with the approved DOT&E test plan. The test was adequate to support an assessment of operational effectiveness and suitability. The capstone event was a six-week, 261.6-hour Initial Operational Test (IOT) conducted by Stetson Troop, 4th Squadron, 3rd Armored Cavalry Regiment with five production UH-60M aircraft. This event took place at Fort Hood, Texas, from October 11, 2006, to November 20, 2006. Operational testing included night operations under austere field conditions with dynamic mission planning and threat interaction. The Army conducted operational testing of the MEDEVAC missions at Fort Rucker, Alabama, from January 24 - 26, 2007. UH-60M crews successfully completed four minefield emplacements on February 15, 2007, at Redstone Arsenal, Alabama. Additionally, the Army completed integration testing of the CMWS and the AN/ARC 231 radios onto the UH-60M. These systems were operationally tested at Fort Rucker, Alabama, on March 23 and 24, 2007, to demonstrate that these systems were effective.

Live fire test and evaluation was adequate to assess vulnerability to a variety of expected ballistic threats. This phase of testing included threats at and above the user's requirements in the Operational Requirements Document. Ballistic damage results from previous combined Army and Navy H-60 series aircraft testing and combat data supported the vulnerability assessment. Smaller developmental and operational test events provided additional data to complete the assessment.

#### Operational Effectiveness

The UH-60M is operationally effective. The UH-60M successfully accomplished 41 of 45 (91 percent) of assigned combat support missions. Internal and external lift missions were successfully executed day and night in simulated stressful combat environments. The aircraft exceeds performance requirements for internal lift, external lift, and self deployment. The digital moving map and other cockpit displays reduce pilot workload and improve crew situational awareness, some improvements in subsystem integration are necessary. Subsystem integration with digital messaging systems, communications systems, flight management systems, or aircraft survivability equipment caused some level of degradation in 71 percent of aircraft sorties. In spite of the degraded subsystems, UH-60M crews successfully completed assigned missions.

#### Operational Suitability

The UH-60M is operationally suitable. In operational testing, the UH-60M was reliable and required infrequent repairs. The UH-60M is more reliable than the current UH-60L, which is the basis for requirement thresholds. Mission aborts and other reliability failures occurred less often than expected. In the 261.6-hour IOT&E, in which six mission aborts would have been acceptable, the UH-60M had three mission aborts. When the aircraft did fail, it was repaired quickly by unit maintainer. Aircraft were available for mission execution over 95 percent of the time.

## ANNEX B - CONGRESSIONAL REPORTS

The UH-60M provides an expanded shipboard operating environment and is more compatible with the shipboard environment than UH-60A/L aircraft. Operators found aircraft systems to be intuitive, well-integrated, and compatible for human use. Some subsystems warrant redesign or improved training to make them more usable by operational crews.

### **Operational Survivability**

Operational and live fire testing demonstrated that the UH-60M is survivable in expected threat environments and that the overall susceptibility to surface-to-air threats is lower when compared to the legacy UH-60A/L aircraft. Susceptibility improvements are largely the result of the integration of CMWS on the UH-60M. During integration testing on the UH-60M, the CMWS demonstrated timely detection, declaration, and flare dispenses in response to simulated infrared threat signatures.

In other testing, the performance of the APR-39 radar receiver on the UH-60M was poor and no better than legacy aircraft. The radar warning receiver demonstrated a high false alarm rate that eventually resulted in aircrews disregarding correctly reported radar threat warnings.

Testing and analyses showed that the UH-60M is no more vulnerable to projected ballistic threats than the UH-60L. Combat data indicate that the UH-60 can survive some hits from rocket propelled grenades (RPGs), but will not survive most hits by man portable air defense systems (MANPADS). Improvements in the UH-60M safety and crashworthiness features enhance crew survivability in the event of a threat encounter or crash.

### **Recommendations**

The UH-60M Black Hawk utility helicopter is operationally effective, suitable, and survivable. The UH-60M program executed the Initial Operational Test and Evaluation and live fire testing in accordance with the DOT&E-approved test plans. I recommend the Army address the following issues:

#### *Operational Effectiveness*

- Improve network connectivity for secure communications and digital messaging systems. Reduce latency of position reports.
- Complete integration and testing of the AN/ARC-231 radio.
- Develop an individual subsystem reset capability after system startup.
- Complete integration of Aviation Mission Planning System with the UH-60M to include loading and displaying tactical overlays.
- Examine weight, functionality, and endurance for an Army airborne command and control system for use during command and control missions.
- Develop and document procedures for identifying where, when, and how to use digital messaging in an aviation environment.

#### *Operational Suitability*

- Improve performance and reliability of the flight management system.
- Replace the crew chief seat to make more comfortable. Simplify the restraining harness for easier ingress and egress of the crew chief station.
- Continuing development of, and improving training on subsystems for:
  - Communications suite (loading frequencies and digital messaging systems).
  - Flight Management System and moving map display.
  - Secure communications.
  - Aircraft survivability equipment.

#### *Survivability*

- Improve radar warning receiver performance to increase threat reporting accuracy for the aircrew.
- Reduce the potential for gearbox chip detector screen blockage resulting from drive ballistic hits to the main transmission assembly.
- Install an additional fire detector and fire suppression agent dispenser nozzle to the engine nacelle compartment.
- Reinforce or redesign some of the engine nacelle structural components.
- Add fire detection and extinguishment to the fuel plumbing enclosure and transition section of the aircraft.
- Complete the survivability evaluation of the monolithic high speed machined frames, the ballistic testing of the Main Rotor Mast, and the modular ballistic armor protection system.
- Revise Battle Damage Assessment and Repair doctrine and manuals to allow more expedient field repairs.

ANNEX B - CONGRESSIONAL REPORTS

## Common Submarine Radio Room

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The baseline increment of the Common Submarine Radio Room (CSRR) is operationally effective and operationally suitable. The Initial Operational Test and Evaluation (IOT&E) was adequate and executed in accordance with the Director, Operational Test and Evaluation (DOT&E)-approved test plan.

### System Overview

The Navy intends for the CSRR to provide a common communication system across all submarine classes. The CSRR is an incremental acquisition program. The Navy is installing the current (baseline) increment on four of five current submarine classes, but has delayed installation of the CSRR on the fifth class (*Los Angeles* class SSN) until FY15 due to funding constraints. Future increments of the CSRR are intended to address obsolescence issues and add new communications capabilities as they mature.

The CSRR integrates modern antennas, radios, cryptographic equipment, and messaging systems for control and management from a single workstation (on some submarine classes, dual workstations are provided). The CSRR provides the frequency coverage and waveforms to communicate on existing submarine radio frequency external communications circuits and the ability to integrate future circuits as they become available.

A single operator using the central control terminal can operate the CSRR. Although not required, a second operator is often utilized in practice to assist with message dissemination and multiple simultaneous communication requirements.

### Test Adequacy

The operational testing of the CSRR was adequate to support an assessment of the system's operational effectiveness and suitability. The Navy's operational testing and evaluation agency (OTA) executed the IOT&E in accordance with the DOT&E-approved test plan. The OTA conducted separate operational testing on a *Seawolf* class SSN, an SSBN, and two SSGNs. The *Virginia* class SSN variant of the CSRR will be tested in 2008 as part of overall *Virginia* class platform IOT&E; this is considered an upgraded version of the current baseline system. The Navy also conducted a five-day maintenance demonstration at the Trident Training Facility in Kings Bay, Georgia. Although there were several minor limitations in test execution, these limitations did not prevent an adequate evaluation of CSRR effectiveness and suitability.

### Operational Effectiveness

The CSRR is operationally effective. A submarine equipped with the CSRR is able to effectively communicate in support of its assigned mission. All Navy-specified performance requirements were met.

Submarines with the CSRR demonstrated the ability to reliably establish communications in support of their assigned mission, with an overall success rate of 97 percent. When problems were encountered, the submarine crew was able to establish alternate circuits to support the submarine mission. The testers evaluated 100 percent of transmitted and received data elements (totaling over 1,000 individual data elements) as usable without the need for retransmission. Also, all data elements were routed correctly to the appropriate enclave within the CSRR and to appropriate external interfaces. The CSRR architecture allowed rapid reconfiguration of the radio room to support changing needs. The CSRR supported simultaneous operation of up to 12 separate communications circuits on the SSN, 13 circuits on SSGN, and 18 circuits on SSBN, sufficient for all submarine missions.

As the Navy transitions to internet protocol (IP) submarine broadcasts and becomes increasingly reliant on IP products (e.g., web browsing, E-mail, and chat rooms), Extremely High Frequency (EHF) connectivity has become increasingly important to submarine operations. The CSRR adequately implements EHF by integrating the EHF Follow-On Terminal (FOT), developed separately and implemented on both submarines and surface platforms. However, throughout the testing, it became apparent that successful EHF communications were highly dependent upon satellite availability and adequate shore support. The testers observed, and the crews reported, frequent problems conducting EHF communications.

The Navy's EHF architecture is not optimized to support rapid restoration of communications following an inadvertent interruption. Shore EHF terminals do not employ circuit-checking protocols to periodically determine if user stations remain connected; as a result, the terminals consider the station already logged on and will reject attempts to re-establish communication. Testers observed interruption of EHF communications on multiple occasions during testing. Circuit restoration was delayed and required the ship to conduct troubleshooting with the shore communications station, since the shore EHF terminal remained blocked until reset by shore personnel.

**Operational Suitability**

The CSRR is operationally suitable. In operational testing, the CSRR was reliable and required infrequent repairs. The system was available for mission execution over 99 percent of the time, exceeding the established requirement of 92 percent. In total, the CSRR operated for over 1,000 hours on four different platforms with no hardware-related operational mission failures and only four software-related operational mission failures. The software failures were rapidly corrected with system restarts. During the separate maintenance demonstration, trained operators rapidly located and corrected faults inserted by the testers. The CSRR was compatible and interoperable with other ship's systems. Although some improvements are warranted, CSRR design, training, and documentation supported operations and maintenance by fleet personnel.

**Recommendations**

The CSRR is operationally effective and operationally suitable. The Navy should address the following issues:

*Operational Effectiveness*

- Upgrade the CSRR design to allow SSBNs to simultaneously operate more than one Very Low Frequency antenna with omni-directional capability (this operationally-relevant capability existed in legacy SSBN radio rooms).
- Re-evaluate the EHF communications infrastructure in light of the increased importance of EHF communications to submarine operations. Ensure the satellite and shore support infrastructure is sufficiently robust to support efficient EHF communications by submarines at sea.
- Optimize the EHF architecture to allow submarines to rapidly restore communications following an inadvertent interruption.
- Consider outfitting *Ohio* class SSGNs with Submarine High Data Rate masts that reach the same height as *Ohio* class SSBNs.
- Complete certification of the SSGN and SSBN for sensitive information and conduct IOT&E of the CSRR sensitive information communication capabilities<sup>1</sup>.
- Implement procedures to ensure antivirus software virus definition files are updated regularly for CSRR systems<sup>1</sup>.

*Operational Suitability*

- Incorporate a second AN/UYQ-70 central control terminal for SSNs<sup>1</sup>.
- Conduct IOT&E to evaluate the susceptibility of CSRR equipment to damage associated with inadvertent interruption of power.
- Consider a design change for future CSRR increments to provide power to EHF components from vital electrical switchboards.
- Improve the shore CSRR shore training infrastructure to support long-term crew training requirements.

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<sup>1</sup> These issues are adequately addressed in the Navy's near-term plans for the CSRR program.

## CH-47 Block II Improved Cargo Helicopter

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The CH-47F Block II Cargo Helicopter is operationally effective, suitable, and survivable. The Initial Operational Test and Evaluation (IOT&E) and live fire testing were adequate and executed in accordance with the Director, Operational Test and Evaluation (DOT&E)-approved test plans.

The CH-47F is operationally effective. The CH-47F Block II successfully accomplished 10 of 10 assigned assault and lift missions. The aircraft exceeds performance requirements for internal lift, external lift, and self deployment. The digital moving map and other cockpit displays reduce pilot workload and improve crew situational awareness. The digital map and other cockpit enhancements reduce pilot workload. Improvements in subsystem integration with the Aviation Mission Planning System (AMPS) and the Flight Management System (FMS) are necessary.

The CH-47F is operationally suitable. During the 62.7 hour operational test, the CH-47F did not have a mission abort and reliability failures were infrequent. CH-47F aircraft exceeded reliability and maintainability requirements and were available for mission assignment 90 percent of the time. The CH-47F has features that provide added flexibility for shipboard operations.

Operational and live fire testing demonstrated that the CH-47F is survivable in expected threat environments. The CH-47F LFT&E program consisted of a review of existing static test data to address the unresolved dynamic test issues from Phase I and includes vulnerability analysis to Man-portable Air Defense Systems (MANPADS).

### System Overview

The CH-47F Block II Chinook is a tandem-rotor, heavy lift helicopter that transports personnel and delivers time-sensitive critical supplies. The CH-47F is a multipurpose cargo aircraft equally capable of supporting air assault operations in the mountains of Afghanistan and domestic disaster relief operations. CH-47F aircraft operate in aviation companies of 12 to 15 aircraft assigned to General Support Aviation Battalions. Each aircraft is flown by two pilots, assisted by two crew chiefs in the rear cabin. CH-47F aircrews employ the aircraft in single or multi-ship formations, dictated by mission requirements. The Army approved the original CH-47F requirements on November 17, 1996, and the updated requirements with Change 4 on June 26, 2006.

The CH-47 Chinook helicopter was originally designed in the 1960s. The CH 47F Block I program restored CH-47D airframes to their original condition and extends the aircraft life another 20 years. In addition, the following improvements were designed into the CH-47F Block I aircraft:

- Digital cockpit and interoperability with the Army's Tactical Internet
- Fuselage stiffening to reduce vibrations in the forward cabin

This report covers the CH-47F Block II which has the following enhancements:

- Common cockpit and digital flight control systems
- Monolithic frames to extend airframe durability
- Compliant with Global Air Traffic Management System requirements

In November 2004, the Army Acquisition Executive approved entry of this program into full-rate production based on the results of the Initial Operational Test and Evaluation Phase I of two prototype CH-47F Block I aircraft. The production decision was limited to the MH-47G aircraft for Special Operations Aviation and the initial production of CH-47F Block II aircraft. This report supports the Army decision to continue the production of a total acquisition of 333 CH-47F Block II aircraft, of which 119 will be new-build aircraft. The prime contractor is Boeing.

### Test Adequacy

CH-47F test plans and execution were adequate to assess operational effectiveness, suitability, and survivability. The IOT&E and live fire testing were executed in accordance with the DOT&E-approved test plans. Data to support this assessment was collected from operational testing (supplemented by developmental testing) and live fire test as described in the DOT&E-approved Test and Evaluation Master Plan. The Army conducted testing and evaluation for the CH-47F aircraft in two phases. Phase I was conducted in May 2004, and Phase II in March 2007. Phase II of the Initial Operational Test at Fort Campbell, Kentucky, from March 6 to 27, 2007, was adequate to support an assessment of operational effectiveness, suitability, and survivability. This report covers the CH-47F IOT&E Phase II.

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The CH-47F Live Fire Test and Evaluation (LFT&E) was based mainly on prior static testing and new analyses. The CH-47F LFT&E program consisted of a review of existing static test data to address the three unresolved dynamic test issues from Phase I.

### **Operational Effectiveness**

The CH-47F is operationally effective. The CH-47F successfully accomplished 10 of 10 assigned assault and lift missions. Internal and external lift missions were successfully executed in simulated stressful day and night combat environments. The aircraft exceeds performance requirements for internal lift, external lift, and self deployment. The digital moving map and other cockpit displays reduce pilot workload and improve crew situational awareness.

While the CH-47F Block II provides significant improvements over the CH-47D, improvements in subsystem integration to the Aviation Mission Planning System and the Flight Management System are necessary. The radar warning receiver and digital messaging systems were degraded in 50 percent of aircraft sorties. In spite of the degraded subsystems, CH-47F crews successfully completed assigned missions. Adding an integrated cargo handling system or adding the current cargo handling system to each aircraft will improve the operational effectiveness of CH-47F units.

### **Operational Suitability**

The CH-47F is operationally suitable. During the 62.7 hour operational test, the CH-47 did not have a mission abort and reliability failures were infrequent. CH-47F aircraft exceeded reliability and maintainability requirements and were available for mission assignment 90 percent of the time.

The CH-47F has features that provide added flexibility for shipboard operations. Operators found aircraft systems to be, well-integrated, and compatible for human use. Some subsystems warrant redesign or improved training to make them more usable by operational crews. Additional development is needed to improve the electronic maintenance manual.

### **Operational Survivability**

The CH-47F aircraft is operationally survivable in most threat environments. Enhancements to aircraft survivability equipment reduce the probability of successful engagement by enemy infrared-guided missiles.

The Common Missile Warning System (CMWS) provides a significant increase in countermeasure effectiveness against infrared-guided threat missiles compared to the legacy missile warning system. The APR-39A radar warning receiver is not reliable and provides inaccurate warning of radar threat systems, undermining its usefulness against radar-guided threat systems.

The CH-47F is no more vulnerable than the CH-47D, but improvements could be incorporated to increase its survivability. The live fire tests performed earlier, and presented in the 2004 BLRIP report to Congress, indicated that there were three unresolved dynamic tests; specifically the engine fire detection and suppression system, dynamic rotor blades, and the tunnel region. During 2006, halon concentration tests were conducted to evaluate the engine fire suppression system and indicated that the system does not meet required halon concentration levels. Recent analysis includes a MANPADS vulnerability assessment that was postponed from the earlier evaluation. A live fire analysis to evaluate the new monolithic airframe components, determined that the new monolithic structure is no more vulnerable than the CH-47D model to withstand damage after ballistic impacts.

### **Recommendations**

The CH-47F Cargo Helicopter is operationally effective, suitable, and survivable. The CH-47F program executed the IOT&E and live fire testing in accordance with the DOT&E-approved test plans. I recommend the Army consider the following recommendations:

#### *Operational Effectiveness*

- Complete integration of Aviation Mission Planning System (AMPS) and the Common Avionics Architecture System (CAAS) interface to transfer mission information such as hazards, phase lines/boundaries, and engagement areas, from the AMPS to the Flight Management System.
- Develop an integrated cargo handling system for each aircraft or increase the number of the current cargo handling system from two per company to one per aircraft.
- Develop aviation tactics, techniques, and procedures for digital messaging in an aviation environment.

#### *Operational Suitability*

- Complete integration and testing of the Common Avionics Architecture System and the Digital Automatic Flight Control System.
- Further develop electronic maintenance manuals to better address maintenance procedures for the new F-model systems.

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### *Survivability*

- Ensure that CMWS provides improved protection against infrared missile threats in comparison to legacy infrared jammers.
- Develop an effective radar warning receiver or improve the APR-39 radar warning receiver performance to increase threat reporting accuracy for the aircrew.
- Continue the effort to meet the required halon concentration levels in the engine nacelle, and to evaluate the nacelle fire detection/suppression system when impacted by ballistic threats.
- Add design features to reduce the fuel leaks and fire hazard to the passengers from the fuel plumbing.
- Evaluate the feasibility of using suction fuel pumps to the maximum extent to improve fuel system safety and crashworthiness.
- Include improved crashworthy crew seats (such as those currently used on the Royal Air Force Chinooks), crash attenuating troop seats (like the UH-60L), and an evaluation/improvement in the crash worthiness of the landing gear to accommodate the increase in maximum gross weight from the original 33,000 pounds.

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## UH-72A Lakota Light Utility Helicopter

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The UH-72A Lakota Light Utility Helicopter (LUH) is effective in the performance of light utility missions, but is not effective for use in hot environments or for medical evacuation of two litter patients requiring critical medical care. The LUH is effective for air movement and aerial sustainment missions, but does not meet its prescribed performance criteria to lift required external and internal loads. The LUH provides an increase in demonstrated performance and mission effectiveness over the Kiowa and Huey aircraft it will replace (OH-58A/C and UH-1H).

The LUH aircraft is not operationally suitable due to excessive heat in the aircraft cockpit and cabin from the sun, heat generated by aircraft avionics, and inadequate ventilation. Additionally, the aircraft's Rotorcraft Flight Manual describes an avionics overheat condition where various avionics components have a 30-minute operating time if temperatures exceed safe operating ranges. This did not occur during the IOT&E.

The LUH meets required design standards for crashworthiness in accordance with the Federal Aviation Regulations to protect crew and passengers.

The LUH program executed the Initial Operational Test and Evaluation (IOT&E) in accordance with the DOT&E-approved test plan. Testing was adequate to assess mission effectiveness, suitability, and survivability. Additional testing is needed to ensure deficiencies in effectiveness and suitability have been corrected.

### System Overview

The LUH will replace OH-58A/C and UH-1H aircraft to provide light utility support worldwide in non-hostile operational environments. The LUH will support homeland defense, U.S. Army test and training centers, and the U.S. Army National Guard and Reserve. It is the Army's intent that LUH aircraft operate in non-hostile environments.

The Army plans to purchase 322 LUH aircraft over an eight-year period with a peak production rate of 69 aircraft per year. The Air Ambulance Detachment, Fort Irwin, California, received its full complement of six aircraft during April 2007 becoming the Army's first unit equipped with LUH aircraft. Eurocopter is the prime contractor.

### Test Adequacy

The Army executed the Initial Operational Test and Evaluation (IOT&E) in accordance with the DOT&E-approved Test and Evaluation Master Plan and test plan. The LUH test execution was adequate to assess operational effectiveness, suitability, and survivability. The Army augmented the IOT&E with flight data from Reliability Verification Efforts, Source Selection Performance Demonstration, Army safety testing, and cross-country ferry flights of production aircraft to the IOT&E site at Fort Irwin, California. The combined flight hour data was adequate to demonstrate reliability. The Army will not operate the LUH in combat. It is not a Live Fire test and evaluation covered system.

### Operational Effectiveness

The LUH is effective for light utility helicopter missions. In realistic operational scenarios, the LUH successfully completed 14 of 18 difficult light utility helicopter missions. The LUH provides an increase in demonstrated performance and mission effectiveness over the Kiowa and Huey aircraft it will replace (OH-58A/C and UH-1H).

The LUH cannot meet its prescribed performance criteria to lift an external load of 2,200 pounds, or an internal load of 1,250 pounds, at 4,000 feet pressure altitude and 95 degrees Fahrenheit. The LUH demonstrated the capability to accomplish air movement and aerial sustainment missions with lighter loads.

The LUH is not operationally effective for the MEDEVAC mission because the aircraft configuration precludes medics from providing medical treatment to two litter patients. The LUH is effective performing MEDEVAC missions with two medically stable litter patients requiring no in-flight medical care; a mission with one litter patient; and ambulatory patients as seated passengers. The LUH unit successfully completed three of five IOT&E medical evacuation missions. Two missions were unsuccessful because of insufficient cabin space and configuration to permit patient treatment by the in-flight medic.

- With two litters there is not sufficient room for the medic to provide immediate medical care to the patients.
- Medics are not able to properly perform or sustain critical medical treatment such as defibrillation or cardiopulmonary resuscitation.
- There is no dedicated provision for cabin ceiling rails to hang IVs, infusion hooks, or to store and secure medical equipment.

- At night, completing medical evacuation missions was hampered by insufficient cabin and external lighting to the rear of the aircraft.

### **Operational Suitability**

The LUH aircraft is not operationally suitable. During the IOT&E, excessive heat from the sun, heat generated by aircraft avionics, and inadequate ventilation resulted in elevated temperatures and limited operating time in the LUH cockpit and cabin. The LUH does not have the environmental control unit (air conditioner) common on most of the commercial EC 145 aircraft. High cockpit and cabin temperatures limit crew endurance and affect passengers and medical casualties. Additionally, the aircraft's Rotorcraft Flight Manual describes an avionics overheat condition where if temperatures exceed safe operating ranges, various avionics components have a 30-minute operating time and will shut down. This did not occur during the IOT&E because of the moderate ambient temperature.

The reliability, maintainability, and availability of the LUH exceeded requirements. The LUH costs less to operate and support than the UH-60A/L helicopter. The LUH is compatible for transport by land, sea, and air. Despite excessive heat and the limited size of the cabin for MEDEVAC missions, LUH crews found the aircraft easy to fly and operate. The communications suite proved interoperable with military and civilian agencies. The pilots found the LUH to be compatible with the Air Warrior components. The New Equipment Training package is still in development as are the flight simulators.

### **Survivability**

The Federal Aviation Administration (FAA) has certified that the LUH meets FAA standards for crashworthiness. As a commercial aircraft, the LUH does not have ballistic tolerance criteria nor does the Army intend to employ this aircraft in operational hostile environments. The Army agreed to comply with the FAA certificate and plans to limit LUH flight operations as defined in the approved flight manual. When operating the LUH, aircrews can wear various components of the Air Warrior ensemble. These components (chemical masks, night vision goggles, survival equipment) afford protection to the crew in the event of an emergency.

### **Recommendations**

The Army executed the LUH IOT&E in accordance with the DOT&E-approved test plan. There was no dedicated developmental testing for the LUH. Many deficiencies noted during the operational test of the LUH would have been identified and corrected prior to the IOT&E. In order to address deficiencies found in the IOT&E, the Army should consider the following recommendations:

#### *Operational Effectiveness*

- Reconfigure or modify the cabin to provide additional space for the medic and MEDEVAC equipment when in a two-litter configuration.
  1. Install provisions for cabin ceiling rails from which to hang IVs, infusion hooks, or to store and secure medical equipment.
  2. Add lighting to illuminate the tail rotor and rear clam shell doors to enhance safety and facilitate rear loading and unloading of litter patients.
- Develop unit tactics, techniques, and procedures to address the external and internal lift performance shortfalls.
- Continue to update, develop, and document LUH performance data to incorporate into a standardized flight manual and to facilitate more accurate mission planning.

#### *Operational Suitability*

- Install and test potential material fixes such as an environmental control system to moderate excessive cockpit, and cabin temperatures to enable operations in hot/humid environments.
- Reconfigure the LUH communication package to allow simultaneous communication on Ultra High Frequency (UHF) and Frequency Modulation (FM) channels and secure communications.
- Install engine inlet barrier filters to reduce the probability of ingesting foreign object debris and increasing overall engine life cycle costs.
- Continue to develop the Aircrew Training Manual, Performance Planning Card, and revising Weight and Balance charts.
- Assess the New Equipment Training package and the hybrid maintenance concept planned for Army National Guard units once implemented.
- Install skid shoes to protect and extend the life of the LUH landing skids.
- Relocate first aid kit and fire extinguisher to allow for immediate crew chief and passenger access.

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